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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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NORTHWEST MEDICAL ISOTOPES SUBCOMMITTEE

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THURSDAY

SEPTEMBER 21, 2017

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ROCKVILLE, MARYLAND

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The Subcommittee met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B1, 11545 Rockville Pike, at 8:30 a.m., Margaret Chu, Chairman, presiding.

COMMITTEE MEMBERS:

MARGARET CHU, Chair

RONALD G. BALLINGER, Member

DENNIS C. BLEY, Member

CHARLES H. BROWN, JR., Member

MICHAEL CORRADINI, Member

WALTER L. KIRCHNER, Member

JOSE MARCH-LEUBA, Member

DANA A. POWERS, Member

JOY REMPE, Member

GORDON R. SKILLMAN, Member

JOHN W. STETKAR, Member

MATTHEW W. SUNSERI, Member

DESIGNATED FEDERAL OFFICIAL:

KATHY WEAVER

ALSO PRESENT:

JOHN ATCHISON, ISL*

MICHAEL BALAZIK, NRR

GREGORY BOWMAN, NRR

MICHAEL CORUM, NWMI

GARY DUNFORD, NWMI

CAROLYN HAASS, NWMI

STEVE LYNCH, NRR

JAMES MASTERLARK, NWMI*

SAM SWAN, NWMI*

DAVID TIKTINSKY, NMSS

ANDREA VEIL, Executive Director, ACRS

*Present via telephone

AGENDA

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

(8:30 a.m.)

CHAIR CHU: Good morning. Good morning, this meeting will now come to order. This is a meeting of the Advisory Committee on Reactor Safeguards, Northwest Medical Isotopes, NWMI Subcommittee.

I'm Margaret Chu, Chairman of the Subcommittee. Members in attendance today are Ron Ballinger, Matt Sunseri, Gordon Skillman, Dana Powers, Dennis Bley, John Stetkar, Jose March-Leuba, Walt Kirchner, Charles Brown and Joy Rempe.

The purpose of today's meeting is for the Subcommittee to hear briefings from representatives of Northwest Medical Isotopes regarding their construction permit application for a radioisotope production facility in the City of Columbia, Missouri for producing Molybdenum-99. We also expect to hear from the NRC Staff regarding their review of this application.

This Subcommittee meeting will focus on revisions or changes made to the PSAR and the SER chapters, as noted in the agenda.

This meeting is being conducted in accordance with the provisions of the Federal Advisory Committee Act. Rules of conduct of and participation

in the meeting have been published in the Federal Register, as part of the notice for this meeting.

Kathy Weaver is the designated federal official for this meeting.

Portions of this meeting may be closed to the public to protect the information proprietary to NWMI or its renderers, as shown on the agenda.

A transcript of the meeting is being kept, therefore it is requested that all speakers first identify them self, then speak with sufficient clarity and volume so they can be readily heard.

During the open portion of the meeting, a public bridge line will be open on mute so that those individuals may listen in. At the appropriate time, later in the meeting, we'll have an opportunity for public comment from the bridge line and from members of the public in attendance.

During the closed portion of the meeting the public bridge line will be closed. However, at the request NRC Staff, we'll have a phone line open for some of their NRC contractors who contributed to the NRC Staff review. During this period, please keep this phone line on mute so as not to disrupt our meeting.

We'll now proceed with the meeting, and then I'll call upon Steve Lynch, Acting Branch Chief,

Research and Test Reactor Licensing Branch, in the Office of Nuclear Reactor Regulation, to open the presentation today.

MR. LYNCH: Great, thank you. So, this is our fourth ACRS Subcommittee meeting on the Northwest Medical Isotopes construction permit application, having met with the members each month this summer. We appreciate your time and the priority you have given to this important and somewhat novel project.

Your insights on the safe operation and design of nuclear facilities and the use of nuclear material has benefitted the Staffs review and better informed our finding supporting the issuance of a construction permit to Northwest Medical Isotopes.

As a result of our meetings with the members, the NRC Staff has updated areas such as seismic and accident analyses in our SER.

This morning we will provide the members with a complete look at the enhancements modifications and refinements of the Staff safety evaluation report. We thank you again for your time and we look forward to your continued feedback as we prepare for the November full committee meeting.

CHAIR CHU: Go ahead.

MS. HAASS: Hi. I'm Carolyn Haass, I'm

the chief operating officer of Northwest Medical Isotopes, and today I have with me Mike Corum, who is our engineering lead, and Steve Reese, who is our radiation lead for Northwest.

We're here for this morning to talk about a summary of what we've done in the last three previous meetings and to go through the revision and changes we did to our construction permit application.

I'm not quite sure, today is a little different, I know, then we had before and I didn't know if there was some type, if there is any specific thing or procedural thing you want us to follow or you just want us to go through the presentation? I'm not quite sure.

CHAIR CHU: I would suggest you go through the presentation. If people have some specific things they want to raise then please go ahead.

MS. HAASS: All right. So, this is setup where I've identified here the major changes we did to the construction permit application.

And Chapter 1, obviously there were changes to, but that's based on the other changes that were done on the other chapters. And most of the changes in Chapter 1 had to do, when we summarized a nearby facilities and any accidents associated with that and

some other minor changes. And so as I said, I'm only going to go through the major changes.

And the first is Chapter 2. Mr. Stetkar, I know that you had several comments when we went through it in the first meeting.

On Page 2, on transient population, we did update that. We have gone through, and unfortunately, the university didn't have a good idea on how they planned, on what the transient population growth was going to be, so we did work with them verbally. And so we did add that to that. And so we just wanted you to know that that has been added.

Also since this was written, back in 2014, we did do some updates.

MEMBER STETKAR: And that's, I wasn't looking for precision, I was looking more for general philosophy. The general philosophy is now there.

MS. HAASS: Correct. And so we appreciate that. Just wanted you to know we had done that.

MEMBER SKILLMAN: Carolyn, let me ask you please to go back to Chapter 1, even though you don't have the slide.

MS. HAASS: Yes.

MEMBER SKILLMAN: As we were asked to prepare for this meeting, we were asked to round up

our comments and be prepared to present those if we wished.

And my comment is on your, actually, it's in Revision 3, Page 1-26. And the Paragraph is 1.3.2.1.

And there on your application you express, design will provide for adequate protection against natural phenomena, with consideration of the, and here's the highlighted area, the most severe documented historical events for the site.

And here's my question, does that mean you look back two millenniums and found a rainfall that's greater than the standards that you were using or does this simply mean, you took a look at convenient data and that there just happen to be an incident that caught your attention, you might give consideration to that, but generally you're going to use all the codes and standards that you've listed, in the application?

It seems to me it's really the latter. But the way that text is worded it suggests that you have been able to pluck out of an almost comprehendible amount of data in fire, flood, earthquake, ground motion, water, precipitation, ice, straight wind, tornado. And you've chosen, among those, the worst and included those. I don't think that that's what you meant.

MS. HAASS: You are correct on that. And --

MEMBER SKILLMAN: Okay, I'll just leave it there.

MS. HAASS: Okay.

MEMBER SKILLMAN: Thank you.

MS. HAASS: Thank you.

MEMBER SKILLMAN: Oh, one more.

MS. HAASS: Oh.

MEMBER SKILLMAN: Chapter 1. Boone County sinkholes.

MS. HAASS: Yes.

MEMBER SKILLMAN: And I heard you say in our last meeting, and we discussed this you'll be vigilant in your borings to ensure that you don't site this facility on top of one or several. I don't know where that's written down, but it seems that that ought to be something that you've codified somewhere.

I live in an area that is sinkhole prone. We have major road closures right now because of these, in Central Pennsylvania. So, I'm familiar with the consequence.

MR. REESE: So, later in the geotechnical slide we'll address that specifically actually.

MEMBER SKILLMAN: Thank you. Okay. But

I draw that from Chapter 1 general, is why I raised it here instead of later on. Thank you.

MS. HAASS: So Slide Number 3. So, the modification we did on this slide, Mr. Stetkar, had to do with Pipeline Number 1. Wasn't a line that wasn't there previously, and it's about .4 miles away.

Pipeline Number 2 for Ameren was inactive at the time and has now become active. And then there was an additional line that's been put in, which is the Magellan liquid hazardous waste pipeline. So, we have done that, I wanted you to know.

Also, there was a bit of a misunderstanding on the heliports.

MEMBER STETKAR: And I got that. This is, as best as I can tell, accurate. There's a couple of inaccuracies still in the text, both in Chapter 3 and Chapter 1, where it still talks about three.

And for the Staff's benefit, the Staff still believes there's three of them. That's fine. I don't care about text and editing, I care about the technical stuff.

MS. HAASS: Right. Correct.

MEMBER STETKAR: And the technical stuff actually counts up the number of flights from each --

MS. HAASS: That's correct. And so when

we go to the --

MEMBER STETKAR: Yes.

MS. HAASS: -- next slide on airports, I'm going to have it over to Mike in a minute, but what, to go get the proper flights per year, we went directly to the airport and to the airport manager. We have documented that through our references and through the emails. So we do feel comfortable.

We got 2014, '15 and '16 on that. And what you're seeing is the data for 2016, John. And also, the percentages on types of operation came directly from the airport manager as well.

So, I'll let you go, Mike.

MR. CORUM: Mike Corum with NWMI, I'm doing this section of Chapter 2. And I think Carolyn kind of summarized Slide 4 pretty well already.

The nearest airport to the RPF is the Columbia Regional Airport, that's the one that has the impact that we'll talk about on the next slide. Again, the data is presented here that was obtained directly from the airport administration.

And then can we have the Slide 5? So, we do have two heliports. And I know in some of the text, particularly in Chapter 2 on Page 52, where we're doing the calculation for impact frequency, we still have

the three helipads and estimated at 1,825 flights per year.

So that is an inconsistency with what we have on the slide and the data that we've obtained.

The result is the same. We're going to go back in the operating license application, as part of the ISA external event analysis and look at the general aviation crash.

So, next slide.

MEMBER STETKAR: Okay. I don't know where to start on this. Let me just say I'm really disappointed. The aircraft crash analysis in Rev 3 is wrong.

And let me point out, I use that term because I don't know what other term to use. I can't say it's conservative, I can't say it's optimistic, it's wrong.

So, let me point out the things that I found, just for your reference. First of all, your Table, 2-16, which summarizes the results, I obviously did not have a copy of your contractor's report, which has details, I'm assuming in there, but all I had was your summary of results.

I'll take, and thanks for going to the airport and getting the actual number of takeoffs and

the distribution by aircraft type, that really helped me a lot.

If you look at the number of flight operations per year in Table 2-16, which were actually used for your calculation, they don't add up to your total of 21,894, they add up to 42,834. If you look at all of the takeoffs and landings on all of the runways that were used in the calculation.

And I thought, well, that's a strange number. Is it twice, for example, because they double counted?

Well, it's not quite twice. So I'm not sure how, whoever did the analysis, came up with a number of takeoffs and landings on each of the runways.

They are over counted by roughly a factor of two. Which, in the sense of wrong in the high direction, I will not use the term conservative, I will use the term wrong in the high direction, it is wrong in the high direction from that perspective.

Okay, so let's see, I got the number of flight operations. The flight operation, according to FAA by the way, is either a takeoff or a landing, so it's not a flight. A flight is, involves both a takeoff and a landing.

But as I said, it isn't precisely twice

so it wasn't just a double counting of, I don't know what they did.

Also, there's a curiosity that on Runway 1331 air taxis seem to takeoff twice as often as they land, which means that there's a net flux of air taxis out. You must have a manufacturing facility there somewhere.

It's just, make the numbers add up for crying out loud.

Now, in the analysis it says the crash rates for type of aircraft category were obtained from DOE Standard 3014-2006, Table B-1. And indeed, they're not.

I don't know where the crash, I'll give you one example. The general aviation, which is the biggest contributor in that table, the takeoff and landing crash rate in the table is 2e to the minus 4, the general, in our table, is 2e to the minus 4.

In Table B-1, from the cited reference, there are four different types of general aviation aircraft cited. The highest frequency of crash, per takeoff, is 1.1e to the minus 5, roughly a factor of 18 lower. And per landing it's 2e to the minus, or a factor of 10 lower.

So I don't know where -- and in the table

in the cited DOE reference, there are different frequencies for crashes on takeoff and landing. Your table uses the same frequency for each type of aircraft.

So it's clear that you didn't take the crash frequencies from the reference that you said you took them from.

So, let's see, that's Number 7. I just need to keep track of my whining here.

I checked the -- what kind of Military aircraft use that airport? It's got a reasonable amount of Military operations and I couldn't find any information.

The reason that I ask is the methodology and data distinguished between crashes of large Military aircraft and small Military aircraft. Large Military aircraft, this is a tradeoff because large Military aircraft have lower crash rates, but they have a large impact area, if you will.

And smaller Military aircraft have higher crash rates but they have a smaller impact area. And you know, so I did the analysis assuming all large and all small, and it comes out about the same because I had an exposure area for your facility for small Military aircraft crashes. It's just about a tradeoff.

So, it really doesn't affect the overall

numbers, from at least the airport operations. But I just found it curious that you used the smaller of the two crash frequencies. You did use the larger of the impact areas.

The summary of results that you have here on the slide shows a 3.27e to the minus 11 frequencies of crashes from air taxis. That is not even correct based on your table because you missed a line item entry in your table that's on the order of 10 to the minus 10. Not that it affects the overall results, but I can add up numbers on a spreadsheet.

What I'm trying to build here is a symptom, symptoms of a rather sloppy analysis. And I use that term intentionally. And I don't know who reviewed the analysis and I don't care.

The models that you used, I know what models you used and I don't want to quibble over models, that's a different issue because you did follow the models. Accept for what I call bookkeeping stuff. The models in the guidance in that DOE standard.

I'll just note for the record that I have no confidence in that DOE standard for aircraft crashes, from what's typically known as cruise operations in airways. That standard has a model that says, every square foot of the continuous 48 States in the United

States has an equal likelihood of getting whacked by an airplane falling out of the sky.

The frequency is different depending on the type of aircraft, so they do distinguish between the types of aircraft, but it has no model for proximity to airways, air traffic within an airway. And there are other methodologies that do indeed account for that.

You do need, for those other methodologies, to know the number of types of aircraft that are using the airways and the proximity of the airways to your particular facility.

As I said, I'll just note that for the record because the crash rates in your analysis, for aircraft falling out of the sky, I use that, this terminology for cruise operations, were done consistently with the guidance using frequencies and that methodology. I just have a real problem believing that somebody out in the middle of the Mojave Desert has the same likelihood of getting whacked as somebody who lives in New Jersey. It's just curious.

It was okay. I think the DOE standard and the methodology was developed primarily to evaluate Yucca Mountain.

Now, Yucca Mountain has a problem that it's fairly close to some Military facilities and some

Military training areas. So, they focused a lot on Military stuff. And it's probably the best of data and models for Military type crashes.

It's probably conservative to say that an averaged geometrical, a geometrically averaged crash frequency for the entire United States might be conservative for Yucca Mountain, maybe not so conversation, for example, for New Jersey.

And I use New Jersey, I don't want to, I have no idea what it would be for your facility, because I don't know the air traffic in your airways. It can be found.

It's difficult to do. The FAA doesn't, FAA has the information. They don't give it out readily for various reasons.

The last item that I want to mention is that your preceding slide, the last little sub-bullet here, I discovered that you have an air show at the Columbia Airport every year, which I didn't go search for before. And so I got interested in it because I like air shows.

And indeed, if I looked at the program for this year's air show it's held on Memorial Day Weekend. I looked at the general types of aircrafts, so it looks like a pretty interesting air show.

They had the Canadian Forces Snowbirds come in and give a fly through, and you have jet aerobatic aircraft, you got an Osprey demonstration, F/A-18's and the traditional historical Military aircraft.

You noted that the number of flight operations from the airport, from the air show, were added into, were included in your total. It strikes me the crash rates during air shows are a little different than crash rates during routine aircraft operations.

So, you may want to take a re-look at the air show effects. You're quite a ways away from the airport for most crashes that happen during air shows. They tend to be in pretty close proximity to the runways.

I lived in Southern California for several years, about five miles away from what was the El Toro Marine Corps Air Station, and they had a huge air show every year. And I like where I live because the Blue Angels used to fly at the Marine Corps air shows.

And the Blue Angels used to stage over my house. When they did their spectacular swoops in down over the runways, they used to come out past where I lived, and I they came screaming over my house. And I was about five miles away.

So it was pretty exciting for me because I didn't have to, I could see the Blue Angels up close and person, get my windows rattled by them.

The point is that if the area around Discovery Ridge is used for staging of any of the air shows flybys and acrobatics, that can substantially affect the crash frequencies, given the types of aircraft and what they're doing. I have no idea. It kind of aligns with one of the runways, but I have no idea which way they do their staging.

So anyway, if I was going to redo the analysis, and I think you should, for the FSAR, I would pay some attention to the air show.

Now, this is a subcommittee meeting and this is my own personal opinion, I did re-did the aircraft crash analyses, focusing primarily on the airport operations, because I didn't have flight densities in your local airways there for the cruise operations.

I looked at, I used the crash frequencies from the DOE standard. I, as I said, I did a comparison between large Military and small Military because I didn't have the distinction.

And as far as everything that I can tweak, the frequencies are small enough to justify, in my mind,

the construction permit. And find frequencies that suddenly jumped up.

The contributions are distributed differently than your contributions. So for example, there's, in some of the analyses that I did, there's much larger contribution, relatively larger contribution, for Military aircraft branches than general aviation.

So you're focusing, in the PSAR, you say, well, you're going to go reexamine general aviation aircraft crashes. And maybe helicopters, but they're like a factor of three or four high, just by the counting.

It's not clear to me that general aviation is, it's probably the biggest, it's not clear that it's greater than 1e to the minus 6e, or it might be.

I'd also caution you, when you reexamine general aviation, if you do a more detailed analysis, that general aviation isn't your grandfather's single piston engine Piper Cub, it includes pre-doggone high-performance business jets, and things like that, which have a heck of a lot more energy and impact capability. So, don't just say general aviation is somebody's little plane.

That's all I can say on the aircraft

crashes. As I said, it was -- I don't know if you have anything else to say. I was disappointed.

MS. HAASS: All I can say is wow. We will go back and reexamine that. One of the things we had thought about is going away from the DOE standard, as you had suggested.

I will be honest, I don't know what type of military goes in and out of there off the top of my head.

MEMBER STETKAR: Yes.

MS. HAASS: And, you know, I can go get more information on that.

MEMBER STETKAR: For general discussion, and, again, it's not ACRS's purview to kind of recommend what methods or data you should use. That's not what we do.

I can give you kind of my experience, it's really difficult to get military crash data and I think that the DOE for Yucca has -- I don't know whether it's real because I can't independently confirm their crash rates, or their models, especially for crashes in the vicinity of an airfield.

So I pretty much have to take that at face value because I know that they looked at it quite a bit for Yucca for military. Commercial stuff is

different.

The NTSB, you can find good, contemporary crash frequencies for each phase of operations, and, you know, taxi, takeoff, climb, cruise, initial decent, final decent, landing, by general type of carrier.

So you can get air taxis, you can get cargo, you can get large commercial, you can get -- Generally aviation is a little more difficult, you have to search around.

There are models that, different models for how you can distribute the crashes as a function of, I call it crash exposure area, you know, how you develop that, those are different geometrical models.

For in-flight operations there is a different method that is recommended in some of the NRC guidance that, again, I personally have a problem with how they calculate the exposure area, but it basically says take a flux of a certain type of aircraft in an airway, the crash rate for that aircraft in terms of crashes per aircraft type flight mile, which is something you can get from NTSB, and then spread the crashes out in some exposure area.

And that, regardless of how you calculate the exposure area, is somewhat more appealing, at least to me, because it says if your facility is located in

the reasonable proximity to high traffic airways you'll have a higher crash frequency compared to more distant from lower traffic airways.

The key there is though you have to get the air traffic flow, the air traffic densities from FAA, and as a private citizen I have had problems doing that in the past.

I have worked with folks who are governmental agencies who have been able to get it from FAA. They don't publish that information in any public places that I can find. And that's all I'll say.

CHAIR CHU: Let's keep going, okay, thanks.

MEMBER STETKAR: Don't try to fix it up before the -- Don't try to fix it up in REV-4. Please don't.

MS. HAAS: Go ahead.

MR. CORUM: Okay. So Mike Corum moving on now with the pipelines. There are three natural gas transmission pipelines within five miles of the RPF and basically we've done an analysis assuming a complete break with the constant source available to the break and using the ALOHA model and due to the concentration of the gases below the LEL we concluded that a delayed flammable vapor cloud ignition cannot

occur and there won't be any explosive over pressure.

Next slide. Okay, releases from trucks on US 63 were analyzed and we used an accident frequency of 2 times 10 to the minus 6 accidents per truck mile where 20 percent of the accidents resulted in a spill and then 20 percent of those spills were greater than, I believe, 10 percent of the contents.

We did that for ammonia, chlorine, and sulfur dioxide and the analysis is shown in the table and the results of the analysis is shown in the table. So, next slide.

MEMBER STETKAR: I don't know.

MEMBER BROWN: Can you, yes, stay with that one. Did I interrupt, did somebody say something? John?

MEMBER STETKAR: I did, but you were first off the block, so --

MEMBER BROWN: No, this was just -- I was just looking at the FEMA data, it's 1989. The NUREG-6624, what's the date of that when it was published, do we know, does anybody around here know?

I'm just asking, trucking is a lot heavier now than it was in 1989, and yet you are basing all your frequencies and the 20 percent accidents and spills on 28, 29-year-old data.

(Simultaneous speaking)

MEMBER STETKAR: I'll tell you my spin, Charlie. That NUREG, we have, and I'll state it on the record here for this meeting to alert you, the ACRS has a working group that is looking at the general issue of manmade hazards, and trucking is part of that.

We are looking at several of the methods and data that have been cited. I personally have some questions about both the methods and the data in that particular reference. That isn't your issue.

MS. HAAS: Right.

MEMBER STETKAR: You did follow the guidance in that NUREG and that NUREG is cited in the NRC Staff's guidance.

So this is not, you know -- The pedigree, if you will, of that crash rate and the pedigree of those, the fraction of accidents that result in a spill and the conditional probability of ignition is not your problem.

MR. CORUM: Right.

MEMBER STETKAR: That's different from the aircraft crashes where some of the counting was your problem, but that's not your problem though, it's a different issue and we are following that in a more generic sense in a different activity.

So, Charlie, you're right that that stuff is outdated, but it's not NWMI's problem, it's more of a general agency problem.

MEMBER BROWN: No, I understand that point. It's just I just -- Based on other meetings where we have gone back and used data for other, not just highway stuff, but other, not with you all, and I guess it seems to me that even though it's not your fault you've still got to do an analysis that's based on current application of your facilities, that's all, and that while you can follow the guidelines it would, I would just -- Highway accidents are not -- You read about trucking stuff going on and they seem to be nastier and nastier, including, and we haven't even talked about railroads yet, but I don't know whether that's in here or not, but they've been, you know, they're longer hauls, they got longer trains, they've got more stuff in them and the same thing with trucks.

So it just seems to me that that, what the, how close the facility is to major highways where there is major trucking going on. If I was doing it I would try to give a little consideration of that.

Obviously, that's my personal opinion, not a Committee opinion, but I just wanted to point that out from that standpoint, it's a philosophy thing more

than it is calling the rules.

Rules, I love rules, but if you didn't have exceptions you wouldn't need rules, and that's kind have been my philosophy now for 50 years.

MS. HAASS: Well, thank you for the input. I mean definitely we will go back and look at it.

MEMBER REMPE: The NUREG was issued in 1999.

MEMBER BROWN: 1999, so it's 18 years. It's 18 and 28, so, anyway, that was my only thought process, more of a philosophy issue relative to how we treat our new facilities and then do we follow the rules or not.

MS. HAASS: Thank you.

MEMBER STETKAR: Okay, the only comment, and, Charlie, I'm kind of glad you did bring that up, the only comment that I would make on kind of following the guidance from that NUREG is that they -- In your analysis there are several fractions that you use.

You use that 2 times 10 to minus 6 accident per truck mile crash rate, you use a 20 percent conditional probability of a spill given an accident, which is in your third bullet here.

There is a 20 percent probability that more than 10 percent of the inventory is released, which

you highlight here. There's another curious one, and that is there is a 20 percent conditional probability of ignition given a release.

You haven't highlighted that one on here, which I guess I can maybe understand for spills of liquid things, you use that also for things like hydrogen and propane and that might be optimistic.

I am not an expert on hydrogen, but it tends to want to ignite and you may want to re-look at that for your hydrogen and propane, because you do look at hydrogen and propane, but I am not sure about the liquids.

A bigger issue for me is that in our last meeting I had two comments on the highway accidents. One was regarding units, and you fixed that up. You made estimates of the number of trucks per year that passed the site so the units are now accidents per year.

I still think that your analysis does not correctly account for the total frequency. It accounts -- The way that the methodology, or the NUREG is subdivided it says that 20 percent of the accidents will result in a -- I have to look up my numbers here so that I get it right for the record -- that there is a 60 percent probability that you will get up to a 10 percent release, a 20 percent probability that

between 10 and 30 percent of the inventory will be released, and a 20 percent probability that all of the inventory will be released.

Now each of those releases, there is an analysis that you have that looks at what I will call a standoff distance or a damage distance, given a release of a certain amount of the material and you are a 1/4 of a mile away from the intersection of the highway and for, I'll use hydrogen as an example because I worked that one out, the damage distance for 10 percent release is 1/3 of a mile.

So even if you get a 10 percent release you are within the damage distance. The only part of your calculation that you accounted for was the 20 percent probability that you had a complete release that resulted in a damage radius, if I will, of 0.77 miles, which got the 1.54 linear distance along the highway that you used.

So you only accounted for 20 percent, that 20 percent, that's the big booms. You didn't account for the 20 percent what I'll call middle booms, which has a smaller exposure distance, it's not 0.77 miles, it's 0.49 miles.

And you didn't account for the 60 percent of the 10 percent releases, which will still get you,

which has even yet, it's only about 0.33 miles. If you do the integral you come up with a, I'll just say it's a higher number.

I don't want to be saying a much higher number, it's countably higher than what you have. And I made that comment about doing the integration the last time around, you still haven't done the integration.

So from my perspective I think you need -- The summary in the PSAR is you've dismissed, and I don't want to take up too much time looking at my notes, you've dismissed a couple of the explosions, you retained one of the explosions, I think you retained the three toxic releases for further analysis.

I think you need to take a re-look at all of them in the FSAR. And, again, from the calculations that I did, from my personal opinion I didn't find anything that rose to a level of concern that I would say you have a problem, you know, for going ahead with a construction permit, so this isn't something that in my opinion is an issue for the construction permit phase, but for the final FSAR when you look at protections of structures or if you look at toxic gas effects, you know, or toxic chemical effects, for personnel onsite you probably need to look, to take

-- Just redo the highway analysis is what I am saying.

MS. HAASS: We plan on that. Thank you.

MEMBER STETKAR: Yes.

MEMBER REMPE: John?

MEMBER STETKAR: Yes?

MEMBER REMPE: This is twice you've brought up things and you said I did a calculation, I think things are okay, but with all due respect to the integrity of your calculations I am kind of wondering, I'm sitting back here wondering, well, did the Staff do some independent analysis and --

MEMBER STETKAR: No, well, believe me, when the Staff comes up --

(Simultaneous speaking)

MEMBER STETKAR: No, they didn't.

MEMBER REMPE: Yes, because I really think more than one ACRS member should --

(Simultaneous speaking)

MEMBER STETKAR: No, that's right, and that's why I am careful. This is a Subcommittee meeting and that's why I am careful to say in my personal opinion based on my calculations.

I would welcome anyone else on the Subcommittee to do calculations. I would have hoped that the Staff would have done independent

calculations. It's clear to me they didn't.

MEMBER REMPE: Well, that's where I am coming from that I think the Staff should have reviewed this before the construction permit comes forward, so when the Staff comes up I would have a lot of questions about that because I mean even if a couple of us did calculations and got the same number as you did it's really the Staff's job to do that.

MEMBER STETKAR: That's right. When they come up, I don't, you know, I'll say something to the Staff when they come up, but I don't know what to say to them.

CHAIR CHU: Okay, now due to schedule constraint we need to -- okay, thanks. I just want to let you know some of the folks, some of the Members will have to leave before 12:00, so we'll make sure we've got the significant stuff discussed before 12 o'clock.

MS. HAASS: Sorry. I think as we spoke several times in the last three meetings that, you know, we are doing a site-specific geotechnical investigation at the site.

We have done certain things in conjunction with the university, and I know that data is not available, but we are doing that, and I wanted to make

sure everyone understand that.

I also want to know that we are specifically based on comments. We got -- You know, we're looking at it from a sinkhole perspective and, you know, if we believe that there is any reason that we think there could be a sinkhole, a sinkhole could occur, you know, we will be designing for that.

I am waiting for data to come in from that, you know, from the geotechnical investigation, but, you know, from a design perspective, you know, we have people who understand how to design for sinkholes and that we will be doing that and I think in the final design you'll be seeing that, and that's where I was just trying to go with this slide.

So, next slide. Other, this has to do with Chapter 2. You asked us to do a couple of things. One, we wanted you to know that the Maxwell probable precipitation in a 1-hour period is 3.14 inches per hour. That has been changed.

We have updated a lot of different things, you know, tables in there, at your request, because they were a bit dated based on when this was written, so we have done that.

And then the very last one is the vibratory ground motion. We are going to go in much more detail

in a couple slides that I am just going to ignore that right now, but we'll go forward.

One of the questions that I know that the Staff has had as well as you guys is our design evolution.

My point on this slide here is that we are going to go from a preliminary, you know, design and all of the documentation that goes with it, whether it's the hazards analysis or the criticality, the shielding program, everything like that, they were all preliminary.

Everything we do, all of these documents are going to updated based on the final design, and that's very key for us. I mean I don't want you to think that just because we've done a preliminary shielding analysis we're done.

No, actually, we've taken our preliminary shielding analysis and we have now separated it into 11 different shielding analysis because now we're going area by area in the facility.

We're going to be doing the same thing with -- Well, we already have already done the criticality analysis based on the new USL, and you're going to see that later on as well.

But we, you know, this design is evolving

as we go along and I think everyone understands that, but I want everyone to know that, I mean we are working very hard at that, making sure all these things evolve and that they are all going to be consistent with one another.

MEMBER REMPE: So before you leave that slide --

MS. HAASS: Yes?

MEMBER REMPE: There were a couple items that were brought up during our Subcommittee meetings that Members mentioned and I believe either you or some of your colleagues said, oh, yes, we will look at that.

They didn't get identified in the Appendix A so I would like to bring them up here if you don't mind.

One of them was the discussion about having enough room for layup capabilities, and I believe Northwest Medical Isotopes said, yes, we will look at that, and maybe it's somewhere in your updated documentation, but I didn't go through every chapter. Is that somewhere that you have committed to do that?

MS. HAASS: What appendix are you referring to?

MEMBER REMPE: The Staff had an SE and they identified some items from ACRS discussions and they

did not mention layup capabilities in their Appendix A.

I will ask them about that later, but I believe that you did agree to it on the transcript, and so are you going to be looking at that capability in your updated design?

MS. HAASS: Yes, we have to. We have to have -- I mean when we do a design we look at it both from a constructability and an operability perspective and we do bring in experts to go do that and lay-up is a very important thing for us.

MEMBER REMPE: And is that documented somewhere in your updated REV-3?

MALE PARTICIPANT: No.

MEMBER REMPE: Because, again, I kind of consider the construction permit in Appendix A and what the Staff does in the SE kind of a commitment on what has been agreed to in all these discussions and I didn't see it anywhere and I think you said, yes, we'll do that.

MS. HAASS: I completely agree it has to be done. I don't know off the top of my head is in there.

MEMBER REMPE: Well, again, it's on the transcript.

MS. HAASS: Yes.

MEMBER REMPE: I hope Appendix A gets updated to reflect that. The other thing was that I believe it was Matt said what about and independent control room, and I believe Steve said, oops, we didn't do that, but we'll look at it, and I didn't see that anywhere in Appendix A or in your documentation, so I just wanted to bring both of those points up on the transcript.

MS. HAASS: Well, and that was just to evaluate an independent control room.

MEMBER REMPE: Yes.

MS. HAASS: Correct.

MEMBER REMPE: And so I would -- If I am still on ACRS when you come back with your operating license I've got my notes and I plan to bring it up and say you guys said you'd do this, so thank you.

MEMBER SKILLMAN: I want to say amen to what Dr. Rempe said, but I want to add one more that I at least witnessed you rogering up on when I raised it, and it is the capability, now we're in a construction permit period right now, so the background of my comment is making provision as you do your foundation and your basement design, and that is the capability to absorb fire protection water.

MR. CORUM: Water, yes.

MS. HAASS: Yes.

MEMBER SKILLMAN: And I will tell you I have been involved on a number of fires, one in particular where we couldn't relieve the compartment and that blocked our capability to further fight the fire.

So what you don't want to have is a fire that is an extended fire and by your fighting it you can no longer gain access or by fighting it you have precluded access.

You've got to have a way for that water to drain, and I bring your attention to your document, REV-3 of your application, it's 3.3.1.4.1, 3.3.1.4.1, and I think that needs to be amended to say we've confirmed that we can absorb a reasonable fighting of fire and I think you've got to put some dimensions on that --

MALE PARTICIPANT: Yes.

MEMBER SKILLMAN: -- 20 minutes at 500 gallons a minute, or 10 minutes at 500, whatever you choose in accordance with your codes.

MS. HAASS: Right. We agree with you and that we will be doing that in the final, yes.

MEMBER SKILLMAN: Thank you. Let me make

one more comment, and it also to do with fire, and that is your capability to fight a fire in your ductwork.

It's easy to think the ventilation systems are out of sight, out of mind, not accessible, but if you get a fire in your ductwork and you are using water you can get into a situation where you've got water going everywhere and you need to think that through at the construction stage. Thank you.

MS. HAASS: We agree, thank you. The next slide, Slide 13, goes through design evolution. I did a little bit of specificity here on flooding just because we had a lot of discussion on flooding that we are going to take that, obviously, into account just like we are with fire, and that, you know, we will be working through that and when you see our operating license application you will be seeing that type of information.

Slide 14, site grading. You know, I know that there was a lot of discussions on site grading. We understand that, you know, it is definitely a primary goal that we are going to grade this site appropriately to ensure that the stormwater flows away from the site, you know, appropriately, and our structural and civil engineers understand this and that, you know, we are taking, we are being methodical

about how we go do this so we don't have water flow into the site, it goes out.

And, you know, we don't want to flood our facility for some reason. It's just like, you know, firewater, how do you go deal with that, how do you absorb that, and so we do understand that and they are working through that.

You know, Mike's staff is very key in getting that done for us.

MEMBER SKILLMAN: I would make one comment, and this is from personal experience, after the basic foundation layout of this particular facility was confirmed as final we went back and suggested raising the floor elevation by 12 inches, one foot, to much the consternation, and this was the LES centrifuge facility in Hobbs, New Mexico.

And there was some pushback, but finally the site leadership agreed to raise one foot and grade based on that changed elevation, and lo and behold, just the way the weather began to unfold, big storms coming up from the Gulf that found their way into Western Texas and that corner of New Mexico, that extra foot saved the day.

And my point is it's cheap to do it on the front end, and if it's six or eight or ten inches it

can be the difference between success and failure on cliff effect for water in the basement or truck bays. It's cheap to do it up front. Thank you.

MS. HAASS: Thank you. The next item we are going to talk about is seismic, and I am going to hand it over to Mike.

MR. CORUM: Okay. Based on the PSHA that was performed by the NRC Staff for the MURR site we have used that to infer that the seismic response spectrum with the peak ground acceleration of 0.2G envelopes the GMRS up to about 16 hertz and at that point the GMRS exceeds the seismic response spectrum.

So based on the EPRI guidance the ground motions greater than 10 hertz are not damaging to any of the SSCs of the system except for those components that are sensitive to vibration, such as, as was brought up last time, electrical relays. So we will be taking that into consideration going forward into our final analysis.

Next slide. So we'll be doing both static analysis during the final design phase, that will include finite element modeling of the entire facility as well as doing, well, that's the static load computations, but we'll also look at shake table test data and the existing earthquake experience using the

EPRI database for equipment, in particular, as well as looking at some of the most recent earthquakes in Japan that have affected nuclear power plants. Onagawa is one in fact that we will use during our analysis.

Let's see. Yes, so we are going to require that all of our equipment, mechanical equipment, electrical equipment, is seismically qualified according to the standards, and even subsystems then, equipment that are not relied on for safety will be designed per the IBC-2012. I believe that's all that we need to say on this one.

As far as tornadoes, tornado missiles are assumed rigid for maximum penetration, we'll use the tornado versus the hurricane at the same annual frequency of exceedance, use the standard design missile spectrum from Reg Guide 1.76, and the tornado missile spectrum are shown on this table here.

MEMBER STETKAR: God, I hate to do this, but my personality forces me to.

FEMALE PARTICIPANT: You have a choice.

MEMBER STETKAR: No, I don't, actually. But that's okay. I brought this up before. There's a Table 3-20, and it's not something that you highlighted here, that lists probable maximum winter precipitation amounts that you use for roof loading,

okay. Trying to orient you there.

That table lists a 24-hour value of 18 inches, I'm rounding, 18 inches, a 72-hour value of 22 inches, and a 48-hour value of, and I'll be precise here, 8.73 inches. And I observed earlier that -- I'm sorry, in the text it says, well, the 48-hour was derived from linear interpolation between the 24 and 72 hours. Well, that's clearly not the case.

The updated PSAR admits that if you did a linear interpolation you'd get 20 inches for 48 hours. But you cite a completely different reference for that 8.73 inches. So I dutifully went and found the reference.

And it's from something called NOAA Atlas 14 which is kind of an interesting document if you go look it up. And it's got tables and numbers. And the 8.73 inches is the 100-year, two-day, mean value. In other words it's NOAA's estimate of the amount of water that will fall out of the sky in a 48 hour period once in 100 years.

And NOAA actually gives you uncertainty bands on that. It's from seven to 11 inches. Their 1,000-year estimate ranges from 9 to 16 inches. They note in their table that these estimates were not compared with probable maximum precipitation values.

So it's not clear to me why a 100-year mean value is being advertised in your analysis as a probably maximum precipitation. I'll just point that out. I don't know how it affects your overall loading analysis. You can work it out in the final FSAR.

But it's clear that you're taking one set of numbers from one reference and another number from another reference, characterizing them all as probable maximum precipitation, and using 8.73 inches in your analysis. It's an observation.

MR. REESE: All right. So the whole purpose of this slide is to acknowledge something I believe you had pointed out about the number of targets and making sure that is consistent, recognizable, understandable, and you can fold it into the heat calculations in making sure our cooling systems can cover those heat calculations. But we're just acknowledging and recognize that that does have to be cleaned up. There was an inconsistency there.

MEMBER REMPE: And a shading done. But I noticed you didn't have one for Chapter 11 where you also used those values. And I hope that that is something --- I'll admit, I did not go back and look at Chapter 11 to see if you updated it. Because I assume you're going to do your optimization study later.

MR. REESE: Yes.

MEMBER REMPE: And so could you please also acknowledge that ---

(Simultaneous speaking)

MEMBER REMPE: -- you're going to also do this in Chapter 11? Because the release is in --- won't it affect not only the air releases, which the staff identified in Appendix A, but also the liquid and the solid waste values? And so their condition or whatever acknowledgment of Appendix A also needs to be updated.

MR. REESE: That's good.

MEMBER REMPE: But I kind of wanted you to say that here too. So thank you.

MR. REESE: I agree.

MEMBER REMPE: Thank you.

MR. REESE: Our CAAS system, so we are very much --- we're committing to endorsing that 8.3 and also that which is required under 3.17, Reg Guide 3.17, for how the CAAS system will be implemented.

So obviously the CAAS system hasn't been finalized at this point. We have a draft of what it looks like. But we will definitely have a complete evaluation for the FSAR and the OL application.

We will have, as required by 8.3, we're going to have coverage in all areas that exceed the

mass limits and, more to the point, in areas --- we're going to have double detectors in areas where these are, but we're also going to have --- and I think I talked about this in the next slide. Yes, okay, I'll wait on that.

The idea is that we'll have the ability to prevent or we want to prevent material from going into places that aren't covered by the CASS system. And the capability of the system is, and I believe this comes out of 8.3, is be able to calculate, or I'm sorry, detect 20 rads of combined neutron gamma then un-shield this as two meters within one minute.

So one of the concerns that came up, just to make sure that we are cognizant of the fact that shielding design will have to be, or the CASS system and the shielding, the final shielding design will have to be done together. You wouldn't want to create a situation where you couldn't detect a criticality accident because of shielding. And we recognize that. So we realize that those two things go hand-in-hand.

And the idea is that operations will be rendered safe by shutdown quarantine if necessary if any area or CASS cover has been lost or not restored in a specific number of hours.

So in addition to trying to prevent

material from going to places it's not covered, we want to be able to do this. We want to be able to stop work and render safe any situation if part of the CASS system failed, such that we weren't covered in areas we were supposed to be.

And the whole thing will be provided an uninterruptible power supply that has not admittedly been designed at this point.

MEMBER SKILLMAN: Steve, please go back to 20, Slide 20.

MR. REESE: You bet.

MEMBER SKILLMAN: The last bullet there, "Ability to detect within one minute," is that one minute part of a regulation or a guide? It seems like that is --- 60 seconds is a long time for --

MR. REESE: A crit accident? Yes.

MEMBER SKILLMAN: I mean, that's a long time. Shouldn't the detection time span be seconds versus a minute?

MR. CORUM: Yes, this particular bullet is just to set up the minimum accident of concern. So it really has nothing to do with the detector threshold itself. It's really creating the minimum accident of concern that the detector is going to have to respond to.

MEMBER SKILLMAN: Okay. What's the normal response time? I'm thinking it's milliseconds?

MR. CORUM: It is, yes.

MEMBER SKILLMAN: All right, okay. Thank you. Thank you.

MR. REESE: So for criticality safety, so prior to the end of construction and submittal of the operating license, we will ensure that all the processes in the RPF are evaluated to be sub-critical under all normal and credible abnormal conditions. And we'll do that using the new USL that we developed in the revised validation report.

Of the 11 or so degrees of freedom that we have to work with, NWI is going to basically use controls for mass geometry moderation volume and interaction. And we will commit to the specific criteria associated with each one of those parameters that are listed in the guidance in New Reg 1520.

We're also going to, well, we acknowledge that using a single NCS control to maintain values of two or more control parameters, it only constitutes one leg of double contingency. And double contingency will be the method that we use primarily for the evaluations of crit safety accidents.

Order of preference for NCS controls are

listed here, passive being the most desired and administrative controls, of course, being at the bottom of the list.

So 23, Slide 23. And this just reinforces that we're going to use passive engineer controls where we possibly can and with preference toward engineered geometry control to make criticality safe by geometry.

If we are going to do controls on a single parameter, we'll commit to using diverse means of control rather than just redundant means of control. And we've got all the general criteria that are established on controls on parameters that are listed as guidance in New Reg 1520. We will be following those during the final design phase.

This just reinforces that we will meet the revised USL of 0.924. We're going to be updating all the criticality safety evaluations during the final design phase. And we'll establish the operating limits based on the optimum and most reactive credible values of the parameters. And we'll provide specific controls and management measures necessary to make sure that the controls are available and ready for operation when called upon.

Next slide. So the point of this slide is to reinforce three things. One is that, although

some aspects of the control systems will be digital, all of the safety functions we will have hardwared or analog logic or interlocks to control those processes.

The other thing is that we're going to make sure -- because this entered into the discussion, I can't remember with whom -- but this concept of what we're calling interlocks and what we're calling permissives.

So to be clear, this is how we interpret it. An interlock is essentially, it's an engineering control such that it prevents you from going into a configuration that you shouldn't be going into.

Whereas, a permissive is essentially an administrative switch that is allowed once actuation --- some action is allowed by an independent person by the actuation of a switch. So it requires a person to intercede and override the ability to perform some function. So that's how we're interpreting it. And if it's okay, this is how we're going to go forward on this.

MEMBER BROWN: Just for committee issues, I went back and looked at the --

(Off-microphone comment)

MEMBER BROWN: Oh, thank you very much. I'm getting as bad as Ron.

(Laughter)

MEMBER BROWN: I did go back through Rev 3 and compared it, sometimes generally section by section, sometimes line by line where necessary. So this is fairly consistent with the changes the made between Rev 0 and Rev 3, mostly clarifications and minor edits.

The only thing that was kind of different was the figure, in that they repositioned the controls for a number of --- I don't know, I can't read it right now, but it's plant process type stuff, not target and other type things.

The left hand box, they moved them from being under the FP, facility process control. They put it under the building management system as opposed to the facility process.

It's just an --- it's just a high level, functional, doesn't really say much architecturally. So it doesn't change anything of what we've done. But it'll just have to be evaluated based on our other comments when we finally get around to it for independence control of access and things of that nature. So other than that, it's pretty minor changes.

MS. HAASS: So, Dana, the next item we wanted to talk a little bit about, uranium metal fires.

I know you brought that up. Just to let you know, we've already done, over the last six weeks, a fairly extensive, you know, our own white paper that's going to support us in our final design and make sure that there isn't any uranium metal fires.

But what you're doing is you're seeing some snippets that come from this. But, you know, we gone and evaluated it. You know, we understand how, you know, potential areas, I mean, potential ways to go extinguish a uranium metal fire. So that's what you're seeing here. And we wanted to make sure that you know that we wouldn't ---

MEMBER POWERS: I couldn't help but go quickly examine it. The one thing that struck me is have you ever seen a uranium metal fire?

MS. HAASS: I personally have not, but the team has. I have not. And the people who wrote this up have.

MEMBER POWERS: There is a formidable aerosol generation associated with those fires. And you didn't seem to address that.

MS. HAASS: It is addressed in the white paper, because I read that. It was me ---

MEMBER POWERS: Probably ---

MS. HAASS: -- that, you know, developed

these slides here. And I apologize, but that was not in there. But we did look at the aerosol aspect.

MEMBER POWERS: Yes. The problem is post-fire.

MS. HAASS: Understand.

MEMBER POWERS: You've got a kind of a headache and what not. I don't know what you're thinking of doing and, I mean, there're advantages if your fire's going to be relatively small and approachable.

I would have --- I have used graphite and what not for those kinds of fires. Hydroid fires are really interesting. Because you can't do anything with them. They're over before --- as soon as you know there's fire, it's over.

MS. HAASS: And so, I mean, I think the key thing here is --- and I know that Margaret really, I know she's trying to push us along --- is that, you know, we have developed a document that goes and looks at this specifically.

This information will be used in our accident scenario for uranium metal fires, you know, during target fabrication. We fell fairly comfortable right now. We know where we need to go on that so we can take it forward into the evaluation.

MEMBER REMPE: So are you planning to provide this white paper to us before the full committee meeting?

MS. HAASS: No, this is something we are developing for our final design and our FHA. It has not been peer reviewed yet, anything. And so, you know, I mean, it's not ready to go forward.

Margaret, that's it, thank you, unless there's any other questions.

CHAIR CHU: Okay, any questions for NWMI?

MEMBER SKILLMAN: I did have several comments that I would like to offer on the record. And I'm following the direction of our subcommittee chairman who asked us to round these up and make sure we present them here as our last chance.

On Chapter 8. -- it's in Chapter 3, power for, emergency power, "The diesel generator will maintain power until the normal power system is operating within acceptable limits." Just a caution, wherever you place that, ensure that its exhaust does not compromise your facility ventilation intake.

Next comment, it's in Chapter 9, Chapter 9.3.2. You state in your document, "Space has been reserved that, if required, the fire protection system can have a dedicated water storage facility onsite.

The need will be dependent on the reliability and flow rate of the city water supply."

As I did before in the last meeting, I would like to challenge that. I think you're betting on a positive outcome. My sense for a facility of this value and for what you are going to be doing, you should and need to have your own no nonsense dedicated tank onsite. I just don't think you can take the chance that, for the unforgiving 30-minute timeframe that, for whatever reason, the city water supply lets you down.

And the reason I make this comment and reinforce it is it changes how you think about the availability of your fire protection systems. You go from thinking, well, I think it's available to being able to say I know it's there, I can see the water level, and I can see the, if you will, suction pressure on the fire pump. It provides a benefit that is beyond perhaps the value of the tank.

MS. HAASS: Thank you for that comment.

MEMBER SKILLMAN: And my final comment is this. In Chapter 11, you give the data for your stack data. You say it's 65 feet tall, it's so many feet in diameter, so on, and so forth.

That is a foundation, a cement, concrete building foundation question that has to do with your

construction permit. You've got to make sure that that number is correct. Is that the right stack height? Does that meet your queue requirements? Is it the right diameter for the flow rate that you intend?

And I raise this kind of in the spirit of John's comment in challenging fine detailed data. This has to do with your foundation, where this thing is placed, how the ventilation systems feed into it. You've got to get that one right, right in the beginning. Thank you.

MEMBER BROWN: I had one comment, and you reminded me of it, thank you. It was your --- it's on. I made it this time.

On the diesel generator transfer, once your power is back -- only I was hoping that there would at least be some human interaction on before you transfer back from your diesel over to -- back to commercial power.

I bring that up, it just dawned on me because I had a --- there's a tear-down next door to me. They went out to try to get the power turned off, transformer didn't work right. There was a problem with it. They had to replace it.

When they put it back in service, my house fluctuated four or five times before I had no idea what

was going back in their substation. But it was not fun. Lights went on and off, and clocks went bananas. And fortunately my computer was on a UPS, so I floated through those. But anyway, it was --- and they were unpredictable. It lasted over about a half an hour period.

So you need to have some thought, once you've gone on it, that you know that you've got stable tests not coming back within parameters. It needs to be stable. So it's just an observation, that's all.

CHAIR CHU: I have a question, Carol. How long do you anticipate the construction will last, roughly?

MS. HAASS: It's right around 17 to 18 months.

CHAIR CHU: And when do you plan to submit your operating license application?

MS. HAASS: We are not submitting the operating license application until after approval of the construction permit application.

CHAIR CHU: Yes, that's --

MS. HAASS: We want to make sure that --

CHAIR CHU: -- obvious.

MS. HAASS: -- you know, we're consistent with everything that you guys say. And so we're looking

--- I know that the NRC staff asked me this as well -- and we're looking at somewhere between, you know, the 60, 90, 120 days, and we're hoping after we get approval on the construction application. I'm not quite sure. It's going to depend on everything when we get there. You're laughing at us, John.

CHAIR CHU: You know, the reason I'm asking this is because there's still a lot of design evolution that's ---

MS. HAASS: Well, and, you know, we're not just sitting here waiting for approval here, then to go do the final design. And, you know, unfortunately, you know, we're having to be very specific on the application at hand, even though we've done a lot more work.

And so sometimes you'll, you know, you know we've done something, but we don't really talk about it. And so we are, especially from a process perspective, we've done a lot of that type of external hazards, those types of things, you know, getting into the structural and civil. But we are moving along on that.

CHAIR CHU: Okay, thank you. Anything else for now? Yes?

MEMBER KIRCHNER: This is not a question,

it's not a statement, but just one personal opinion. I know you've got a lot of experience on your team. I was thinking on ducts, and uranium fires, and just general contamination of them. And this is not a comparison. Rocky Flats is -- your operation is nothing like Rocky Flats.

(Laughter)

MEMBER KIRCHNER: But I was just thinking back to how much plutonium was found in the duct work. So anything that you can do in your operational plans and design to prevent that is good from all kinds of reasons.

Hopefully, it would never be enough to be a criticality issue. But it certainly -- uranium processing could be a fire issue. And you certainly have to look at the contribution to source term. So I just raised that, Margaret. It's not a criticism, it's just maybe something can be learned from that.

MEMBER POWERS: I don't think that uranium fires and the duct work are their problem. I think they have an ammonium nitrite problem in the duct work, potential problem.

And let's, you know, if I were doing the design alternatives, I would go with metal HEPAs instead of paper HEPAs for exactly that reason. Paper is, in

fact, for ammonium nitrate. But that's a tradeoff they make based on a lot of considerations besides that particular one.

MR. REESE: Related to what you were saying, we also hope that we wouldn't find ourselves in a condition where we'd be raided by the FBI.

(Laughter)

MEMBER POWERS: I don't know, they're really nice guys. It can be a lot of fun.

CHAIR CHU: We're going to take a 15 minute break and then come back at 10 after 10:00. Thank you.

(Whereupon, the above-entitled matter went off the record at 9:55 a.m. and resumed at 10:11 a.m.)

CHAIR CHU: We are resuming the meeting. And the NRC staff will be giving presentations.

MR. BALAZIK: Good morning. My name's Mike Balazik. I'm the Project Manager for the Northwest Medical Isotopes facility. I'm within Division of Policy and Rulemaking in the Research and Test Reactor Licensing Branch.

Next to me is Steven Lynch. He's Acting Branch Chief for my branch.

And next to Steve is Dave Tiktinsky. He's a Senior Project Manager in the Office of Nuclear

Material Safety and Safeguards.

So real quick, some of the topics we'd like to discuss today is provide ACRS members a status of the safety evaluation report for the Northwest Medical Isotopes construction permit application. We're going to discuss SER Appendix A because I think this is the first time that the members have seen it, and to explain it a little bit.

And, also, we would like to discuss the plan for the full committee meeting that's scheduled for November.

So, first, just a quick SER status. Right now the SER that was provided to the committee is updated to Revision 2 of the Northwest PSAR. Rev. 1 incorporated all the REA -- RAI responses. And then during our subcommittee meetings we received Rev. 2.

I'd like to point out that Rev. 2 was received after the discussion of, of those chapters. So, for 2, 3, 6, 7, and 8 we received the PSAR after we had already discussed those specific chapters.

So, the staff went back, looked at Revision 2 and we updated the SER status or just the information. Just to put a couple examples: we evaluated the additional information on the heliports and airport

operations.

And then and also another example, an issue that came up when we were talking about Chapter 13 is that the staff will confirm additional analysis and details in the ISA process for specific technical topics such as IS team qualification, screening of credible action sequences, admin. controls and supporting measures.

Now, I'd just like to add that that second part is not in the SER that you have but it was just something that I discussed with one of the technical reviewers prior to sending it up. But we will put that in the SER.

MEMBER STETKAR: So, I'm the -- you heard, you heard my comments on Chapter 2. I'm really disappointed that the staff did not do a review of the aircraft crash analysis. And it's clear that you didn't do a review of the aircraft crash analysis. Your guidance says that the staff should do an independent review and confirmation. You didn't do that.

So, I really hope in the final safety analysis that the staff follows through on their mandate to actually do a review, and independent confirmation.

That's all I'm going to say about it.

MEMBER REMPE: Well, I can go further. This is a construction permit. If you approve a construction permit and then it comes to the operating license time and you find that because, you know, there was an error in their analysis, some of the information's incorrect, and although John did a check, nobody's reviewing John's calculations, but you find, hey, there's a problem because of this analysis, I think Northwest Medical Isotopes could legitimately say, hey, that was in the construction permit. You guys didn't review it. You said go ahead and build.

And just doesn't seem like a fair situation. I think you're obligated to do an independent analysis at this time.

MR. LYNCH: Sure. I appreciate the, the feedback and the comments on this.

As far for the construction permit application we do need to go back and look through and verify all of the numbers and inputs that Northwest used in their calculations. Most of our focus at this point was making sure that Northwest was using appropriate methodology and using guidance that was consistent with similar types of facilities. We do

need to take a closer look at this.

MEMBER REMPE: So before we have the full committee meeting we're going to have someone up from the staff say we did an independent validation of the analysis and we, even though there may be some numbers wrong, we used correct numbers and we think it's fine to go forward with the construction permit.

MR. LYNCH: Yes. We will.

MEMBER REMPE: That would be good. Thank you.

MR. TIKTINSKY: Can I, can I add one other point to this? Related to your question about finding issues later on that, you know, might impact Northwest Medical, this is a preliminary design. And the preliminary design has -- they are not official commitments to things like codes and standards. I mean it has, we follow Part 50. They have suggested things they are using for inputs.

So there is really no way at this point, because we don't have a final design, we don't have final commitments to exactly how they're going to build something, you can't assure that later on when the operating license is reviewed and the actual data on the final design, and the actual commitments are there,

that they wouldn't need to do something else related to construction.

MEMBER REMPE: However, some of the points John raised were how many flights were in the air going over at this location. That's not going to be impacted by, unless they move the location of the sight.

I mean, these are things that should be addressed in the construction permit. It's not based on how the concrete's poured, it's basically where, the location where they sit. And I think those things ought to be settled now. It's just my understanding of the process. Right?

MR. TIKTINSKY: We agree.

MEMBER REMPE: Thank you.

MR. BALAZIK: So Northwest provided a PSAR Rev. 3 to support today's meeting. It is in ADAMS. It was put in ADAMS on September 14th.

The staff doesn't anticipate major changes to PSAR. However, we will take a look at Rev. 3 before the full committee meeting and update the SER accordingly.

MEMBER STETKAR: Mike, I have to apologize because for some reason in hard copy we only got the odd number pages. And I, on my goofy computer --

MR. BALAZIK: Of your slides.

MEMBER STETKAR: Of your slides. And I can't open the even number pages on my computer because I don't have a compatible version.

Anyway, that's my problem, not yours.

MR. BALAZIK: I do have --

MEMBER STETKAR: It's fine. Just don't, don't worry about it. I just wanted to intercept the discussion before we get past kind of the details.

I have some comments on the SER on some sections that I wanted to get on the record before we get into path forward for the full committee meeting and Appendix A. And I think this is the time to do that, isn't it?

The next slide is, is --

MR. BALAZIK: Yeah.

MEMBER STETKAR: That's the only reason why I wanted to intercept it here.

In Chapter 8 of your SER you seem to refer to a review of Rev. 2 explicitly of the PSAR. Just double check that you actually review Rev. 3 please.

That -- let me get my notes here -- that similar comment applies to Chapter 9 where you only refer to Rev. 1 and RAIs. So just, just make sure the

final SER is written against the final version of the PSAR that exists.

In Chapter 13 I had a few for you. And, again, this is, you might consider them editorial. Some of them are somewhat substantive. In the interests of time I'll focus on the couple of substantive ones.

Section 13.4.7 is Chapter 13. You still refer to the old ASCE-7 seismic analysis with the 2,500 year return period. NWMI has for quite a while now said that they're going to file -- follow Reg Guide 1.60. So you all have to really clean that up because that's like Rev. 0 of the PSAR.

And, also, on 13.4.7, which to me indicates that the person who wrote the seismic stuff for Chapter 13 didn't really look at Rev. 3 of the PSAR, which is, again, troubling, says "the Applicant should also determine impacts on safety-related SSCs on seismic events with shorter return periods in order to determine whether additional IROFS may be needed."

What you really mean is longer return periods, which is a lower frequency. A shorter return period is a higher frequency. So kind of, kind of get your what you're looking for straightened out, please.

Those are the only ones that I have that -- it, it's just there's no need for it. You know, read. Read the stuff. I mean, if we read the stuff, you guys, this is your job.

MR. LYNCH: Absolutely. And just to clarify on some of the timing for the submissions and idiosyncrasies with the nomenclature. So, with respect to references, at the time that we provided the current graphs of the chapters to the members we had not received Revision 3 yet. So we are currently in preparation for the full committee meeting.

MEMBER STETKAR: Okay.

MR. LYNCH: We'll have updated the chapters for the full committee.

MEMBER STETKAR: Okay, that's great. Okay, I didn't realize that because --

MR. LYNCH: Yeah.

MEMBER STETKAR: Well, no, we got the SER after, two days after anyway Rev. 3.

MR. LYNCH: Okay.

MEMBER STETKAR: Thanks. That helps by the way.

MR. LYNCH: No problem.

CHAIR CHU: Just want to double check.

So our letter will be based on that October 6th version of the SER; right?

MR. LYNCH: That is correct.

MR. BALAZIK: That is correct.

There's one change I do want to bring up about the SER, and that's the licensing conditions that we had in Chapter 13. The staff is going to issue RAIs to Northwest on aspects of criticality control. And determining -- that is depending on Northwest's responses we may remove those licensing conditions.

MEMBER STETKAR: Wait a minute. Wait a minute.

Margaret needs to read this. The ACRS needs to write a letter on something that has finality. That, that thing has to be in the ACRS' hands 30 days before the ACRS full committee meeting.

We can't have a Rev. 4 of one chapter of the PSAR in a state of flux or the ACRS meeting has to be put off. I mean, you know, so issuing the RAIs now that can result in a change to the PSAR, which can then result in a subsequent change to the SER to me doesn't sound consistent with our process. We cannot review something that is in a state of flux for the full committee. Subcommittee's fine.

MR. LYNCH: Sure. Your comment is taken. And we will ensure that the SER and PSAR are in a final state by that October 6th date.

MR. BOWMAN: This is Greg Bowman --

CHAIR CHU: When would the final frozen date be?

MR. LYNCH: The final frozen date for -- the final safety evaluation report from the staff with no further changes to it will be provided on October 6th. So currently we are reviewing information provided in Rev. 3 of the PSAR. We are -- Northwest has indicated that they have some additional information that they could provide to address some of the proposed conditions by the staff.

We have agreed that we will look at this information if they provide it to us, and we'll consider whether those conditions could be removed. However, at this point, based on the information we have, those conditions remain in place, at least as a recommendation from the staff.

MEMBER BLEY: October 6th. It isn't 30 days before October 6th. And that gives us no time to review.

MEMBER STETKAR: We're in November.

MEMBER BLEY: Oh, we're set up for November?

CHAIR CHU: Yeah, we're set for November.

MEMBER BLEY: Oh, that's right. We moved it to November.

CHAIR CHU: Yes.

MEMBER BLEY: Never mind.

MEMBER REMPE: So you think, though, you're going to get something that you haven't seen yet from Northwest Medical Isotopes and make changes to your SER and get it to legal or something and get it to us by October 6th?

MR. LYNCH: Yes. So at this time chapters are currently being reviewed by our legal team. We are revising them based on feedback. Any changes that we make based on feedback related to these conditions we expect to be minor changes to the SER Chapter 6.

MEMBER REMPE: Removing a licensing condition doesn't seem minor to me.

MR. BOWMAN: This is Greg Bowman. I just want to go back to Steve and what Steve just said in direct response to John's question. The SER that you get on October 6th is, that's final from our standpoint.

If we aren't able to resolve the conditions

by October 6th, then they will stay as conditions.

MEMBER REMPE: There will be the potential that you may be deleting a condition. And you think you can still turn it around by October 6th. And that's, I just want to know --

MR. LYNCH: That is correct.

MEMBER REMPE: Okay.

MR. BALAZIK: So I just want to, really quickly want to talk about Appendix A. Big picture, what Appendix A does is it lists proposed licensing conditions, Northwest commitments regarding contents of the operating license application, and Northwest research and development activities.

So, what are we going to use these items for? They'll basically inform inspections and verify design completion for the operating license stage. And also demonstrates a shared understanding between the staff and Northwest on the status of the design, and sets expectations for future oversight, construction inspection, and licensing activities.

So, just to break down Appendix A, here are the main points: We identified commitments identified during ACRS meetings. Our commitments are identified in response to RAIs.

What North -- RAIs that Northwest has responded to acceptably and incorporated in the PSAR: ongoing research and development, and also proposed construction permit conditions.

MEMBER REMPE: So during the meeting today there were several items that were brought up by members that didn't appear in Appendix A. Are you planning to make any changes based on the discussion today?

MR. LYNCH: Yes.

MEMBER REMPE: Okay.

MR. LYNCH: And we can do that now, but my plan was at the very end I would summarize all of it. I'll just be making a summary later.

MEMBER REMPE: That would really be great.

MR. LYNCH: Yes.

MEMBER REMPE: Thank you.

MR. TIKTINSKY: Can I raise one more point on this? So Appendix A, want to make sure it's clear, when we get an operating license review we will do a complete operating license review of everything, using our regulatory guidance. So, just because something isn't, you know, everything isn't, that we're going to look at is not in Appendix A. We're going to look at everything from A to Z in that final license review

as we lay out in 1537 and the ISG.

MEMBER REMPE: I understand that. But on the prior slide is my understanding of what Appendix A should do: a shared understanding on the status of the design and setting expectations. And so, if there are some things you know that are missing, I think it's nice to identify those.

So that's why I'm emphasizing that.

MEMBER BLEY: I guess I also need to say that these are subcommittee meetings. These are individual thoughts of individual members. So they're not guidance from the ACRS as such, which will only come in our letter.

MR. BALAZIK: Yes.

MEMBER BLEY: Lest this be viewed as direction from us. We can't do it in a subcommittee meeting.

MR. BALAZIK: Yes, sir. I think what we tried to do is look at, when we read the transcript, look at the discussion and see --

MEMBER BLEY: Make your own decisions based on that.

MR. BALAZIK: -- like numerous times that something was missing, you know. We saw it in several

different places. And say, well, we need to identify this as an item.

So that's what our, our -- I guess how we look at it.

MEMBER BLEY: That's the right way to look at it. It's your decision based on the things you hear.

MR. BALAZIK: So these were -- we listed a couple of our commitments identified from the ACRS subcommittee meeting. These commitments will be submitted by Northwest and documented in the SER.

First item is on seismic. We had numerous discussions on seismic, specifically the high frequency impact. So we captured that as a commitment that Northwest provide an evaluation on those high frequency impacts in its final safety analysis report.

Also, we heard numerous times is grading, local, I'll call it local flooding. So we captured that on depending on how the site is graded that Northwest will also provide that in the FSAR.

Another item that we identified was the final, for the final hazard analysis, that we will reexamine those accidents that were screened out of the preliminary hazard analysis, just to ensure that the final hazard analysis properly accounts for the

action sequences relevant to the final design.

The last item was that Northwest provide an evaluation on the physical impacts of a facility uranium fire in a target manufacturing facilities as part of its FSAR.

So, those were the items that we captured in the SER as identified during previous subcommittee meetings.

And also, as Steve mentioned earlier, we've got some that we're going to add. And we'll go over those after the presentation.

Ah, we have one more. Apologize.

Also what was brought up a couple times was electrical fires and how deranged equipment interactions with safety systems, the evaluation of that. So we also captured that as an item that was discussed during ACRS meetings.

MEMBER STETKAR: Mike, where does the term "deranged equipment" come from? This is the first time that I've, I've seen that phrase used.

(Laughter.)

MR. BALAZIK: Well, that's a term that was used on fires in any electrical panel. After you put the fire out it's deranged equipment.

I don't know, can somebody back me up on the meaning?

MEMBER STETKAR: I've never seen it used before. I mean, it's fine. You're captured, you've captured the issue. It's just --

MR. BALAZIK: We can change that to something that's more --

MEMBER BALLINGER: Does the electrical grid have a soul?

(Laughter.)

MEMBER STETKAR: It's probably, and I'll put this on the public, it's probably just a veiled reference to me.

(Laughter.)

MR. BALAZIK: Next topic staff would like to talk about is commitment to identify the response to RAIs. What we did is we went through all the RAI responses and we asked approximately about 150 RAIs in total. And where Northwest committed to providing something in the operating license we captured those items.

So the staff concluded that deferring the review of this information until the operating license would not significantly impact construction. And the

staff considers that these commitments is necessary to demonstrate understanding of inputs needed to the final design.

Just a couple examples. I know on our first subcommittee meeting it was brought up about the geotechnical analysis that we conducted on the site. So that's also, that's captured in that appendix.

Also, seismic requirements and evaluations of the RPF, Northwest committed to providing more information after the license. So all these were captured in the, in the appendix.

And the staff will verify completion during the review of the operating license.

The next item in Appendix A is the full regulatory commitments identified in response to RAIs.

So, big picture, these, the RAIs that the staff had asked Northwest, Northwest responded and incorporated PCR -- PSAR where the technical review found acceptable. Again, there were 63 items that were listed in Appendix A, A.3. And just a couple examples again:

The quality assurance plan to clarify difference between quality level 1 and 2.

And also from EP perspective, there was

an error in identifying the primary contact for radiological emergencies. And that was updated in Chapter 12.

Next is ongoing research and development. And this is required by 50.34(a)(8). And these items were captured within the PSAR and within response to RAIs. So the staff will verify research and development is completed before the end of construction, through inspection, and operating license review.

So there were four items that we captured here. First item is from the PSAR that Northwest perform testing to validate the acceptable operating conditions for material and target solutions, compatibility with the University of Missouri research reactor and DOE National Labs.

And they'll examine a corrosive environment to examine the effects on properties of select raw materials, welded samples of the targets.

The other item is to confirm whether a pressure relief system is feasible for an ion exchange column operating at the specified pressure, and the uranium separation process approach will continue or if a design change will happen.

And the third one is laboratory resins, have to determine the interactions between solutions and resins as a function of temperature. And this will help define the hazard and accident controls.

And the fourth item is to evaluate the release of resin extracted from the ion exchange column media during operation. It poses both a thermal and radiolytic decomposition concern and a potential criticality concern if they were to collect in a non-geothermal vessel.

So those are the four items that we captured in R&D. And like I said, three of the items were RAIs, and one was captured in a PSAR.

MEMBER STETKAR: Mike, can I interrupt you here? And I apologize for this. I missed one of the questions that I had. Something you said sort of reminded me of it.

Back in Chapter 3, in Section 3.4.5 of the SER, just to orient you, look at that section. That's where you discuss the classifications and the seismic and quality assurance classifications. I want to make sure, and this is for clarity from NWMI. I didn't ask it when they were up because I thought that I understood it.

It's my understanding that all IROFS, regardless of whether they're safety related or non-safety related IROFS, all IROFS will be classified as QA Level 1 and Seismic Category C-1.

And I went to get confirmation from NWMI, if I could, that that is accurate. So, could I get that? All IROFS are QA Level 1 and Seismic C-1?

MR. BALAZIK: Yeah. This is Mike. That is correct.

MEMBER STETKAR: Okay. Then the staff needs to correct the SER because the SER doesn't lead you to believe that's the case.

MR. LYNCH: Staff made note of that.

MEMBER STETKAR: It gets convoluted with non-safety related IROFS and safety related IROFS and non-safety related other stuff or whatever, so.

Thank you, NWMI.

MR. BALAZIK: The next topic I'd like to speak to is the proposed construction permit conditions. Real quick, just want to go with the purpose of conditions, that since design of SSCs can significantly impact construction of safety related components, proposed conditions will require periodic updates on certain design elements to enable the staff

to confirm their adequacy during the construction inspection.

So, for right now we have three proposed construction permit conditions, and they all have to do with criticality control.

And what I mentioned earlier is that the staff plans on issuing RAIs that if Northwest provides additional information the staff would evaluate that information to determine if these licensing conditions could be removed.

But I'd still like to go over the three construction permit conditions. The first one talks about that periodic reports to the NRC, at intervals not to exceed six months from the date of the construction.

And this one is that these reports shall identify changes in the criticality safety evaluations and any changes to those evaluations for processing special nuclear material.

The next one talks about the --

MEMBER SKILLMAN: Mike, let me ask about that. Regarding reporting, if the requirement that you're imposing licensing condition is only report change, I would suggest you're deficient in your

guidance.

I think what you want is identify change and equally confirm no change. It's got to be both, otherwise I think you've left your, your flank wide open.

MR. BALAZIK: I appreciate that feedback.

MEMBER SKILLMAN: Thank you.

MR. BALAZIK: When we discussed Chapter 6, one item that Northwest and the staff talked about was a change, a revision in the upper subcritical limit. So that was updated in the validation report. But it carried forward to a lot of design calculations, design input.

So another licensing condition that the NRC is proposing is for Northwest will ensure that the processes are evaluated to be subcritical under all normal and critical conditions. And this interpretation can be done Section 6311 of the PSAR, and it should be consistent with the revised upper subcritical limit.

The third proposed construction permit has to do with the criticality accident alarm system, that Northwest shall submit periodic reports, not to exceed six months. These reports shall provide technical

basis for the design of the criticality accident alarm system.

Prior to completion of construction the report shall demonstrate detector coverage as defined in the requirements of 7024.

So, for right now just to plan for the full committee meeting. Right now the SER is going through internal reviews to finalize the SER.

The staff plans for the draft final SER to be publicly available prior to ACRS full committee meeting. And that meeting is scheduled for November 2nd, 2017.

The staff plans to present our findings from the review that support issuance of a construction permit. And also we'll update the members on the status of the proposed licensing conditions if they've changed.

MEMBER STETKAR: You'll have to update the full ACRS on the licensing conditions even if they don't change.

MR. BALAZIK: Yes, sir. We plan on doing that.

So once the SER is finalized and made publicly available to support the mandatory hearing

following ACRS full committee meeting, and right now the mandatory hearing could be held in late January of 2018.

And that concludes the staff's presentation. We can go over a couple of action items that we've taken away from this.

MR. LYNCH: Sure. This is Steve Lynch again.

So, listening to the Northwest presentation and feedback received from the ACRS both while we were presenting and while Northwest was presenting, we've made a list of items that we are going to follow up, both internally and with the applicant. And these could end up in Appendix A. Regardless, we will address them all at the full committee meeting.

So, in preparing for that full committee meeting and the updated SER, you will see by October 6th we will review and update our SER based on Revision 3 of the PSAR that we have recently received.

Other particular technical areas that we will focus on in this update are looking at protections of structures and toxic gas events on the staff and the facility associated with highway hazards. And we'll do this using the guidance in NUREG/CR-6624.

We will also provide an update on our

analysis and verification of the calculations used for aircraft impact. That will be based on our guidance provided in NUREG-1537 and the DOE Standard 3014-2006.

We'll also take a look at extended layout provisions and ensure that that is documented, both in our SER and in the PSAR.

We will work with the applicant to ensure that appropriate considerations have been given for future evaluation of an independent control room.

We'll also look at provisions for the retention of fire water onsite and how that's considered during construction, if necessary.

And the last item that I had here is that we will also look at the numbers and inputs for maximum precipitation at the facility.

And also, we will ensure that all chapters, particularly Chapters 3, 8, 9, and 13, as brought up by Member Stetkar, are updated editorially at the very least to ensure that they reflect the most recent revision of the PSAR.

MEMBER REMPE: So there was a condition or something associated with just airborne releases in Chapter 11 that would be consistent with the optimized number of targets. And it should be more than just

airborne releases. And that was brought up during the discussions with Northwest as well.

MR. LYNCH: Thank you. I have added that to our list.

MEMBER REMPE: And then as a mix, to make Dennis happy, you did mention the subcommittee meeting and that the ACRS-initiated updates were in your Appendix A. But the title of it says "ACRS Meeting," and it really should change it to Subcommittee and he'll be happier.

MEMBER STETKAR: And I wanted to reemphasize, you characterize, and this is a public meeting and we have a transcript, so I want to make it very clear on the public record of this meeting it's a subcommittee meeting. You characterize these as ACRS action items. They are not.

What you have heard today is the babbling of individual members of the Advisory Committee on Reactor Safeguards. You need to consider the babbling of individual members as the individual members' opinions, questions, et cetera. They are nothing more than that.

The full ACRS has not deliberated on any items here. So you may decide to not consider specific

questions and comments from individual members. That's your -- the whole reason we have the subcommittee meetings is to facilitate individual member's ability to raise issues, ask questions, have a discussion among the subcommittee, and an exchange with both the applicant and the staff so that both the applicant and the staff can then go back and consider which issues they feel need to be addressed. And it's not ACRS.

Until the ACRS writes a letter in November, presuming we stick to that schedule, there is no ACRS action item, there is no ACRS conclusion about anything.

MR. LYNCH: We understand. Thank you for the clarification.

MR. BALAZIK: That ends the staff's presentation.

MEMBER KIRCHNER: Margaret.

CHAIR CHU: Yes. Questions?

MEMBER KIRCHNER: Just a process question. I'm looking at slides 20 through 21.

I think I understand the intent but I was just curious. Obviously you don't want to be surprised, or neither party wants to be surprised by criticality safety issues. But rigorously, isn't that required as part of the FSAR?

What's -- the six month interval just struck me as odd. Why wouldn't you ask that on seismic and almost everything else? Is this just to prevent surprises and allow time to conduct an in-depth criticality safety review?

MR. LYNCH: Sure. So, the purpose of the conditions is not to perform a detailed technical review. Based on how the regulations are written, the next technical review we will do of criticality safety will be during the FSAR. However, what we will use the information and the conditions for is to help inform and prioritize our construction inspection, especially as it relates to, for example, pouring concrete that could affect the impact of detectors to perform their job.

MEMBER KIRCHNER: Or passive safety.

MR. LYNCH: Yes. So, it will help us, you know, with limited resources we want to look and make sure we're focusing our inspections on the most safety-significant items and getting these updates periodically. Six months is consistent with what we required of the SHINE review.

And, also, based on our general talks with applicants on how quickly their design will evolve,

requesting updates sooner may just be a greater administrative burden. And we settled on six months as an appropriate interval.

MEMBER KIRCHNER: Thank you.

CHAIR CHU: Any other questions?

MEMBER BROWN: Yeah, one other question.

I looked back at the revision of Chapter 7. This is just, this is more of an administrative thing. And if I hadn't had it nailed or referenced in my own filing system I would not have been able to tell the difference between the version from -- that we used in the subcommittee meeting and the new version that you list as final. There's no, there's no date. There's nothing that says "final" in the text or anything else.

This is, this is not new by the way. The staff is very consistent in being able to have indistinguishable SERs from one version to the next. I would personally, again it would be appreciated if somehow that the dates, there be dates put on them or some words that refer to them as another version based on Rev. 3, or whatever they are.

Because I did look at it and went through it, and it's largely a few editorial words missing and

stuff. There was no basic technical variation. All the conclusions read roughly the same.

So I, that's, like I say, it's almost indistinguishable unless you go do a word by word, paragraph by paragraph comparison. And even then you can't tell where which one's beginning and which one's the initial and which one's -- it's just my filing that allowed me to tell the difference.

So, anyway, that's strictly an administrative tracking issue.

MR. BALAZIK: Appreciate that feedback. Thank you.

MEMBER BROWN: I'm done.

CHAIR CHU: I have a question. You know, in my prior lives I was trained in the high level waste disposal area. One of the most important things for us was what could go wrong. Okay? Just the scenarios, eventually we had to do analysis.

So, to me one of the things I really pay a lot of attention is say have you identified the right stuff: the initiating events, you know; the what could go wrong. Did you input parameters, the right ones? And then we had to go through the kind of rigor, okay, you -- I think that some of you may be familiar with

it -- you need to be so comprehensive and rigorous. So you make sure absolutely you don't miss anything.

And just a comment and probably a question for you. I think I encourage you to have that mentality. And because if you have something missing then the whole game is over, in my opinion.

And then I would almost require NWMI to put down what is their methodology? How did they start with the initial list? Was it conversation or was it -- did it have basis? And then that needs to be documented. And because, you know, later on when you get new data or new information you need to go back. And without good documentation you would not be able to revise whatever you came to the conclusion.

Thank you.

MEMBER BROWN: Can I make one other observations?

If you look at your slide 4 it says ACRS provided the SER updated. I don't think we provided an updated SER to the staff. I think it's the other way around.

And I guess that SER that you issued is based on Rev. 2 based on that slide. Is that correct?

MR. BALAZIK: Yes, sir. It's based on

Rev. 2. Rev. 3 --

MEMBER BROWN: I saw the subsequent slide.

MR. BALAZIK: Yes.

MEMBER BROWN: So that I just wanted to confirm as to what, what we have. Okay, thank you.

MEMBER STETKAR: By the way, just because it's a public meeting, and transcripts tend to take on a life of their own, the ACRS cannot require anybody to do anything. We're a body that makes recommendations.

CHAIR CHU: Always.

MEMBER STETKAR: So don't, please with a public record don't interpret anything as ACRS stating that something should be required.

CHAIR CHU: Anything else?

MEMBER BROWN: Hopefully I was clear when I made my comment when I said it was just my personal observation.

CHAIR CHU: Okay, thank you for your presentation.

Now, according to our agenda this is public comment period. I would like to know if there is anybody in the audience would like to give comment?

(No response.)

CHAIR CHU: If no, I will ask is there

anybody on the phone line who would like to make a comment.

(No response.)

CHAIR CHU: No. Okay, thank you.

Now, according to our agenda we have, we could have closed session and continue on discussion. I would like to know is there anymore questions that require the meeting to be closed to continue our discussion? Or is everybody satisfied and happy?

MEMBER POWERS: That's two very rigorous requirements, being satisfied and happy.

(Laughter.)

CHAIR CHU: Carolyn.

MS. HAASS: This is Carolyn Haass, Northwest Medical Isotopes.

When Steve and Mike were talking about the criticality potential conditions in the RAIs, we have received those draft RAIs. And we have already responded to the draft RAIs. And we have provided them, we actually put them even in your Dropbox area. And I have the copy for Document Control today.

So, I just wanted to say that, you know, we're supporting the NRC staff as quickly as we can so that the SER can be finalized on October 6th.

CHAIR CHU: Okay.

MEMBER STETKAR: Since you brought it up, you are planning -- or I'll just ask you, are you planning a Rev. 4 of the PSA -- no changes for the PSAR?

MS. HAASS: No changes. My understanding is we just want to -- that's why I provided you the letter, because the three of them, there's also a second letter in there that talks about how we're going to approach the things that we went over today that didn't include the criticality.

MEMBER STETKAR: Thank you.

MS. HAASS: Sure.

CHAIR CHU: If there are no more comments the meeting is adjourned.

(Whereupon, the above-entitled matter went off the record at 10:56 a.m.)

U.S. Nuclear Regulatory Commission
ACRS Subcommittee Review

Public Session – Revisions/Changes to Construction Permit Application

September 21, 2017

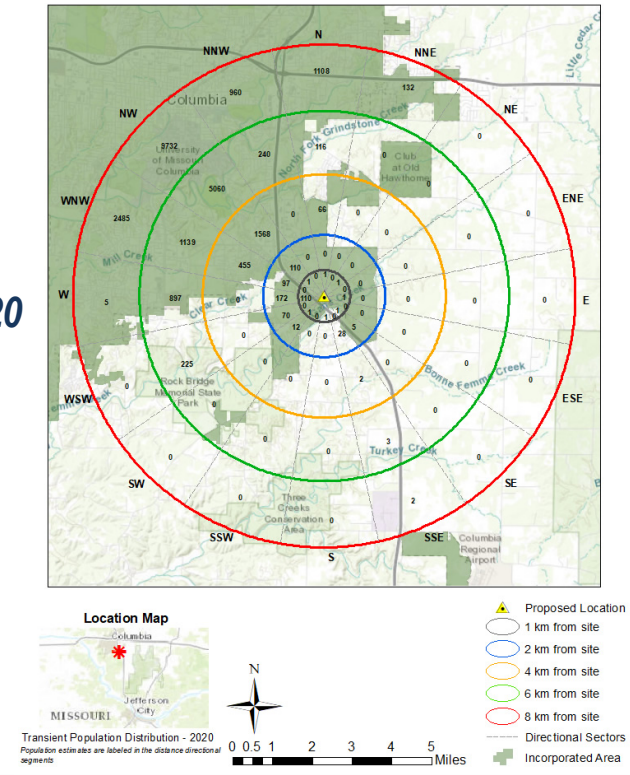
Chapter 2 – Transient Population

Total Project Transient Population

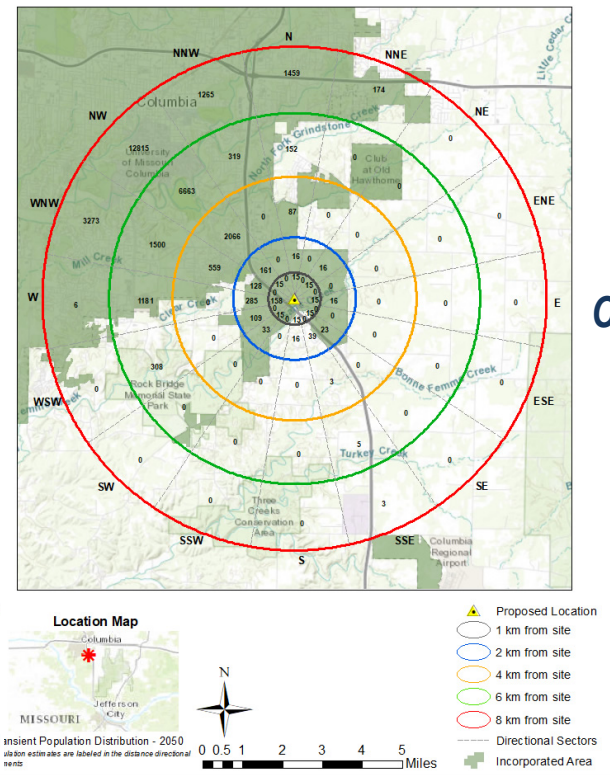
Year	Distance Band (km)					
	0 – 1	1 – 2	2 – 4	4 – 6	6 – 8	Total 0 – 8
2010	94	207	1,807	6,633	12,452	**21,193**
2014	100	395	1,912	7,033	13,207	**22,647**
2015	101	397	1,944	7,140	13,406	**22,988**
2019	107	486	2,060	7,566	14,210	**24,429**
2020	117	494	2,091	7,680	14,424	**24,798**
2045	341	657	2,562	9,426	17,669	**30,447**
2050	391	714	2,755	10,125	18,995	**32,732**

[a] Includes Fr. Tolton Catholic High School and the Central Regional Conservation Office starting in 2013.
[b] Includes Discovery Office Park starting in 2016.
[c] Includes employment growth at Discovery Ridge Research Park starting 2020.

Calendar Year 2020



Calendar Year 2050



Chapter 2 – Nearby Industrial, Transportation and Military Facilities

Industrial Facilities

- Analytical Bio Chemistry Laboratories, Inc.
- Radil Discovery Ridge
- Gates Power Transmissions Materials Center
- MU South Farm
- MU Woman's and Children's Hospital
- Ryder Transportation
- Truegreen
- Schwan's Home Service
- Petro Mart #44

Pipelines

- Southern Star Central Gas – Natural Gas Transmission Pipeline
- Magellan Pipeline Company – Non-HLV product Hazardous Pipeline
- Magellan Pipeline Company – Liquid Hazardous Pipeline
- Ameren Natural Gas – Transmission Pipeline #1
- Ameren Natural Gas – Transmission Pipeline #2

Fuel Storage Facilities

- Magellan Pipeline Company – Breakout Tank

Transportation Routes/Facilities

Heliports

- University of Missouri heliport
- Boone Hospital Center heliport

Land

- U.S. Highway 63
- U.S. Interstate 70
- State Route 163
- State Route 740
- State Route 763
- Waterways – None
- Railroads – COLT Transload

Military Bases

- *None*

Mining and Quarrying Operations

- None

Chapter 2 – Airports/Heliports

Three airports and two helicopter ports located within 10 mi of RPF

- Airports
  - Columbia Regional Airport (COU) (public) located ~6.5 mi south of RPF
  - Cedar Creek Airport (private) located ~6.6 mi northeast of RPF
  - Sugar Branch Airport (private) located ~9.7 mi northwest of RPF
- Nearest airport to RPF is COU
  - Commercial and privately owned aircraft
  - Situated on approximately 1,314 acres and is owned and operated by City of Columbia
  - January through December 2016 → 21,894 (22,439, including overflights) aircraft operations
    - 67.6 percent general aviation
    - 17.7 percent air taxi
    - 9.3 percent military
    - 4.8 percent air carrier
  - City of Columbia has an annual airshow on Memorial weekend, activity included in COU annual flights per year

200 D^2 Limits

Airport	Distance km (mi)	Flights per year	200 d^2 limits[a]
Columbia Regional Airport	10.4 (6.5 mi)	21,894	21,632
Cedar Creek	10.6 (6.6 mi)	730	22,472
Sugar Branch	15.6 (9.7 mi)	365	48,672

[a] d is the distance in kilometers from the airport to the RPF site (200 × distance squared).

RPF = radioisotope production facility.

Chapter 2 – Airports/Heliports (con't)

- Heliports
  - Two helicopter ports are located within 10 mi of RPF and support hospital operations
  - Calendar year 2016 (January through December) → 654 flights annually
    - University of Missouri Hospital and Clinics located 3.7 mi northwest – 308 flights (Jones, 2017)
    - Boone Hospital Center heliport located 3.9 mi northwest – 346 flights (Eidson, 2017)
  - Calculated crash impact frequency from heliport is less than NUREG-0800 requirements of being within an order of magnitude of 10^{-7} per year

- Summary → General aviation crash will be evaluated as part of integrated safety analysis (ISA) external event analysis and included in OL application

Crash Impact Probabilities for Airports and Heliports

	Airport operations	Overflights	Total
General Aviation	1.78E-07	6.77E-07	8.55E-07
Commercial Air Carrier	1.61E-11	6.27E-09	6.29E-09
Air Taxis	3.27E-11	1.30E-08	1.30E-08
Military Large	1.66E-08	3.12E-09	1.97E-08
Military Small	0.00E+00	2.82E-08	2.82E-08
Helicopters	–	9.70E-07	9.70E-07
Total	–	–	1.89E-06

Chapter 2 – Pipelines

- Three natural gas transmission pipelines within 5 mi of RPF
  - Southern Star Central Gas Pipeline, Inc. located ~1 mi from RPF
  - Ameren natural gas transmission pipeline #1 located ~0.40 mi from RPF
  - Ameren natural gas transmission pipeline #2 located ~3.75 mi from RPF
- Transmission pipelines are made of steel and generally operate at pressures ranging from 500 lb/in.^{2} to 1,400 lb/in.^{2} gauge
- Pipelines can measure anywhere from 6 in. to 48 in. in diameter (ANL/EVS/TM/08-5, *Natural Gas Pipeline Technology Overview*)
- Each natural gas pipeline was modeled as a complete break with a constant source of natural gas available to break
- An analysis was performed using ALOHA model
- Results: Due to concentration of any gases listed above are below LEL at RPF → therefore, a delayed flammable vapor cloud ignition cannot occur and there will be no explosive overpressure

Chapter 2 – Highways

- Releases from a truck on U.S. Highway 63 were analyzed using a probabilistic analysis
- Accident data were taken from NUREG/CR-6624 and FEMA (1989)
- Accident frequency used was 2×10^{-6} accidents per truck mile, where 20 percent of accidents result in a spill
- When a spill occurs, 20 percent of spills are between 10 and 30 percent of contents and 20 percent of spills are complete release

Flammable Vapor Cloud Explosion Analysis for Highway 63

Hazardous material	Quantity		Acceptable distance (LEL)		Probability[a]
	kg	lb	km	mi	
Ammonia	22,680	50,000	0.93	0.58	2.2×10^{-7}
Diesel	22,680	50,000	0.35	0.22	-
Gasoline	22,680	50,000	0.35	0.22	-
Glycol ether PM	22,680	50,000	0.06	0.04	-
Hydrogen	1,497	3,300	1.24	0.77	3.0×10^{-7}
JP-4 aviation fuel	22,680	50,000	0.35	0.22	-
Methyl ethyl ketone	22,680	50,000	0.19	0.12	-
Petroleum naphtha	22,680	50,000	0.35	0.22	-
Propane	22,680	50,000	1.37	0.85	$>1 \times 10^{-6}$
Toluene (32-8413)	22,680	50,000	0.13	0.08	-

Source: EDF-3124-0016, *Analysis of Potential Accidents at Facilities*, Rev. 2, Portage, Inc., Idaho Falls, Idaho, 2017.

[a] Probability only calculated for chemicals with acceptable distances greater than 0.4 km (0.25 mi).

LEL = lower explosion limit.

Chapter 2 – Nearby Facilities

- Review of chemicals at nearby facilities did not contain any toxic materials that would be greater than those located on U.S. Highway 63
- Toxic chemicals released from a truck considered in analysis were ammonia, chlorine, and sulfur dioxide which were all greater than distance from U.S. Highway 63 to RPF of 0.25 mi
  - Distance to IDHL for an ammonia release on U.S. Highway 63 is 6 mi
  - Distance to IDHL for a chlorine release on U.S. Highway 63 is 1.1 mi
  - Distance to IDHL for a sulfur dioxide release on U.S. Highway 63 is 1.9 mi
- All releases from a truck on U.S. Highway 63 were analyzed using a probabilistic analysis
- Assumptions used in all analysis include:
  - Accident frequency → 2×10^{-6} accidents per truck mi where 20 percent of accidents result in a spill
  - When a spill occurs →20 percent of spills are between 10 and 30 percent of contents and 20 percent of spills are complete release
  - Accident data were taken from NUREG/CR-6624 and FEMA (1989)
- Annual probability (i.e., when multiplied by only four trucks annually) is greater than 1×10^{-6} per year; therefore, this event will be evaluated as part of ISA external event analysis and included in OL Application

Chapter 2 – Fires in Adjacent Facilities

- Three natural gas transmission pipelines within 5 mi of RPF
  - Southern Star Natural Gas Transmission Pipeline
  - Ameren Natural Gas Transmission Pipeline #1
  - Ameren Natural Gas Transmission Pipeline #1
- Transmission pipelines are made of steel and generally operate at pressures ranging from 500 lb/in.^{2} to 1,400 lb/in.^{2} gauge
- Jet fire analysis that was performed using ALOHA model (EDF-3124-0016)
- Pipeline was modeled as a complete break, with a constant source of natural gas available to break
  - Pipeline jet fire is not considered a threat to RPF for any transmission pipeline

Chapter 2 – Geotechnical Investigation

- A site-specific geotechnical investigation of RPF site will be conducted to identify specific soil characteristics
  - If highly plastic clays are identified at site, design will include excavation of clays and then backfill with structural fill
  - RPF structural design will be completed during RPF final design and will be included as part of OL Application
- If sinkholes are identified, RPF final design would incorporate one of following alternatives:
  - Excavate site both vertically and horizontally to remove that potential and backfill with structural fill
  - Install piers to bedrock to support substructure

Chapter 2 – Other

- Maximum probable precipitation in a one-hour period is 3.14 in/hour
- Seasonal and annual frequency of historical tornadoes (1954 – 2016) updated
- Seasonal and annual thunderstorm wind events (1955 – 2016) updated
- Lighting events (1998 – 2016) updated
- Seasonal and annual hail events (1958 – 2016) updated
- Winter weather events (1996 – 2016) updated
- Recorded Missouri earthquake history updated
- Vibratory ground motion
  - NWMI has committed to using NRC Regulatory Guide 1.60, *Design Response Spectra for Seismic Design of Nuclear Power* Plants, for final RPF seismic design
    - Regulatory Guide 1.60 spectrum eliminates need for soil classifications used as part of IBC methodology
  - Estimated maximum ground acceleration at RPF site will meet Regulatory Guide 1.60 free-field response spectrum anchored to a peak ground acceleration of 0.20 g

Chapter 3 – Design Evolution

- RPF design is being completed in stages
- RPF preliminary design complete and final design initiated
- Final design is needed to develop OL Application and construction drawings
- Construction documentation consists of drawings and specifications
  - Describe quality, configuration, size, and relationship of all components of RPF
  - Serve as a basis for obtaining bids from contractors
- All supporting documentation will be finalized, which includes but is not limited to:
  - Final hazards analysis and associated qualitative risk assessment
  - Integrated safety analysis
  - Criticality safety evaluations and associated calculations
  - Criticality safety program
  - Criticality accident alarm system/dose analyses
  - Shielding analysis
  - Fire hazards analysis
  - Radiation protection program
  - Waste management program
  - Material control and accountability program
  - Natural phenomena hazards/external events analysis
  - Emergency preparedness program
  - Quality assurance program
  - Safeguards and security program

Chapter 3 – Design Evolution (con't)

- Primary areas of evaluation during final RPF design will include design bases for all SSCs that could be affected by predicted hydrological conditions at site
  - Structures resulting from force or submergence of flooding
  - Systems resulting from I&C, electrical or mechanical malfunction due to water
  - Equipment (e.g., fans, motors, and valves) resulting from degradation of electromechanical function due to water
- NWMI will provide reasonable assurance that SSCs would continue to perform required safety functions under credible water damage conditions
- Design will use applicable local building codes to help ensure that water damage to SSCs at RPF site would not:
  - Cause unsafe RPF operation
  - Prevent RPF safe shutdown
  - Cause or allow uncontrolled release of radioactive material

Chapter 3 – Site Grading

- NWMI's primary goal of proper grading design is to ensure that stormwater flows off of RPF site in a safe, efficient manner (i.e., grading is performed to ensure proper drainage)
- Primary design parameter of all grading designs is to maintain positive drainage
  - e.g., water always has an ability to flow away from site
- Grading of site will serve three basic purposes:
  - Re-form land surface to make it compatible with intended land use
  - Establish and controls new drainage patterns
  - Help define character and aesthetics
- Drainage analysis will serve as basis for design of all proposed drainage structures and will influence layout of site plan
  - Analysis will set basic parameters for grading design
  - NWMI will consider both runoff that starts on site and runoff that flows onto site from off-site
- NWMI will verify all features of site that could lead to flooding or other water-induced damage at site in drainage analysis
  - Information will cover possible hydrologic events, their causes, historic and predicted frequencies, and potential consequences to RPF
  - Water table will be located and potential for radioactive contamination of ground/surface waters will be considered

Chapter 3 – Seismic

- Probabilistic seismic hazard analysis (PSHA) was performed by NRC staff for University of Missouri Research Reactor (MURR) site to assess seismic safety of reactor facility using present-day methodologies
- Seismic hazard curves were estimated at control point (top of weathered rock layer)
  - 10^{-4} and 10^{-5} uniform hazard response spectra were also calculated using results of confirmatory PSHA and site response analyses and ground motion response spectra (GMRS) was computed using Regulatory Guide 1.208
- NWMI compared seismic GMRS with peak ground acceleration of 0.2 g
  - Used in Callaway Nuclear Plant and MURR
- GMRS is enveloped by seismic response spectrum with peak ground acceleration of 0.2 g up to about 16 hertz (Hz)
- GMRS exceeds seismic response spectrum above this frequency
- Based on EPRI guidance, ground motions at higher than approximately 10 Hz frequency are not damaging to SSCs of a nuclear reactor, except functional performance of components sensitive to vibration (e.g., electrical relays)
- If electrical relays are fail-safe on excess vibration or loss of power, safety function of such relays will not be compromised

Chapter 3 – Seismic (con't)

- NWMI will also evaluate dynamic analyses of RPF structural components
- Static analysis will be completed during final design by using:
  - Combination of static load computations to ensure that SSCs remain in place and intact
  - Combination of existing shake table test data and existing earthquake experience will be used to ensure that equipment functions following an earthquake
- Analysis of safety-related structures may be either completed by:
  - Linear-elastic response spectra method performed in accordance with ASCE 4, *Seismic Design of Safety-Related Nuclear Structures*, Section 3.2.3.1, and ASCE 43, *Seismic Design Criteria for Structures, Systems, and Components in Nuclear Facilities*, Section 3.2.2
  - Linear-elastic time history method performed in accordance with ASCE 4, Section 3.2.2, and ASCE 43, Section 3.2.2
- NWMI will also define specific acceptable qualification methods in procurement packages to demonstrate seismic qualifications
- Seismic qualification of IROFS will include:
  - Calculations/verification that main structural components of SSC can withstand seismic loads derived from in-structure floor response spectra at damping value derived from Regulatory Guide 1.61
  - Reference to available shake table testing that demonstrates seismic capacity of SSC or of multiple similar items
  - Demonstration of seismic capacity through performance of type of SSC in actual earthquakes

Chapter 3 – Seismic (con't)

- Per NRC Regulatory Guide 1.100, Seismic Qualification of Electrical and Active Mechanical Equipment and Functional Qualification of Active Mechanical Equipment for Nuclear Power Plants
  - Active mechanical equipment relied on for or important to nuclear safety will be required to be seismically qualified in accordance with Regulatory Guide 1.100
  - Active electrical equipment important to or relied on for nuclear safety will be required to be seismically qualified in accordance with IEEE 344, IEEE Standard for Seismic Qualification of Equipment for Nuclear Power Generating Stations
- Subsystems and equipment not relied on for nuclear safety but designated as a component of a seismic system per International Building Code (IBC) 2012, Chapter 17, will be required
  - Existing databases of past shake table tests will be used (e.g., Office of Statewide Health Planning and Development database provided by state of California)
  - Tests will be done based on ICC-ES AC156, Acceptance Criteria for Seismic Certification by Shake-Table Testing of Nonstructural Components, spectrum
- Seismic design will also include a check to ensure that pounding or sway impact will not occur between adjacent fixtures (e.g., rattle space)

Chapter 3 – Tornado-Generated Missile Impact Effects

- Missile is assumed rigid for maximum penetration
- Expected speed of tornado missiles is larger than expected speed of any hurricane-generated missiles at same annual frequency of exceedance
  - NUREG/CR–7005, *Technical Basis for Regulatory Guidance on Design-Basis Hurricane Wind Speeds for Nuclear Power Plants*
- Tornado-generated missile impact effects are based on standard design missile spectrum from NRC Regulatory Guide 1.76
  - Wind velocities in excess of 75 mi/hr are capable of generating missiles from objects lying within path of tornado wind and from debris of nearby damaged structures
- Recommended RPF roof and wall system design criteria are also taken from DOE-STD-1020, Table 3-4

Design-Basis Tornado Missile Spectrum

Description	Weight	Dimensions	Horizontal velocity	Vertical velocity
Automobile	4,000 lb	16.4 ft × 6.6 ft × 4.3 ft	92 mi/hr	62 mi/hr
Pipe	287 lb	6.625 in. diameter × 15 ft long	92 mi/hr	62 mi/hr
Steel Sphere	0.147 lb	1.0 in. diameter	18 mi/hr	12 mi/hr

Source: NRC Regulatory Guide 1.76, *Design-Basis Tornado and Tornado Missiles for Nuclear Power Plants*, U.S. Nuclear Regulatory Commission, Washington, D.C., March 2007.

Chapter 5 – Coolant Systems

- Weekly Irradiated Target Heat Generation rate added
- Thermal load is characterized by radial heat transfer in a vessel and uranium concentration of solutions held within vessels throughout RFP
- Number of targets to be irradiated will be optimized in Operating License (OL) Application

Chapter 6 – Criticality Accident Alarm System

- RPF criticality accident alarm system (CAAS) will meet Title 10 CFR 70.24, *Criticality Accident Requirements*
- NWMI commits to current endorsed version of ANSI/ANS-8.3, *Critically Accident Alarm System*, with modifications as noted in Regulatory Guide 3.71, *Nuclear Criticality Safety Standards for Fuels and Materials Facilities*
- CAAS evaluation will be completed during RPF final design and provided in OL Application
- CAAS coverage will be in all areas in which greater than 10 CFR 70.24 mass limits of SNM are handled, used, or stored, and in all shielding areas of RPF
  - Controls will be established to preclude such SNM from areas where coverage is not provided
  - Each monitored area will be covered by two criticality detectors
- CAAS monitoring system will be capable of detecting a nuclear criticality that produces an absorbed dose in soft tissue of 20 rad of combined neutron and gamma radiation at an unshielded distance of 2 meters (m) from material within 1 minute (min)

Chapter 6 – Criticality Accident Alarm System (con't)

- NWMI will establish a CAAS appropriate to RPF for type of radiation detected or shielding and magnitude of minimum accident of concern
  - Will consider potential damages from anticipated adverse events such as a fire, explosion, and corrosive atmosphere
  - Will be resistant to RPF design-basis earthquake
- Operations will be rendered safe, by shutdown and quarantine, if necessary, in any area where CAAS coverage has been lost and not restored within a specified number of hours
- Emergency power will be provided to CAAS by uninterruptable power supply system

Chapter 6 – Criticality Safety

- Prior to end of construction and with submittal of OL Application, NWMI will ensure that all processes containing SNM within RPF are evaluated to be subcritical under all normal and credible abnormal conditions
- NWMI will use nuclear criticality safety (NCS) controls for mass, geometry, moderation, volume, and interaction
  - NWMI commits to specific criteria for each on parameters under NCS control at RPF
- NWMI commits to evaluate controlled parameters at associated safety limits and to evaluate parameters that are not controlled at most reactive credible values
- NWMI acknowledges that use of a single NCS control to maintain values of two or more controlled parameters constitutes only one component necessary to meet double-contingency principle
- Order of preference for NCS controls will be:
  - Passive engineered
  - Active engineered
  - Enhanced administrative
  - Simple administrative controls

Chapter 6 – Criticality Safety (con't)

- NWMI will make every effort to use passive engineered controls, in particular, passive engineered geometry control
- If RPF operations rely on two or more controls on a single parameter, NWMI commits to using diverse over-redundant means of control
- Following general criteria will be used in establishing controls on parameters:
  - When a single-parameter limit is used, all other parameters will be evaluated at optimum or most reactive credible values → In determining single-parameter limits, specifying a particular physicochemical form and isotopic composition is permissible
  - When process variables can affect normal or most reactive credible values of parameters, controls to maintain parameters within specified ranges will be established
  - When measurement of a parameter is needed, instrumentation subject to facility management measures will be used
  - When criticality control is based on measuring a single parameter, independent means of measurement will be used
  - Safety limits on controlled parameters will be established, taking any tolerances and uncertainty into account

Chapter 6 – Update of USL and Criticality Safety Evaluations

- NWMI will ensure that all processes containing SNM under normal and credible abnormal conditions will meet revised USL of 0.9240
- Criticality safety evaluations (CSE) will be updated during RPF final design
- NCS operating limits will be established based on analyses assuming optimum or most reactive credible values of parameters unless specified controls are implemented to limit parameters to a range of values
  - e.g., most reactive conditions physically possible or bounding values limited by regulatory requirements
- Specific controls and management measures necessary to enforce NCS safety limits and/or operating limits will be specified in each CSE

Chapter 7 – Instrumentation and Control Systems

- FPC system will be a DCS that functions independently
- IROFS/ESF safety functions will be activated via hardwire (analog) interlocks
- Process control system includes interlocks (both hardwired [ESF] and computer logic) to implement an automatic action on a parameter approaching or being outside its setting
  - Interlocks defined as specific set of conditions or parameters that need to be met for an activity to occur
  - Example of an interlock is shutting down a pump on a tank high-level alarm signal or switching to a spare unit or process train based on a change in parameters (and corresponding alarm)
- RPF will also implement a permissive philosophy that allows HMI operations to be enabled once control room has confirmed prerequisites conditions have been completed
  - Permissives differ from interlocks in that permissives require manual approval via a switch (or similar) that must be satisfied for an activity to occur
  - Interlocks are engineered features, and permissives are administrative features
- Permissive and interlocks will be described in more detail in OL Application

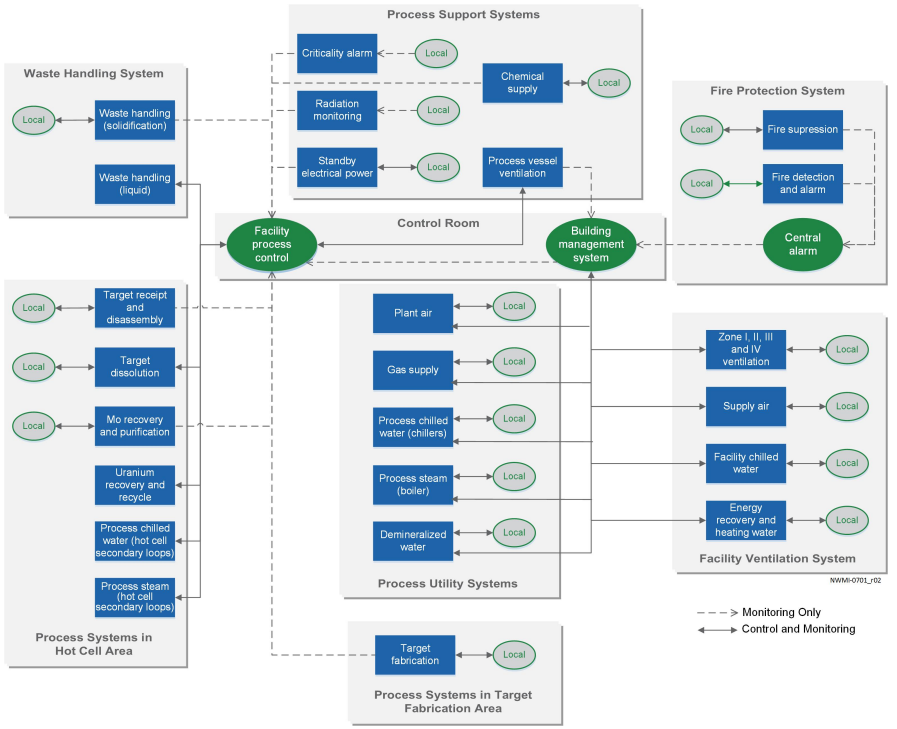


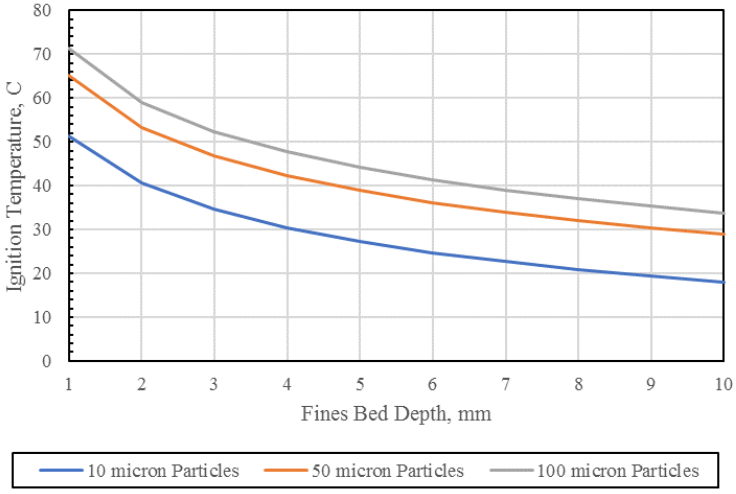
Figure 7-1 Facility Instrumentation and Control System Configuration

Chapter 13 – Uranium Metal Fires

- Targets are fabricated from uranium (U) metal receipts (Y-12) during initial operation
  - U metal receipts are significantly reduced once target inventories have been developed to support reactor operations, and majority of U input to target fabrication can be acquired from recycled U
- NWMI's evaluated packing and shipping of U metal in compliance with ES-3100 container requirements and planned handling at RPF
  - NWMI-2015-SAFETY-007, *Quantitative Risk Analysis of Facility Fires and Explosions Leading to Uncontrolled Release of Fissile Material, High- and Low-Dose Radionuclides*
- NWMI will evaluate nonstandard payloads and configurations and failures of hardware/control at RPF as part of OL Application
  - Evaluate worker safety/exposure impact from potential U metal fires
  - Controls will be elevated to IROFS controls to meet 10 CFR 70.61, "Performance Requirements," for U exposure
- Evaluation in NWMI-2015-SAFETY-007 is based on an existing analysis in SNF-6192-FP, *Uranium Pyrophorocity Phenomena and Prediction*, of ignition test observations for U hydride powder with a characteristic particle diameter of 1.85 micron (μ)
  - SNF-6192-FP analysis concluded that a particle bed depth of 7 millimeters (mm) was required for ignition at ambient temperature, which was consistent with test observations

Chapter 13 – Uranium Metal Fires (con't)

- NWMI's current evaluation indicates that significant particle bed depths (greater than 7 mm) are required to observe ignition at ambient temperature
  - This bed depth to accumulate on a metal shape piece during shipping/storage is considered highly unlikely
- U metal handling activities will be reevaluated during RPF final design and provided in OL Application
- NWMI plans to implement appropriate controls in hood/glovebox to extinguish a U metal fire (e.g. magnesium oxide sand) per DOE-HDBK-1081-2014, Primer on Spontaneous Heating and Pyrophoricity
- Examples of extinguishing a U metal fire in a hood/glovebox include:
  - U metal fires will not be approached without protective clothing and respirators unless fire is enclosed in a glovebox → Most effective agent is magnesium oxide sand
  - Flood hood/glovebox with argon is effective extinguishing agent (if O_2 content is maintained at 4 percent or less) → Argon may be used effectively to cool burning U metal prior to use of magnesium oxide sand
  - Water is generally acceptable for use as an extinguishing agent for fires involving U metal unless criticality safety considerations preclude introduction of moderators



Calculated Ignition Temperature for Small Deposits of Fine Uranium Metal

Questions?

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Advisory Committee on Reactor Safeguards
Subcommittee Meeting
Northwest Medical Isotopes Construction Permit Application

Safety Evaluation Report Status

U.S. Nuclear Regulatory Commission Staff

September 21, 2017

Introductions

- **Michael Balazik -** Project Manager, Research and Test Reactors Licensing Branch (PRLB), Division of Policy and Rulemaking (DPR), Office of Nuclear Reactor Regulation (NRR)

- **Steve Lynch -** Acting Chief, PRLB, DPR, NRR

- **David Tiktinsky** - Senior Project Manager, Fuel Manufacturing Branch, Division of Fuel Cycle Safety, Safeguards, and Environmental Review, Office on Nuclear Material Safety and Safeguards

Discussion Topics

- Provide an update on the status of the Safety Evaluation Report (SER) for the Northwest Medical Isotopes (NWMI) construction permit application
- Discuss SER Appendix A
- Discuss the plan for the Advisory Committee on Reactor Safeguards (ACRS) Full Committee meeting

SER Status

- ACRS provided the SER updated to Revision (Rev.) 2 of the NWMI Preliminary Safety Analysis Report (PSAR)
  - PSAR Rev. 1 incorporated responses to requests for additional information (RAIs)
  - PSAR Rev. 2 incorporated feedback during ACRS meetings on SER Chapters 2, 3, 6, 7, 8, and 13

SER Status (continued)

- Section 2.4.2, Nearby Industrial, Transportation, and Military Facilities
  - SER evaluates the additional flight information on the heliports and airport operations.
- Section 13.4.1, Accident Analysis Methodology and Preliminary Hazards Analysis
  - The staff acknowledges that there will be differences between the preliminary design, as reviewed, and the final design. During the review of NWMI's FSAR, the staff will confirm additional analyses and details of the ISA process and specific technical topics, such as ISA team qualification, the process for screening credible accident sequences, administrative controls, and supporting management measures.

SER Status (continued)

- NWMI provided PSAR Rev. 3 to ACRS to support today's meeting
  - NWMI PSAR Rev. 3 in ADAMS on September 14th (Accession No. ML17257A019)
  - Staff does not anticipate major changes to PSAR Rev. 3
  - Staff will update the SER to reflect PSAR Rev. 3 before the ACRS Full Committee meeting in November 2017

SER Status (continued)

- Final draft SER to be provided to ACRS by October 6th
- RAI responses on aspects of criticality control based on progress in design maturity could remove need for proposed licensing conditions

SER Appendix A

- Appendix A lists proposed license conditions and NWMI commitments regarding the contents of its operating license application and NWMI research and development activities
  - Will be used to inform inspections and verify design completion for the operating license
  - Demonstrates shared understanding between staff and NWMI on status of design and sets expectations for future oversight and licensing activities

SER Appendix A (continued)

- SER Appendix A includes:
  - Commitments identified from ACRS meeting(s)
  - Commitments identified in response to RAIs
  - Fulfilled regulatory commitments identified in response to RAIs
  - Ongoing research and development
  - Proposed construction permit conditions

Commitments Identified from ACRS Meeting(s)

- These commitments will be submitted by NWMI and documented in the SER
  1) NWMI will provide an evaluation of the effects of high frequency spectral accelerations (i.e., > 10 hertz) on high-frequency sensitive structures, systems, and components during seismic events (e.g., electrical relays, instrumentation) in its final safety analysis report (FSAR).
  2) NWMI will provide details on the final grading of site, ensuring that storm water from localized downpours will be directed around and away from the Radioisotope Production Facility (RPF), in its FSAR.

Commitments Identified from ACRS Meeting(s) (continued)

3) NWMI will provide a final hazards analysis for its facility in its FSAR. This final hazard analysis will re-examine those accident sequences that were screened out of the preliminary hazards analysis, ensuring that the final hazard analysis properly accounts for the accident sequences relevant to the final design of the facility.

4) NWMI will provide an evaluation of the potential impacts on the RPF of a uranium fire in the target manufacturing facility licensed under 10 CFR Part 70 on the RPF as part of its FSAR.

Commitments Identified from ACRS Meeting(s) (continued)

5) NWMI will provide an evaluation of the possible effects of derangement of electrical equipment and resulting possible unexpected effects of interaction between otherwise unrelated, independent, and separate circuits, as part of its FSAR.

Commitments Identified in Response to RAIs

- All RAI responses that commit to providing information in the operating license application are listed in SER Appendix A.2 (78 items).
- Staff concludes that deferring review of this information until operating license submission would not significantly impact construction.
- Staff considers the commitments necessary for NWMI to demonstrate understanding of inputs needed for the final design.

Commitments Identified in Response to RAIs (continued)

- For example:
  - RAI 2.5-9 Response: Additional geotechnical analysis will be conducted on the liquefaction potential of the soils on site.
  - RAI 2.5-6b Response: Additional information on the seismic requirements and evaluations of the RPF and associated IROFS will be provided in the FSAR as part of the operating license application.
- Staff will verify completion during the operating license review

Fulfilled Regulatory Commitments Identified in Response to RAIs

- Commitments that are satisfied are reflected in updates to the PSAR Rev.2
- Sixty-three items listed in SER Appendix A.3
- For example:
  - RAI 3.5-3a Response: NWMI has revised its Quality Assurance (QA) Plan to clarify the difference between QL-1 and QL-2. PSAR Section 3.5.1.3 was modified to reflect the changes in the quality level definitions.
  - RAI 12A-2b Response: The listing of the Missouri Office of Emergency Coordination as the primary contact for radiological emergencies is in error. The Missouri Office of Emergency Coordination will be replaced with the Missouri State Emergency Management Agency in Section A3.1.2 of PSAR Chapter 12.0, Appendix A.

Ongoing Research and Development

- As described in 10 CFR 50.34(a)(8)
- Described in PSAR and responses to RAIs
- Staff will verify research and development is completed before the end of construction through inspection and the operating license review
- Four items listed in SER Appendix A.5
  1) NWMI will be performing testing to validate the acceptable operating conditions for material and target solution compatibility at MURR and the DOE national laboratories. The testing will include specific work involving irradiation in a corrosive environment to examine the effects on the properties of selected raw materials and welded samples in an as-received and as-fabricated state.

Ongoing Research and Development (continued)

2) Tests are being performed to confirm whether a pressure relief system is feasible for an ion exchange column operating at a specified pressure and the uranium separation process approach will continue, or if a design change to the system or implementation of additional controls/process parameters to reduce the likelihood of a reaction or change of separation technology is required.

3) Laboratory resin tests to determine the interactions between solutions and resin as a function of temperature. The results will help define necessary hazard and accident controls.

Ongoing Research and Development (continued)

4) Tests are being performed to evaluate the release of the resin extractant from the ion exchange column media during operation. Release of this extractant poses both a thermal/radiolytic decomposition concern (e.g., in concentrators) and a potential criticality concern if the extractant were to collect as a separate phase in a non-geometrically favorable vessel.

Proposed Construction Permit Conditions

- Purpose of conditions
  - Since the design of structures, systems, and components could significantly impact construction of safety-related components, proposed conditions would require periodic updates on certain design elements to enable staff to confirm their adequacy during construction inspection
  - Conditions address areas of criticality control that require additional maturity in the design
  - Additional information provided by NWMI could allow the staff to remove these conditions

Proposed Construction Permit Conditions (continued)

- Three licensing conditions proposed in Appendix A.1
  1) Prior to the completion of construction, NWMI shall submit periodic reports to the NRC, at intervals not to exceed 6 months from the date of the construction permit. As described in the proposed permit conditions in Appendix A of this SER, these reports shall provide the criticality safety evaluations and any changes to those evaluations for processes involving SNM.

Proposed Construction Permit Conditions (continued)

2) Prior to the completion of construction, NWMI shall ensure that processes are evaluated to be subcritical under all normal and credible abnormal conditions. This determination can be done for each area as described in Section 6.3.1.1 of the PSAR as it is completed, and shall be done consistent with the Upper Subcritical Limit.

3) Prior to the completion of construction, NWMI shall submit periodic reports to the NRC, at intervals not to exceed 6 months from the date of the construction permit. As described in the proposed permit conditions in Appendix A of this SER, these reports shall provide the technical basis for the design of the criticality accident alarm system (CAAS). Prior to the completion of construction, the reports shall demonstrate detector coverage as defined in the requirements of 10 CFR 70.24.

Plan for ACRS Full Committee Meeting

- Internal reviews to finalize the SER are ongoing
- Draft final SER will be publicly available prior to ACRS Full Committee meeting
- ACRS Full Committee meeting scheduled for November 2, 2017
- Staff will present on:
  - Findings from the review that support issuance of a construction permit
  - Update on the status proposed of licensing conditions

Plan for ACRS Full Committee Meeting (continued)

- SER will be finalized and made publicly available to support the mandatory hearing following the ACRS Full Committee meeting.
- Mandatory hearing could/to be held in late January 2018.