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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 (NWMI) SUBCOMMITTEE

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OPEN SESSION

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TUESDAY

AUGUST 22, 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, Chair, presiding.

COMMITTEE MEMBERS:

MARGARET CHU, Chair

RONALD G. BALLINGER, Member

DENNIS C. BLEY, Member

CHARLES H. BROWN, JR., 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

ACRS CONSULTANT:

KORD SMITH

DESIGNATED FEDERAL OFFICIAL:

KATHY WEAVER

ALSO PRESENT:

ALEXANDER ADAMS, JR., NRR

STEVE ALEXANDER, ISL*

JOHN ATCHISON, ISL

MICHAEL BALAZIK, NRR

DAN BARSS, NMSS

STEWART BLAND, Chesapeake Nuclear Service

MICHAEL CORUM, NWMI

GARY DUNFORD, NWMI

CAROLYN HAASS, NWMI

JIM HAMMELMAN, NMSS

LOUISE LUND, NRR

JAMES MASTERLARK, NMWI*

CLIFF MUNSON, NRO

TY NAQUIN, NMSS

ANNIE RAMIREZ, NMSS

STEVEN REESE, NWMI

SALLY SCHWARZ, Public Participant*

MOLLIE SEMMES, NMSS

APRIL SMITH, NMSS

SAM SWAN, NWMI*

DAVID TIKTINSKY, NMSS

ANDREA D. VEIL, Executive Director, ACRS

*Present via telephone

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P R O C E E D I N G S

8:30 a.m.

CHAIR CHU: This meeting will now come to order. This is the first day of a two-day 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, Jose March-Leuba, Walt Kirchner, Charles Brown, and Joy Rempe. We also have NRC Consultant Kord Smith with us today.

The purpose of this two-day meeting is for the subcommittee to hear a briefing from presentations from NWMI regarding their construction permit application for a radioisotope facility in the city of Columbia, Missouri for producing moly-99.

We also expect to hear from the NRC staff regarding their review of this application and the NRC's staff safety evaluation report.

The following NWMI construction permit application preliminary safety analysis report, PSAR, chapters.

And then the associated NRC staff safety evaluation reports are scheduled for discussion today,

as noted in today's agenda. They are Chapter 9, Auxiliary Systems; Chapter 11, Radiation Protection and Waste Management; Chapter 12, Conduct of Operations.

This meeting is being conducted in accordance with the provisions of the Federal Advisory Committee Act. Rules for the conduct 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 will be closed to the public to protect information proprietary to NWMI or its vendors. We have designated a portion of the afternoon sessions to discuss proprietary information toward the end of this meeting, as shown on the agenda and the session will be closed to the public.

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

During the open portions of this 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 will have an opportunity for public comment from the bridge line and from members of the public in attendance.

During the closed portions of this meeting, the public bridge line will be closed. The staff has asked to have an open line during the meeting so that certain NRC contractors and staff who were a part of the safety review can respond, if necessary, to ACRS members' questions. We ask that you keep this line on mute, unless speaking, to avoid disruption of the meeting.

We will now proceed with the meeting and I will call upon Louise Lund, Director, Division of Policy and Rulemaking in the Office of Nuclear Reactor Regulations to open the presentations today.

MS. LUND: Good morning. Thank you, Dr. Chu. As you mentioned, my name is Louise Lund. I am the Director of the Division of Policy and Rulemaking in the Office of Nuclear Reactor Regulation. Our staff in the Office of Nuclear Material Safety and Safeguards, Office of Nuclear Security and Incident Response, and Information Systems Laboratory, our technical contractor, as well as our office, NRR, are pleased to be here today to conduct our third briefing for you to on the staff's review of the construction permit

application for the proposed Northwest Medical Isotopes Radioisotope Production Facility.

In addition to the NRC staff are Carolyn Haass, Steve Reese, and others from Northwest Medical Isotopes, as you see up at the front, are here to present information on their application.

As we discussed in mid-July when we last met, the NRC staff received the construction permit application for the Medical Radioisotope Production Facility from Northwest in the summer of 2015.

At the previous meeting, the staff presented Chapters 3, 6, 7, and 8 of our draft safety evaluation report with Northwest Medical Isotopes presenting the companion chapter of their preliminary safety analysis report.

Today, the staff and Northwest Medical Isotopes will present on Chapters 9, 11, 12, and 13.

Our next scheduled meeting with you is on September 21st, where the staff and Northwest Medical Isotopes plan to close out action items as a result of these past subcommittee meetings.

Finally, the full committee ACRS meeting is currently scheduled for October 5th.

Before we begin today, I did want to make a minute to thank the committee for all the feedback

and insights we got from you at our July meeting. We have benefitted greatly from these discussions. It certainly gave us some additional items to examine further as we near completion of our safety evaluation, which will result in a better final product.

Prior to today's presentations, Northwest Medical Isotopes and the staff will address some of the open items that were identified from previous meetings and the actions we're taking or plan to take to address that feedback.

So with that, I'll turn the presentation over to Carolyn Haass of Northwest Medical Isotopes. Thank you.

MS. HAASS: Hello. Good morning. I hope everyone has had a great week and got to spend a little time outside yesterday. Hopefully, they let you out of this grudgingly -- what I was going to say is later this afternoon I was going to put some pictures up. We actually got to see it from the airplane and flew over St. Louis when it was occurring. So, I have pictures from Denver, St. Louis, Columbia, and a gorgeous horizon but I'll put them up later for you guys to see. It's part of your anticipation.

PARTICIPANT: Can you put those in a letter?

MS. HAASS: I can. So yesterday on the plane, I was sitting next to a gentleman from NASA and he was telling the whole first part of the airplane what was going on and it was kind of cool.

But so we're here, as Louise said, we're here for our third meeting. Obviously, we have also met with the full subcommittee back in the May time frame. And we have one major action item that we wanted to discuss today, which is seismic and I know that the NRC is going to follow-up with that.

We believe that all the other action items that have been brought up, whether they were in Chapter 2, 3, 5, 6, 7 we have dealt with and we have revised those chapters appropriately. And then on the September 21st meeting, we can go through them briefly, obviously, how we resolved and answering questions you may have.

MEMBER BLEY: Since you brought that up --

MS. HAASS: Yes.

MEMBER BLEY: -- just a quick question. Some of the things that were brought up in earlier meetings would affect the ISA and other areas. Have you gone back into those as well?

MS. HAASS: We did not go back and do a

full evaluation, no.

MEMBER BLEY: Okay.

MS. HAASS: You know that is actually going to be part of -- it's part of the final design and the final ISA development and those are action items that we are taking forward.

MEMBER BLEY: Okay, that makes sense to me.

Will they be flagged? Where will they be flagged and tracked so we --

MS. HAASS: Well, they're flagged and tracked on our tracking system.

MEMBER BLEY: Okay, that's good.

MS. HAASS: I mean I'm not quite --

MEMBER BLEY: We'll track them, too. But I just wondered.

MS. HAASS: Right, right.

MEMBER BLEY: They won't show up in revisions to any of the chapters or anything like that the first time.

MS. HAASS: No, no. What you're seeing now is several places where you did bring something up. We will identify that it is there and then we say that we will --

MEMBER BLEY: In the chapters?

MS. HAASS: Yes.

MEMBER BLEY: Okay, that's what I'm trying to get at.

MS. HAASS: But we have our own tracking system as well for that.

MEMBER BLEY: I hope so.

MS. HAASS: Okay.

MEMBER BLEY: I hope the staff does, too.

MS. HAASS: Oh, okay.

So what we really want to focus on today is seismic and what our approach has been and where we are going. And I'm going to turn it over to Mike Corum. And I believe Sam Swan, our seismic expert, is on the phone. Sam, are you there?

MR. SWAN: Yes, I'm here.

MS. HAASS: Okay, thank you.

MR. CORUM: Okay, so our approach for seismic is to use the spectra from Reg Guide 1.60 anchored in a peak ground acceleration of 0.2 g. And I guess that is the question of whether that is a bounding for some of the current data that is out there. And as evidence that it is, there was a probabilistic seismic hazard analysis that was performed for the MURR site suing the recent present day methodologies and also using as input the information the CEUS-SSC

database, along with the updated EPRI ground motion model.

And the purpose of this was to generate a site-specific GMRS and then compare that with the Reg Guide 1.60 and the PGA of 0.2g. So, using this analysis for the MURR facility, they developed a GMRS and showed that it is enveloped by the seismic response spectra from Reg Guide 1.60 in a PGA of 0.2 g, up to about 16 hertz. And the GMRS exceeds the seismic response spectrum above that frequency.

Now, based on EPRI guidance, the ground motion is higher than approximately 10 hertz, are not damaging to structure systems or components of a nuclear reactor, except for functional performance of components that would be sensitive to vibration, such as electrical relays.

As long as we provide the electrical relays or fail-safe on excess vibration and the loss of power, the safety function of such relays or any other equipment that is vibration-sensitive would not be compromised.

MEMBER STETKAR: So you didn't think about relay chatter and spurious signals and all that kind of stuff, which is what happens when relays contacts; they can break.

MR. CORUM: Right but once the contact is broken, if we got fail-safe, it will fail into --

MEMBER STETKAR: You didn't hear me. If you have DC power, which you claim you absolutely will have DC power -- there is no uncertainty to that, and DC power is feeding your inverters and you are claiming your inverters will be there, then you will have power to all of those circuits. And as contacts open and close, you will get spurious signals.

MR. CORUM: Sure.

MEMBER STETKAR: Okay, they don't fail, as I like to say, they don't fail clean; they fail dirty. So high frequency stuff can be important when you have contacts that need to open and close, to start and stop equipment, to cause valves to open and close, to do those kinds of things.

In fact high frequencies are important for that stuff.

MR. CORUM: Sure. Sam, do you have experience with that equipment?

MEMBER STETKAR: Or, by the way, poorly fastened printed circuit boards in cabinets and things like that where you get contacts loosening up.

MR. CORUM: Sure. Sam, could you comment on that?

MR. SWAN: Well, it's true the concept of relay chatter and earthquake due to vibration is obviously something that has had heavy focus in the nuclear power industry. The thing that is interesting about earthquakes is you can get relay actuation not just from straight vibration, but from electrical surges; in other words, the relay simply doing its job during the earthquake.

So I think the answer to this is the effect of relay tripping, chatter, or whatever, will be taken care of as a more general review of control systems, assuring that we do have fail-safe. In other words, the actuation of a relay cannot cause an unacceptable consequence. So clearly, it's not just an earthquake issue.

MEMBER BLEY: Well, two kind of related questions here. I'll just preface it. If a relay is energized close, not much happens. If the relay is open, then these contacts can chatter, as they do. They are closed for a while, they are open for a while, they are closed for a while, they are open for a while and the concept of fail-safe may not really apply because it doesn't go to its fail-safe position. It goes somewhere intermediate as this continues to occur.

And that's kind of where John was coming from; have you looked at that? You said it will be looked at as part of control systems. Somebody tell me when that will happen.

MS. HAASS: It's occurring during our final design.

MEMBER BLEY: So when you come back for an operating license that will have been examined. You will be able to explain to us how this could affect your facility.

MS. HAASS: That's correct.

MEMBER STETKAR: Part of my point is this would go to more digital systems and the concept of electromechanical relays changes. I mean there probably will be some sort of electromechanical relays in switchgear protection circuits, and things like, and user switchgear protection circuits.

On the other hand, as we go to digital equipment, we have the problem of all the contact chatter, where what I was saying earlier is loose contacts. If you don't design your cabinets to what I've seen, something on the order of about 0.4 or 0.5 g at about 50 hertz or so, it's not at all clear that they'll remain intact. And when I say intact I don't mean falling apart cleanly breaking all the circuits,

looking like an open circuit. I mean things rattling around in them.

So, I hope people don't get this narrow notion of electromechanical relays are the only thing you need to worry about because that is historically what people have worried about in power plants built in the 1980s.

MR. CORUM: Sam, could you briefly describe what we're going to be doing for the equipment when we are doing our analysis?

MR. SWAN: Sorry, was that to me?

MR. CORUM: Yes.

MR. SWAN: Yes, we're basically going to take two approaches. The focus of the question is demonstration of ability to operate after the earthquake and it will be use of existing shake table test data for equipment that is at least representative of what will go into the facility and, more importantly, the experience from actual earthquakes, which we've compiled quite a large database, which covers all of these issues, including relay chatter, of course, high frequency content, et cetera, et cetera. So, that's the general approach.

MR. CORUM: And all our IROFS are relays. They are not digital.

MEMBER REMPE: So just to follow-up on Dennis' first question, what I believe you said was that perhaps on the 21st meeting you are going to say okay, there were a lot of issues identified and we'll have a sentence in the updated PSAR saying this item was identified and will be addressed in the final design. And so there will be a lot of statements like that, unless there is something you could fix right away. Is that true?

So you have kind of trapped it in a visible public manner because it will be in the PSAR?

MS. HAASS: That is correct and that is already in the PSAR in the new chapters you received.

MEMBER REMPE: Okay, thank you.

MEMBER STETKAR: Just out of curiosity, when MURR did their analysis, which obviously we have not seen, you mentioned that they anchored it at a 0.2 g peak ground acceleration. What was the frequent exceedance frequency, mean exceedance frequency of that 0.2 g?

MR. CORUM: Actually, I don't think they anchored it to a 0.2 g. That was the comparison.

MEMBER STETKAR: I thought you said that.

MR. CORUM: That was the comparison to the Reg Guide 1.60 anchored to a 0.2 g. They used the PGAs

that were associated I believe it was with the ten to the minus four and a ten to the minus five return frequency.

MS. HAASS: And I know Mike and I'm not sure who else will be coming up and talking about that MURR analysis. You know we did not do that analysis. So, we need them to speak for that.

MEMBER STETKAR: Sure. Okay, we'll ask the staff. Thanks.

I was just looking at -- again, I'll reiterate something that I mentioned in our meeting on Chapter 3. Pete Riccardella is not here today so I'll speak of it for him.

If you look at USGS, which is only one input to the -- I always forget the NUREG number but the Southeastern U.S. Seismic Hazard Reevaluation NUREG, if I pull up the coordinates of your site, at a ten to the minus five mean exceedance frequency, USGS has a peak ground acceleration of 0.66 g.

So if you are saying you will design your plant to survive anything that is greater than highly unlikely, you have that 0.66 g, at least from the USGS, as your bottom end peak ground acceleration. It's not speculative.

I didn't try to go back and figure out what

it would be looking from the Central-Eastern U.S. Hazard Analysis and I have not seen the revised hazard for the Callaway site. So, I don't know what they're using for their response to the staff on Near-Term Task Force recommendation 2.1, for example. I just don't know.

MR. CORUM: Okay, if you look at the GMRS that were developed for MURR, I believe that ten to the minus four return frequency, we were looking at a PGA of about 3.5. And at a ten to the minus five, I think it was somewhere in the 0.5 range. Is that right, Sam? Am I remembering that correct?

MR. SWAN: No, I believe it is a 0.3 for ten to the minus five --

MR. CORUM: Okay.

MR. SWAN: -- and something less than that, obviously, for ten to the minus four.

MR. CORUM: Okay.

MEMBER STETKAR: We'll ask the staff about the MURR analysis.

MS. HAASS: Yes and that's what I was actually going to say. I mean I know that they are going to be presenting something. We need to have them do that.

So, that's all we have on the action items from a major perspective. So I know that staff will

come.

MR. BALAZIK: Good morning. My name is Mike Balazik. I'm the project manager for Northwest Medical Isotopes. I'm in the Division of Policy and Rulemaking in the Research and Test Reactor Licensing Branch.

And next to me is Dr. Cliff Munson, who is the Senior Level Advisor for Siting in the Office of New Reactors.

And we wanted to cover two items, two action items this morning and one of them is seismic. The other one was a question from one of the ACRS members on the impact of a probable maximum precipitation and we'd like to talk about that also.

So let's first start out with seismic and I will turn it over to Cliff Munson. You can see what we did. We've got some pictures that may help put this in perspective, so something you can see. So, we'll go ahead and get started.

MR. MUNSON: Okay, so the approach I took was to run our source and ground motion models that we used for siting nuclear power plants, which is the CEUS-SSC, which is NUREG-2115 for the sources and then the ground motion model, the latest EPRI ground motion model for the Central-Eastern U.S.

And then I did a site response analysis to determine the amplification, the local site amplification.

This site is -- from the nearest boring to the site there is about 12 feet of clay over hard sedimentary rock. And then I took advantage of the Callaway Nuclear Power Plant, the analysis we did for that. The rock units are the same for this site and as for Callaway. It's basically limestone over dolomite. Next slide.

Then we rolled the site amplification factors back into the PSHA and developed a control point surface hazard curve. And I developed a number of design response spectra using ASCE 43, a Seismic Design Categories 3, 4, and 5 spectra. Seismic Design Category 5 is equivalent to the GMRS and I was using ASCE 43-05. So, you can see those pictures.

So starting off with the source model, you can see the site with the blue triangle next to Callaway in the right upper corner. This is one of the seven configurations of the CEUS-SSC source model. I pictured this one just because it is the one highly weighted one.

But the purpose source, the New Madrid Fault System, the purple linear feature is the big

hitter for the seismic, which you will see in the next slide.

So, this shows the 1 and 10 hertz rock hazard curves. So, using the source model and the ground motion model, I developed hazard curves from a rock horizon, which you can imagine is 1,000 feet or so below the site.

So if you look at the 1 hertz, which kind of consider low frequency result, the New Madrid, which is the dotted curve, pretty much contributes most everything. And then at 10 hertz, some of the other seismic sources that you saw in the previous picture start to play a role. But still, New Madrid dominates the ten to the minus four. At ten to the minus five, you see the host zone, which is the Mid-Continent A version is starting to show up, which is the green curve.

So that was 1 and 10 hertz. This is all seven frequencies from 0.5 hertz to 100 hertz. And I can take those rock hazard curves and develop uniform hazard response spectra at different return periods.

So what you see on the right are 100,000 year, 10,000 year, and 1,000 year return periods for the rock hazard.

So next, I wanted to fold in the site response. So the site has 12 feet of clay, which has

a sheer wave velocity of about 1,000 feet per second and it jumps over to limestone, which is 4,000 feet per second, and then a hard dolomite beneath that.

So with 12 feet of softer material over this hard rock, you get a very large site amplification at 20 hertz. And the 20 hertz is because of the thickness of the layer. That resonate frequency for this site is basically 20 hertz.

So you get amplifications up there at about 2.5 to 3.0. The numbers on the right are we run the site response at 12 different input loading levels and those are spectra accelerations, so they should have a "g" next to them. Those are input spectra that we load the site with as we propagate up to the surface.

You'll notice on the left hand side that I factored some uncertainty into the site response. I drew three profiles, rather than just a single profile because of the uncertainty in the velocities and the densities. And so there's not too much uncertainty that I factored in but I wanted to capture some of the uncertainty in that.

And then about each of those profiles, I developed 60 randomized profiles about each of those lines you see on the left.

So, next slide. Factoring those

amplification factors back into the PSHA, the hazard -- and developing hazard curves at the surface now, instead of the rock horizon, what you see on the left are the hazard curves for the seven frequencies. And then taking those hazard curves, I developed uniform hazard response spectra for 100,000, 10,000, 5,000, 2,500, and 1,000.

So, the blue curve on the right is the Reg Guide 1.60 spectrum that they're proposing for 0.2 g.

The dark black curves are different Seismic Design Category design response spectra using ASCE 43. So, SDC 5 is the GMRS, basically. SDC 4 and SDC 3 are basically a lower return period ground motions. They are not used for facilities at the NRC but DOE uses these design categories for some of their facilities.

So, that's basically it.

MEMBER BLEY: So tell me what you make of the Reg Guide blue curve compared to the others. I mean it's hardly relevant.

MR. MUNSON: Well, I guess we can go to the next slide, which has the summary.

The New Madrid System, which is about 350 to 400 kilometers dominates the hazard. We have a significant site amplification at 20 hertz.

The proposed Reg Guide covers 1 to 10 hertz but if we go back a slide, there is significant exceedances beyond 10 hertz.

If you look at the rock hazard, you'll see --

MEMBER BLEY: And that's primarily due to the amplification.

MR. MUNSON: Right, it's the amplification. I was going to say that.

MEMBER STETKAR: So let me try to phrase it this way. We've seen submittals from combined license applicants that have shown this type of behavior and they propose to design and construct their facilities to envelope both of those. Essentially, a bimodal, if you try to fit things, or an envelope such that they capture in their design both the low frequency contribution following the Reg Guide and the actual site-specific contribution at the higher frequencies.

Is the staff expecting NWMI to do that?

MR. MUNSON: I guess I'll defer to Mike on that.

MEMBER STETKAR: Okay.

MEMBER BLEY: Well, I'd ask you, as you talk about it, to think back to that discussion about

relay chatter and solid state equipment chatter. And clearly, where that happens is in this amplification area.

MR. MUNSON: Right. So I guess the question is will this structure be embedded at all or is it going to be on the surface.

MEMBER KIRCHNER: That is my question. What you've done, the amplification is coming from the clay, isn't it?

MR. MUNSON: Yes, right.

MEMBER KIRCHNER: So that's only 12 feet. We're looking at a facility that has a basement for the hot cells that is surely going to get down to rock, I would guess.

And so what would be the foundational acceleration, rather than the free surface acceleration?

MR. MUNSON: And that would be basically the rock hazard I showed in the --

MEMBER KIRCHNER: Right. So how would this change, then?

MR. MUNSON: It would go down. If you look at the previous slide, I believe slide 3.

MEMBER STETKAR: But still, if you look at the high frequency in the bedrock, you still get

measurable.

MR. MUNSON: Right, so there is still going to be some amplification.

MEMBER STETKAR: Yes, there would be but how much?

MR. MUNSON: Well the middle curve, the 10,000 year, if you go a little bit higher than that, you would be basically at the GMRS.

MEMBER STETKAR: I mean just look at the curves on the left. Look at the 25 hertz curve at ten to the minus five exceedance frequency is a g.

MEMBER KIRCHNER: That's a lot better than 2.5 g's in the next.

MEMBER STETKAR: It's better than 2.5.

MR. MUNSON: So right, if they do found this on the rock, they will have more likely the results here.

MEMBER BLEY: So by the time they come in with an operating license request, this stuff needs to be pretty clearly handled.

MEMBER STETKAR: It strikes me that they ought to know how much concrete they are going to pour --

MEMBER BLEY: You'd think.

MEMBER STETKAR: -- you'd think before

they come in for an operating license request.

MEMBER BLEY: I know they haven't looked at the effects of it at this point and they can design around it.

MEMBER STETKAR: You can damp things.

MEMBER BLEY: Yes, I mean I wouldn't object to getting through the construction permit stage without having figured out that. And that's not going to -- what John just said is right for what curve is going to be here but it's not right for how you deal with the peak. I mean it doesn't address how you deal with the peak.

MEMBER STETKAR: That's correct.

MEMBER BLEY: And that they are going to have to do before.

MEMBER STETKAR: Well but the key is, are they going to try to do that?

(Simultaneous speaking.)

MEMBER STETKAR: Yes, and that is why I wanted to ask the staff, as far as what is their expectation. And I don't particularly care, you're right, for construction permit or final operating license. But final operation license, what is the staff's expectation?

MR. BALAZIK: Let's go to the last side

real quick. So just in conclusion, NUREG-1537 on seismic damage, there is an acceptance criteria and it says the seismic design should be consistent with local building codes to provide assurance that significant damage to the facility and safety functions is unlikely.

So Northwest is following the guidance in Reg Guide 1.60, which is more conservative than the building codes. And just in conclusion, that we see from the graphs that Dr. Munson was showing, that there is an impact in the high frequency area. And the staff will have it documented in the appendix that this is something that we will look at in the operating license to see how Northwest has dealt with the high frequency that we see from the graphs.

MEMBER BROWN: I guess for the non-seismologist's viewpoint, I guess I have a little bit of a difficulty understanding how you can grant a construction permit if you don't know how the foundations and everything else are going to be anchored to compensate, to take care of this. Operating license, it's already built for the most part. I mean a good bit of it's built. So, I just I wouldn't wait until the operating license review period. It seems to me you have got to have this resolved. That's just

from the uninitiated viewpoint, that seems to make more sense than saying it's okay to go ahead and we'll figure this out after the facility is 80 percent, 70 percent, 90 percent complete because all the concrete, the foundations, the structure, everything has got to be anchored somewhere.

MR. BALAZIK: Yes, sir, and I understand that question but -- and I'm not a seismologist either. Let me put that out there. But in the range from 1 to 10 hertz with big structures, we seem to be pretty good. So what we're looking at is instrumentation like Dr. Bley was talking about and Mr. Stetkar about relays. They're kind of small, I will say relatively small components that Northwest could seismically qualify. I don't know if those are the right words or not. But we're looking at smaller things. We're not looking at big structures because we seem to be pretty good in the 1 to 10 hertz range. It's just that high frequency impact.

MEMBER BROWN: But you're running processes that have relays. You're IROFS that have relays and you don't want stuff to happen and essentially during some high frequency exaltation that you might get.

MR. BALAZIK: Yes, sir, I totally agree.

And right now with the maturity of the Northwest design, specifically in the instrumentation, we don't have all the information to be able to evaluate that right now. It seemed like to me that the design would have to be more mature.

MEMBER BROWN: So your fundamental argument then is you can build the foundations, the slab, the walls, the roof, and everything else and it is how you mount equipment within the structure within the facility that allows you to overcome those high frequency potential issues -- potential problems.

MR. BALAZIK: Yes, I wouldn't say that is -- I'm sure there are numerous ways but I would think that would be one way to do it, as a formality. Like I said, I'm not a seismologist and I'm not a structure guy but --

MEMBER BROWN: But you all have to make the decision.

MR. BALAZIK: Yes, sir, and we'll have that documented.

MEMBER BROWN: And we'll say no on the construction permit.

MR. BALAZIK: Yes, sir, I understand that.

MEMBER BROWN: Well, somebody has got to put the Betty Crocker Good Housekeeping Seal of Approval

on not knowing what you're going to do at that point or not even having a game plan.

MR. ADAMS: Can I add something here?

MEMBER KIRCHNER: Al, you need to identify yourself.

MR. ADAMS: Al Adams from Research Reactor Branch.

So I think we clearly understand what the issue is. We will clearly document the issue in our SER and Northwest is clearly on notice of what they have to do when they come back with a final design.

The fact that the basic structures appear to be where they need to be, that's one thing we'll look at but it's the responsibility of the applicant to come in with the design. And it's their choice as far as what the timing goes but it's their responsibility to come in with a design that shows that public health and safety can be maintained. And it's our responsibility to look at that design and approve or not.

So, it will be clearly documented that this is an open issue to be looked at at the operating license stage and, obviously, something that will be discussed back here at that point.

MR. BALAZIK: But they made the

observation that most of their IROFS are analog relay design type complements, which is just fine. I don't have any problem with that, obviously, or maybe not obviously. But by the time you finish a whole design and then you now try to figure out where --

Let me backtrack. Working in the Navy, I had to deal with high frequency vibration of all the stuff within a ship, whether it's a submarine or an aircraft carrier. And one of the things we had to pay attention to was the high frequency shaft vibrations that you got, wave vibrations, everything that hit the ship, you had to deal with that and you had to know what you were doing before you got into the design. And if you've got components, small relays or others that are mounted inside of cabinets, you've got to take that into account. You've got to have that predesigned as to what you're going to do before you start building the stuff you mount the equipment in. That's something -- I'm just backtracking to actual experience of having designed things to meet high frequency requirements -- higher frequency requirements. There are limits on ships as to what you have to design for, just as there are here.

So that's why I was kind of curious as to not having even a game plan as to how -- because you've

got a lot of pieces. I don't know, I counted the IROFS in one of them and there must have been 30 or 40 IROFS or something like that, maybe more. That means there is a lot of pieces of equipment that you have to compensate for and they're spread around. I presume they're spread around throughout the facility in some circumstances. So, it's just a question. That's all. Thank you.

MEMBER KIRCHNER: Let me ask this. There's going to be a lot of piping in this facility, small diameter pipes and such. I'm not sure what their frequency responses would be and such but do you feel comfortable with where the applicant is now with regard to things like the plumbing and piping of all the hot cell equipment, in terms of have you enveloped what you expect them to design it to? Because a lot of the criticality analyses and such are dependent on retaining that geometry configuration. Otherwise, you're getting into places where you're moving tanks and piping and such that makes it more difficult to convince yourself that you're not approaching some criticality issue.

MR. BALAZIK: I would say that the high frequency impact, well, we thought about that also about you know you have certain tanks that you may not want

to be shaking specifically because of the Northwest --

MEMBER KIRCHNER: They're going to shake but the question is you don't want them closer to each other.

MR. BALAZIK: Or you don't want material coming in or whatever. Again, that would be something that we'd have to look at in the operating license. I can't say that we've bound that at this point but, again, we'd have to look at the impact of the high frequency to the facility as a whole; not just instrumentation but also for tanks.

MEMBER KIRCHNER: Well even if -- maybe our purview is just safety issues but boy, the experience that the Department of Energy has had with some facilities being redesigned to different earthquake loadings and spectras and such is just a disaster in terms of cost. I mean we need the output of this facility, right, I mean for the medical business. So, you want to be success-oriented.

I would just be concerned that you go into this and we've yet to see the really detailed design for the plumbing, et cetera, and you go halfway through it and then you start changing the design basis with regard to your quake loading, the seismic loading.

It seems to me that this is something that could be nailed down here in the beginning to everyone's advantage.

MR. ADAMS: Can I add something here? And this is the struggle that we have is what the regulations allow for construction permit versus operating license. You know this dilemma was probably one of the reasons why Part 52 was developed. And the problem is is that -- and I think we plan to reiterate what the requirements in the regulations we have to reach are to issue a construction permit. And I fully understand what you're saying. It's this applicant's choice. If they come walking in the door with a design that is 20 percent complete, they could walk through the door with a design that was 100 percent complete at this point. The regulations allow that.

And you know the committee has discussed some of the historical events that have occurred during design and the staff appreciates it and, hopefully, Northwest appreciates it, too. But we're regulating to the regulations and what the regulations allow. And maybe we'll quickly touch upon those again.

But at this point, there is a large amount of latitude as to what needs to be done to issue the construction permit because the process of constructing

the facility in and of itself is not a nuclear safety issue. You know the NRC jurisdictional issues are the operation of the facility. It's the applicant's responsibility to come back with an operating license application that is going to meet the regulations and be able to get a complete review by us.

It's a struggle we have worked at and what I can tell you is where we are here, I believe, is consistent with what we looked at for SHINE. And a statement that was made during the Commission hearing on SHINE, they were asked a question at that point, at the point of the hearing at what point was the maturity of their design and their answer was about 15 percent. So, there's a lot of things that this applicant will still have to figure out and the timing of it. And it's up to them when they hand us their operating license, as compared to where they are digging holes, pouring concrete, and the like. And if they get it wrong, it's their responsibility to do what needs to be done to get it right.

MEMBER BLEY: Thanks, Al. Back to what Walt was saying, though, we're not the staff. We can take a broader view of safety and we can certainly, in our letters, raise issues that might be of benefit whoever is building this facility to avoid problems

that we know of occurring in the past and we'll probably do that.

We bring them up as we go along. I think that's important to talk about.

MR. BALAZIK: The other item I'd like to talk about real quick is the probable maximum precipitation. There was a question from one of the members on impact to the site on a PMP. And Northwest had stated at a previous meeting that their PMP rate is 3.14 inches per hour. So, I'll show you a map on the next page and what I did real quick.

But I also wanted to point out another section in Northwest's PSAR that talks about flooding from precipitation events. And it just talks about grading of the site. So right now, the site still is essentially it's a ridge and Northwest will, obviously, cut that down. I'm not exactly sure how but they do say in the PSAR that it will be graded to direct the storm water away from the site.

So what I did is I went ahead and pulled up a map, an elevation map, and looked at some of the lower areas. And I'd like to point out -- here we go.

So, the yellow here is where the facility would be located. And so what I did is I dropped these markers to get an elevation. And so right here, right

where the site is, it runs around 805. As you go up this ridge, it gets higher, and higher, and higher, and I think it peaks around 850 right here.

And so what I did is I looked at both ponds. A member identified that there were ponds close to the facility and I looked at the low points of ponds. And the map will help somewhat that the low points right here for this pond would flow through here and down this way. Right here, it's around 790 feet. So up here, I said it was like 805. So there's a pretty steep grade just to down here.

Looking at the other pond, there is a low point right here that will drain down here to this area and that area was around, running between like 780, 775, right down here. So, these are the two low points.

And the circle that I drew here is -- I know it's called Discovery Ridge, but this is actually a ridge. And I should have probably bolded it a little bit down here but this a ridge. It sits a lot higher than both areas.

So the pond is not going to flood up here. I think I've got a point here that's running around 815.

So, I will add that this road, at some point, will be completed. So the terrain will change.

This will be completed to go out to I-70, the main interstate. I'm not sure about the time period. And this grade right here, I'm just saying it will be impacted. Maybe it will go up. I guess that would make sense but I'm just saying that there are some unknowns there.

So I don't really see much of an impact from these two ponds that are close to the site. So I don't know if there are any specific questions on that but I just pulled up the map and dropped the elevation points.

MEMBER STETKAR: There, too, again, until they actually grade the site, I raise the question about local ponding. These are ponds but you can also think of a parking lot as a pond.

MR. BALAZIK: Yes, sir.

MEMBER STETKAR: We've seen them. And in particular, they have subsurface truck bays, where they back trucks down to unload things. So, unless they grade the thing right, you can get water actively seeking the basement, for example.

But there, too, I saw no mention of it in Chapter 3, what would be the local on-site effects from whatever their probable maximum precipitation is. And I found, quite honestly, a couple different values for

that probable maximum precipitation in Chapter 3.

MEMBER BROWN: But where is the facility relative to -- you were waiving your pointer.

MR. BALAZIK: It's the yellow.

MEMBER BROWN: Oh, okay.

MR. BALAZIK: That's approximate but that's not where it's going to sit.

MEMBER BROWN: Okay.

MEMBER STETKAR: No, I looked at -- when I looked at the contours as you did here for local runoff and things, when I say local I mean within the scope of this slide, I was more concerned about grading on the site and whether they were going to address that just because I saw no mention of it in -- other than probable maximum winter precipitation for roof loading, which they did address, which is one of the areas, quite honestly, where I got really curious because the value that they use -- their 48-hour value is less than the 24-hour value and it's less than the 72-hour value, which didn't make sense to me.

But the only place that I could find where they actually looked at probable maximum precipitation was for the roof loading, the winter roof loading.

MR. BALAZIK: Yes, sir. And like I said, the second bullet was the only thing I found about

grading, where they said that they would grade it to direct the water away from the facility. And as I said, I know it's a general statement but that's the only place they talk about it.

MEMBER STETKAR: Well I mean, again, until they actually build it and grade the site, we don't know. As long as they look at it.

MR. BALAZIK: Yes, sir.

MS. HAASS: Can I make one comment?

MEMBER STETKAR: Yes.

MS. HAASS: So yes, we will be, obviously, grading the site so all drainage goes away from the site.

And I want to step over to the picture just to let you know --

MEMBER STETKAR: You can't do that. You can use the mouse.

MS. HAASS: Oh, okay.

MEMBER STETKAR: But you have to be close enough to a mike so we can pick you up.

MS. HAASS: So just to let everyone know, we were just there in Columbia. This road here has now been built and it is done down about a half a mile. So that was done.

I did ask the City of Columbia and the

University when they felt that this road was going to be built out to I-70. They're still not quite sure yet because they don't have the funding yet.

MEMBER STETKAR: They are going to take that all the way up to I-70?

MS. HAASS: They would like to because they would like -- Highway 63 goes right through town and they're trying to avoid that.

MEMBER STETKAR: Oh, okay.

MS. HAASS: But the key thing is right here is we do have a significant ridge here and here and we don't plan on grading this down to the point that it's level with the road. It will have some angle up. So we will be draining off of the site and the drainage is most likely going to come this way and go down. It's not going to go to the back or to the other pond. It's going to come down this road because that is where the terrain is because right down here is a depression.

And so we have been looking at that. And yes, Chapter 3 did not specifically say that, except for the one sentence that says we will be draining away from the site but yes, we're very aware of the 3.14 inches per hour. And John, there was some values that were confusing. It has now been changed. So Chapter 2 has been modified.

Chapter 2 and Chapter 3 I think had two different values and so those have been modified to be the same thing.

MEMBER STETKAR: You may want to look at, just since we're talking about this, I pulled up Rev. 2 of Chapter 3. On the winter precipitation there is a Table 3-20. We're getting a little off topic here and I apologize for that but it's still precipitation.

There's a Table 3-20, where you calculate the probable maximum winter precipitation for your roof loading analysis and that table shows a 24-hour precipitation, I'll use inches, 18.2 inches; a 72-hour of 22.5 inches; and a 48-hour of 8.73 inches.

It strikes me that the 48-hour ought to be probably somewhere between the 24 and 72. In other words, somewhere between 18 and 22, rather than 8.7.

MS. HAASS: I'd have to go back and look. I'm assuming you're looking at the newer version of Chapter 3?

MEMBER STETKAR: Yes, I just pulled up Rev. 2.

MS. HAASS: Oh, okay. I would have to go back and look at that.

MEMBER BLEY: It's in the transcript for you.

MEMBER STETKAR: It's in the transcript.

MS. HAASS: Yes, thank you very much.

MEMBER KIRCHNER: Let me ask a question now. How would this change your siting analyses, putting in a major road right there, explosions of fuel, et cetera, et cetera?

MS. HAASS: We already accounted for that.

MEMBER KIRCHNER: So you already assumed that road was there in your analyses. Thank you.

MS. HAASS: Thank you.

MEMBER STETKAR: It's mostly accounting for the folks who work in that little dot there.

MS. HAASS: Exactly. It really is.

Thank you.

CHAIR CHU: We need to move along.

MR. BALAZIK: Just real quick, I just want to close out. I just want to talk about -- I shouldn't say close out but talk about one more item. And it kind of falls under what Al was talking about. What we're determining right now is do we have enough information to authorize Northwest to commence and complete physical construction activities and are they applying the methodologies correctly.

You know at this point for the construction permit, we're not approving any safety systems; that

will be done during the operating license review. So I just kind of wanted to throw that out there just to remind everybody on the construction permit.

And basically what we're trying to do is come to the findings on 50.35, which talks about engineering criteria for design. Has Northwest identified that? If there is any missing technical design information, can it be reasonably left for the FSAR, the final design and that research have been identified and will be addressed prior to operation?

Thank you.

CHAIR CHU: Okay, we are only half an hour late after one hour. And we're going to go to Chapter 9, Auxiliary Systems.

MS. HAASS: Chapter 9 is Auxiliary Systems. I mean this is a mishmash of a lot of different stuff. And I will apologize, we are going to be jumping from person to person just because I can guarantee you I'm not a fire protection expert or something like that. And so you will just see us work through this. We will have one person on the phone that will be discussing fire protection.

But the first item we're going to talk about is HVAC. And I think we've already talked a lot about HVAC when we talked about Chapter 4 and Chapter 6.

And I don't want to go too much into this and I will be referring to, if you want to see some pictures, it is in our non-public version. You can go look at it but we're not putting it in the public version of the transcript.

But our HVAC system, obviously, provides confinement for both airborne radiological materials and chemical fumes. And that the RPF will be ventilated such that airflow travels of lower potential to higher potential.

And this ventilation system, you know it has several functions but we need to make sure that we deal with the appropriate temperatures and air quality so we don't impact our production, as well as our workers.

And overall, the HVAC system serves, the functions serves as to protect the workers, the public, and the environment because we maintain those containment barriers through multiple containment barrier systems.

I know those are lots of words and I think we all understand that. And so this is where in a couple of pages we'll talk about you know there is four different zones of ventilation that we have spoken about. If you go into the non-public version of this,

I think page 2, you can see our ground-level confinement zones on the first floor, and page 3 goes to the second level as well as the basement.

So for ventilation, our supplied air is conditioned using filters, heating coils, cooling coils, and it meets all the requirements we need to have to do our production and support having the appropriate worker environment.

We're going to have three air supply handling units. They will be sized at 50 percent capacity and of the three, two will always be operating; one will always be in standby.

Isolation backdraft dampers in the supply duct system at the zone boundaries will close when required to provide any confinement zone -- at the zone boundary. This will also be operated through the building management system, which I know that we have discussed previously and I probably forget what chapter that is at the moment.

We are going to have three exhausted air systems. So you have an exhaust system for Zone I, you have one for Zone II/III, then you have one for the laboratory, and then the process vessel vent system.

Of those four exhaust systems, there will be three stacks, the Zone I and the process vessel vent

system will go through one stack, as Zone II/III and the laboratory exhaust will have their own stack.

Each of the exhaust filter trains will have prefilters, HEPA filters, carbon absorbers, isolation dampers for confinement reasons. And we will also have monitoring and sampling systems on each of those stacks.

To date, and I would have to ask Gary this, we haven't determined which monitoring systems or what we're sampling for yet. I mean we have a good idea but that has not been defined as of yet.

This next slide on 5, this just reiterates what our four ventilation zones are. Zone I is our initial confinement barrier, with Zone II as our secondary confinement, III tertiary, and then IV is our nonradioactive and administrative area ventilation.

And this is a series of cascading pressure zones to draw from the cleanest to the most contaminated areas. And the table that you see here is we have already identified the major areas within our facility what zone they are and this correlates to the picture in the other presentation on page 2 and 3.

MEMBER BROWN: Can I ask a question? You talked about -- maybe you're going to get to it. The way I've read the confinement part of it, if you've

got from zone -- I might be going in the wrong direction so tell me -- III higher, to II lower, to I lower. That's the first one. And is that just based on duct pressure controls in terms of dampers and things or is there entrance and exit? In other words, barrier doors that you have to go through and equalize before you got I, II?

My only familiarization is with some of our sites, where we actually had to go, where we had some cascading pressure things to confine -- actually, contain but we still had to go through isolated doors to not disturb pressure and balance, as opposed to trying to balance high, medium, and low with some type of control system that adjusts dampers as people go in and out of various zones.

MR. DUNFORD: So the short answer is yes. There are air --

MEMBER BROWN: Yes to what?

MR. DUNFORD: There are air locks. There are double doors in three different spots in the facility for that reason.

MEMBER BROWN: Okay, so going from zone to zone to zone.

MR. DUNFORD: Well, typically out of the Zone II area. Probably Zone I is someplace you don't

normally go.

MEMBER BROWN: Yes.

MR. DUNFORD: So the Zone II area, the Zone III are typically where you are seeing that or a Zone III to a Zone IV.

MEMBER BROWN: Okay, so Zone I is the most critical.

MR. DUNFORD: Right. So that's going to have a filter inlet --

MEMBER BROWN: That's the most critical one to have an air lock.

MR. DUNFORD: -- a HEPA filter inlet and all it has is in leakage air. It doesn't have it supplied. It just sucks air out of the Zone II system, Zone II areas into the I out through the Zone I stack. It doesn't have a defined pushing fan into that area.

Like the Zone II/III actually has a supply fan to supply the air to the facility. The Zone I is just an exhaust fan -- exhaust system. It's not an inlet system. It just leaks from Zone II/III into the area.

MEMBER BROWN: So that is at least one airlock for access into that Zone I area. Is that what you're --

MR. DUNFORD: Into the Zone II. You can't

get into the Zone I. Zone I areas that we have are the hot cells and there's not a man entry.

MEMBER BROWN: Are those below grade? I thought I remembered --

CHAIRMAN BLEY: Some of the hot cells are below grade and a lot of them are at grade.

MEMBER BROWN: Okay. Thank you.

MEMBER BLEY: Carolyn and Margaret, we don't have a closed session for this after but there are some things that are proprietary that some members may want to ask about. Is it okay if we raise those during the scheduled closed sessions for other chapters?

MS. HAASS: So what we assumed is when we go into our session on criticality, that we would probably have about ten minutes that you would want to go talk about this and that's why I have some information in the non-public version.

MEMBER BROWN: I presume I didn't violate any closed session protocol or you would have said so.

MS. HAASS: You've violated everything.

MEMBER BROWN: I did. Shoot me now. I'll put my hands up.

MEMBER KIRCHNER: Just clarification on terminology. You say separate stacks but they all go

into one freestanding or supported stack for exhausting or three separate stacks?

MR. DUNFORD: Three.

MEMBER BROWN: Three separate ones.

MR. DUNFORD: Three in the same area. They go through a common support structure. The common support structure is going to support all three.

MEMBER KIRCHNER: So from the standpoint of accident analysis and such, they're all going into that same larger stack or --

MR. DUNFORD: No, no, sir.

MS. HAASS: There is three stacks in one common area of the facility. And obviously, the Zone I process vessel vent system stack is the most important one from an accident perspective.

MEMBER STETKAR: One hole, which supports three pipes going up through the hole.

MEMBER BROWN: Three different pipes, okay.

MS. HAASS: Gary, I'll let you go.

MR. DUNFORD: Okay so we already talked really about this next slide, which is the confinement of the HVAC system. It is an engineering safety feature. We covered that quite a bit in detail in Chapter 6. So I'm going to just quickly go through

this. It is all redundant to what we said previously.

So design criteria, we want to protect the offsite public and on-site personnel and as an overall criteria, we want to minimize administrative controls or complex engineering controls. So we have a fairly simple system. We talked really how it is going to fail previously. We will also talk about that in the closed session in Chapter 13, when we go through some of the -- through the accidents.

The process vent system is the primary confinement pressure boundary. So that is what is on the actual tanks that have the material. We would expect that really in normal operations that the Zone I airspace will be fairly clean. You're not going to go in there but it would be fairly clean, not much contamination in that area.

So we talked about the bubble-tight dampers before. We actually modified some stuff in Chapter 6, based on the last meeting and discussion about that. So, I'll just move on so we can get through this chapter.

So the off-normal events are in Chapter 13 when they deal with the HVAC system and our normal releases we will talk about in Chapter 11 here in just a little bit that come out of that. Our normal releases

are primarily driven, at least the dose is probably primarily driven by the xenon releases from a dose perspective.

One of the things we haven't talked about briefly is why we have the laboratory exhaust system really is kind of another zone, a small Zone I system. And it's a separate system, just really a control flows through the hoods and the equipment areas there. It's just much easier to have its own small exhaust system and stack. So that's actually why it's separate. I've been in facilities where they are combined and it's a pain to try to control the lab face velocities when you've got everything else adjusting for it.

And the items relied on for safety, as we went through the internal safety features, there is a whole list of the components in Chapter 6 that we went through earlier. And obviously, we had talked about previously the exhaust stack height and all those systems then also have to be seismic qualified also.

MEMBER SKILLMAN: Gary?

MR. DUNFORD: Yes, sir?

MEMBER SKILLMAN: On that slide, your second carat, you identified the air balance system and you actually make an entry at Chapter 9.1.3 of your Revision 1 Chapter 9 for air balance system. Failure

of the air balance system is not, in itself, an accident.

What is the air balance system?

MR. DUNFORD: That would be if you had a backflow between the Zone I back to a Zone II or something like that. So, if you lost your normal airflow, that itself doesn't necessarily create an accident. You have to then have a material at risk or a source term.

So a couple things have to be happening in accident space there.

So we have looked at a loss of power accident and contamination from that aspect but just the fact that you've lost pressure control from Zone II to Zone III or something like that, that does not, itself, create an accident condition.

MEMBER SKILLMAN: Is the air balance system a network or a series of, if you will, pressure sensors and logic that determines which zone is pressurized by how much and which has been lost, thus pointing to a backflow?

MR. DUNFORD: Yes.

MEMBER SKILLMAN: In other words, is this actually a logic system that is testable, that is designed with, if you will, an intelligence to

understand how to keep the cascading negative pressures negative as they are intended to be?

MR. DUNFORD: I have a simple answer to that, which is yes, but when I go a little bit more complex, there are some locations -- you open up a rollup door. Typically, you don't want the controllers to try to recover from that. It is a very large change to the system. So you might want an alarm but you may not want to try to control that. You're doing that as a planned perturbation and you know it's going to happen.

But in most cases, in most situations, yes, there is pressure control, there is pressure alarm, and it is part of our building information management system. It is kind of a standard HVAC package you would go buy for an industrial building almost that has room control, zone control, pressure and flow indicators.

MEMBER SKILLMAN: How intensive is the effort to recover after a trip?

MR. DUNFORD: Loss of power or loss of air balance?

MEMBER SKILLMAN: Both.

MR. DUNFORD: In theory, it should be fairly straightforward.

MEMBER SKILLMAN: I'm familiar with losing

either electrical power or a series of dampers or ventilators on a large plant and I know how difficult it is to reset. You've got people running every which way, either closing dampers, adjusting dampers, starting fans, closing fans, closing fan dampers, starting blowers. And so, as I see it, the loss of your ventilating system controls is probably one of the most dicey portions of your Chapter 13 because your ventilation system is what is really protecting your workers and the public.

So if you have failure in this air balance system, my curiosity is how is that managed. Is this a system that is actually a standalone control system that has testable devices or is this simply a concept from which you say well, if we lose power or if we lose the system, we just go and hit a couple of reset buttons and go back to normal?

It's pointed to as a system in 9.1.3 and you pointed to it here in your presentation.

MR. DUNFORD: And it's discussed that way in Chapter 7, too, as a system with controllers, non-IROF controllers but controllers.

MEMBER SKILLMAN: Does it require IROFS?

MR. DUNFORD: The Zone I confinement system and function is an IROF, the Zone II and III

are not.

MEMBER SKILLMAN: And that's part of the air balance system?

MR. DUNFORD: That is part of the air balance system of Zone II and III. That is correct.

So from a safety aspect, you can be safe if your Zone I system and your Zone II and III aren't running. From a plant operations perspective, you probably would not -- you wouldn't be doing anything; you want to go recover that system. But from a safety perspective, you're still safe.

MEMBER SKILLMAN: Is the process by which you reset when you have had an upset going to drive people into areas where they are no longer protected and they now need respirators?

MR. DUNFORD: Yes, well that could definitely be an action on loss of ventilation. You're in the laboratory and you've lost the laboratory system and you need to stay in there, yes, you're going to have to.

MEMBER SKILLMAN: And there is a source term?

MR. DUNFORD: Yes, that would be part of the response.

MEMBER SKILLMAN: For a construction

permit, I think we're where we need to be. I'm asking the questions because it seems to me with an air balance system, at least with the experience that I've had over the years, loss of that can be very dicey and draw people into situations where they are not anticipating what they're getting into. And unless that has been thought through, that can be a real hazard. That's all I'm trying to communicate.

MS. HAASS: I think we agree with you. Understanding that the ventilation system and the air balance function is going to be extremely important in keeping that facility up and operating, we completely agree.

MEMBER SKILLMAN: Thank you.

MS. HAASS: The next thing we're going to talk about is fire protection. And we have --

MR. CORUM: Yes, I have Jim Masterlark is on the line and he is our Director of Fire Protection. Jim, can you hear us?

MR. MASTERLARK: Yes, I can.

MR. CORUM: Okay. I'd like for Jim to take us through the next several slides and I'll jump in whenever I need to. But Jim, if you can start slide 8 for us, please.

MR. MASTERLARK: I sure can. Good

morning. So, for the fire protection system design, we are taking a look at the detection for fires, the notification, and the rapid suppression for fires with, of course, the goal to be preventing small fires from becoming some type of a large or unmitigated fire.

The notification piece of this will be achieved through automatic detection devices, manual pull stations, the automatic sprinkler systems will also send an alarm, and the alarm the devices will broadcast within the building and the area, and also transmit signals to a central alarm station in the control room.

The suppression of the fires will be accomplished with automatic sprinklers, wherever appropriate, wherever we identify that in the fire hazards analysis.

The suppression systems will include the piping and the valves, fittings and the water supply, which would include a water storage tank and the municipal hydrants. We do expect them to have the automatic sprinkler systems and standpipes available.

The fire protection system will provide detection and suppression for fires within the facility, the generation of alarms signals, as I said, to indicate the presence of a fire, and also start the

process for identifying the location of the fire and the actions to take.

This system will be an addressable fire alarm system. It will have both the automatic and capability for manual initiation, wherever that is deemed appropriate.

The detective devices, as I said, will also alarm to the local control panels that ties to the control station. And the alarms, which does include the fire alarm, the supervisory circuit, and trouble alarms will also go to the central alarm station and control room.

That supervisory system is set up to meet NFPA code to be fail-safe. So, it gives both audible and visual alarms, if there is a trouble with the system.

And in addition, the HEPA filter plenum deluge will be expected to be supplied with an eight-inch piping network as part of an overall strategy for the plenum fire safety design.

So there are two main systems that we're talking about here. There is the suppression system and subsystem. This would be the automatic sprinklers, the HEPA filter plenum deluge, glove box fire suppression, and then to support our manual suppression, the fire hydrants.

In addition, there is the detection alarm subsystem. I've talked about quite a few of these already. There is the alarm to the central alarm system. There is the general area detection; these can be the room smoke detectors, heat detectors, and also those manual pull stations.

There is duct smoke detection for the ventilation systems and also looking at the glove box heat detection system. Also applied to that HEPA filter plenum is the heat detection system for actuation and notification.

There will also be the other required complements associated with fire systems, such as waterflow switches, tamper switches, and then the large, the fire pump, the water storage monitoring devices.

MEMBER SKILLMAN: Jim, this is Dick Skillman. Let me jump in here just for a minute.

You're explaining the systems to fight the fire, to actively fight a fire or possibly fight a fire. What provision is there to absorb the water that has been sprayed or applied to the fire? If you assume a 20-minute fire, a 10-minute fire, what provision is there for that water to be ducted, or routed, or captured in a place that doesn't prevent other firefighters or

create a local flooding event that becomes, in and of itself, as great a problem as the fire?

MR. DUNFORD: Let me, Dick, if I can grab that. This is Gary Dunford.

So in the hot cells, themselves, they are just going to be collected there. If the sprinkler system goes off and a large hot cell hits a stainless steel, effectively a stainless steel tank and they will be collected there so the material can be pulled from the tanks, sample processed, and essentially, it is going to be the bulk of this low-level waste if that was the case or whatever the waste class.

If it is in the facility, the Zone II or Zone III areas, there will be four drains that will go to a collection tank. That then will then be sampled. And it should be nonradioactive. And then if it's radioactive, it will have to come back to our low-level system and disposed of as solid waste nonradioactive, which is what we would expect in those areas; then it could go to a sewer system.

MEMBER SKILLMAN: Gary, how is that collection tank sized? You know why is this a relative question here at the construction stage? If that tank is 150 gallons at construction, it's in the basement, it's probably not big enough. Five thousand gallons

is probably too big. It needs to be a size that is responsible for a reasonable duration of either spray or some form of inundation on that fire.

MR. DUNFORD: Yes, I don't remember the number but it was based on a 10-minute or a 15-minute fire-loading type of discharge at the time that we did that in the conceptual design.

MEMBER STETKAR: Not in NFPA. Thirty minutes is NFPA, I seem to recall.

MR. DUNFORD: But it was based on a fire release, a spray, whatever, from a fire incident. That is what we sized for in the conceptual design. I don't know what it looks like right now, to be honest to you.

MEMBER STETKAR: I'll jump to this when we get into the probably closed session because we asked about this earlier also.

MS. HAASS: I'm sorry. You asked about this what?

MEMBER STETKAR: That tank, the collection tank.

MS. HAASS: Okay.

MEMBER SKILLMAN: Let's talk about it later. Thank you, Gary.

MR. MASTERLARK: Okay, I'll jump around just a little bit here. I'll talk about the preliminary

fire hazards analysis that was performed to evaluate all of this.

The analysis was taking a look at the initial design to assess the fire hazards that are there in the facility and also taking a look at the overall site. We took and divided it up so we could identify each of the fire areas that are located there and the hazards that we were looking at for each of those areas to give us the idea of the suppression system and detection systems for each of those areas.

We looked at it in a defense-in-depth methodology. So we were taking a look at the construction requirements for the facility for noncombustible materials, taking a look at the potential fire hazards that would exist, and then look at the suppression from both an automatic and manual direction.

So if I move on to the slide 12, we will be taking a look for the final fire hazards analysis. The pre-fire hazard analysis will need to be updated based on the details of the final design.

There were some gaps or a number of gaps identified in the PFHA that will need to be evaluated to ensure that the detection system, suppressions system designs are adequate for each of those areas

and the hazards that are there.

There were also a number of assumptions that were identified in the pre-fire hazards analysis that then have to be closed out or validated as part of the fire hazards analysis.

As I mentioned, when we go through that, we will go through the fire hazards and then looking at in the defense-in-depth, the consequences of a fire in each area, if the fire were to exist and, if it was bounded, what would be the potential damage to the area and the system.

MEMBER STETKAR: Jim, let me ask you this. I think I can ask this on the record.

I read through what's in Chapter 9. I also read through I've forgotten the report number but NWMI Safety, one of them addresses fires. We did not receive, by the way, the preliminary fire hazards analysis report. So I'm kind of at a loss because I haven't seen that.

I didn't see in what I could read in Chapter 9 or in that other report, whichever one it is where you do a somewhat more detailed analysis, any mention of the treatment of fire-induced spurious signals. It seemed to be that the fire hazards analysis presumed that things fail, and I will use the term again, cleanly;

that the fire stops things that are running and prevents things that are not running from starting.

We have experience in the real world that fires sometimes don't do that, that they cause spurious signals and especially fires in locations like the control room, like rooms that contain instrumentation, control signal cabinets, protection signal cabinets and, depending on whether you use a fiber optic cable or copper wires, fires that can damage cables out to end user for the motor control centers, or switchgear, or whatever you're using.

I recognize some of the effects of those fires depend on actual cable routing, which is, obviously, part of the design but fires in locations that contain cabinets we, I think, already know where the cabinets and the switchgear are going to be.

What I'm trying to lead to and get something on the record is will the final fire hazards analysis account for multiple spurious -- fire-induced multiple spurious actuations, which is, indeed, part of the guidance that you site from Reg Guide 1.189.

It's either a yes or a no answer.

MR. MASTERLARK: Yes, so in the preliminary fire hazards analysis, we talked about that a design-type basis fire will be evaluated for each

of the fire areas and sub-areas that are in there that include the loss of the systems or effect of the systems that are in that area. And like you said, before we can go into the detailed, especially on fire, the detailed effects of that, you need to know the specific location routing of the equipment and cables.

So yes, I believe it is our intent to use that same guidance that we would be using for the plant for the effect of the final system. If I'm wrong, Gary, could you jump in?

MEMBER STETKAR: But again, James, you carefully used the term loss and I'm trying to carefully not use the term loss. I'm trying to use the term multiple spurious actuations. That is not necessarily loss of a system. The Browns Ferry fire and actually some other fires that have occurred since then, not necessarily all in the United States, have demonstrated that the effects of fire can cause spurious actuations. Normally, open valves go closed. Normally, closed valves go closed. Valves go open and closed, and open and closed, or part way. They get part way closed and then the circuit opens up.

The guidance, the regulatory guidance, my understanding, even Reg Guide 1.189, the so-called deterministic guidance, says you ought to, for your

analysis, do a full location -- you know I call it a location; I don't want to call it a zone because a location can have multiple zones -- a full location burnout with accounting for the effects of multiple spurious actuations. And my question is will your final fire hazards analysis account for those multiple spurious actuations, which is not loss of the system. It is not the switchgear is necessarily de-energized coal. It is not that the control signal cabinets put out no signal.

That's what the guidance says.

MS. HAASS: Right. So yes, our final hazard analysis will take that into account. And we understand the methodology we need to go through using --

MEMBER STETKAR: It's not easy to do that.

MS. HAASS: We agree with that. It's very, very important to us, though.

MR. CORUM: And some of the elements will be addressed in the final FHA but this will be addressed in ISA space.

MEMBER STETKAR: Well, the only reason I bring it up now is that some people who have done those analyses at an early stage in the design have made decisions about separation not only of cables,

everybody focuses on cables, but separation of cabinets. You not necessarily having just two rows of two divisions of cabinets in the same location two feet apart, for example, putting a wall between them. And that can affect physical layout of stuff.

Okay, thanks.

MEMBER SKILLMAN: I'd like to ask a question before you go too far here. This is certain fire hazards and it really is Chapter 9.3.2 of Rev. 1 of your document. It is on page 9-18 and here you communicate the need for a dedicated storage tank, this is a fire storage tank, with, dependent on the reliability and flowrate of the city water supply. Now, I recognize that this is a decision that you wish to make for the future.

What are you doing to make sure that if you choose to have a dedicated tank, the facility can support it and de-plumbed to use it?

So, you're building a facility. You've got a foundation. You're going to have parts and pieces under construction. If this is 150 to 200,000 gallon tank, it is a reasonably sized tank, what provision are you doing now to make sure that if you decide that the city water system will not give you what you want, they certainly have the option to put this in?

MS. HAASS: So two things. One is we are waiting for the City of Columbia and that's actually not the city, it's their water department and I forget their name, but to come do that test. If the test states that we have to have some type of storage tank, we are in the process of also negotiating with the university itself for a water tank for all of Discovery Ridge.

So, we are in the process of that. We would rather not have our own.

MEMBER SKILLMAN: Let me push a little further. It seems to me that you would want to have your own, no matter what, which is why I raised the question. I don't know of any nuclear power plant that doesn't have its own firefighting tanks and for a very good reason. You can't depend on the outside. Yes, you can 99.9999 percent of the time but it is an unforgiving 0.00001 percent of the time when you need it; you don't have it; you're in trouble.

MS. HAASS: Well that's where we're hoping to we're able to get a balance between the city, Discovery Ridge, and their water tank. We know that there is some. I just don't know what the volume and the capability is like on a gallons per minute or per hour, what it is. And I know they've done some initial testing; I just don't remember what it is. But we

believe between the two, hopefully, that is going to be sufficient that we don't have to have one on-site. But I'm going to let Gary talk about the one on-site that we have visualized, if we have it.

MEMBER SKILLMAN: Okay.

MR. DUNFORD: So we actually have laid out in one of the early plot plans where it would go. So there is space set aside. It is not -- it's whatever, 30 yards, 40 yards from the facility in an area. So we have already identified if we have to have one, here's where it's going to go. So that's already been reserved for that location. That's if we end up doing one.

I hear your guidance and I hear guidance over here. But we understand if it doesn't get the flow test, we know we have to have something. If it does, you're still asking us to consider whether we should have our own. We understand.

MEMBER SKILLMAN: Thank you.

MEMBER BROWN: I guess to springboard just a question then on you talk about detailed information on fire department response. I presume if the city water system doesn't support your needs from a fire response that means the fire department can't either and they're not going to carry tanks. Is that part of the overall conclusion that then the fire department

will have to your all's dedicated tank in order to continue to fight the fire or will you all have to have -- and how long do you wait for quote professional fire department response to deal with this if it's not a small spot but a larger fire?

MS. HAASS: Well one, if the water tank was part of Discovery Ridge, the university actually depends on the city for firefighting. They don't have their own firefighting force. They do have their own police force but they don't have their own fire. So, we would be depending on them to come fight the fire.

MEMBER BROWN: If it's Discovery Ridge. If it is not yours.

MS. HAASS: No, even if it is ours, we would depend on them. Steven and I have already had initial discussions with the fire department and they would be supporting us in those efforts.

MEMBER BROWN: I guess my question was if there is inadequate water supply for them to tap into and fire hydrants, what good is a fire department if they can't combat it themselves?

MS. HAASS: Right but that's why we're figuring out what the balance is based on if we don't have the appropriate flow from the city through the hydrants, we would then -- you know we're working with

the university for a general water tank for Discovery Ridge but you know in contrast, we also have to look at that balance if we have one on-site, our own, whether it is 150 or 200,000 gallons.

And as Gary said, we have put a space aside and it sits up near where the waste management outbuilding is, up in the upper left hand corner. It is there. It's kind of where all of the little outbuildings are, emergency diesel generator, the waste management, and there is a place for the water tank.

MEMBER BROWN: Okay, thank you.

MEMBER POWERS: This facility has a two-year fire hazard that so far you have not addressed. You have uranium metal coming into the system. So you have the potential of metal fires.

What are the provisions for dealing with metal fires? None of this is going to help you at all.

MR. CORUM: To prevent the metal fires, we're receiving the new metal in a pickled, in an orderly configuration, where it is --

(Simultaneous speaking.)

MEMBER POWERS: Now you catch it on fire.

MS. HAASS: It's less than an inch, probably more like a half inch, quarter inch.

(Simultaneous speaking.)

MR. CORUM: So, we're not dealing with small pieces of metal. We're not dealing with -- we don't have any --

MEMBER POWERS: You will be dealing with small metal. I don't care what your stack is. I know these guys. I've received from them. I've had metal fires from these guys.

MR. CORUM: Okay. So in a fire with U metal, you definitely don't want to use water or any kind of suppressant to put it out.

MEMBER POWERS: How do you prevent your automatic system from providing you that water that you don't need?

MR. CORUM: From what I recall, where we will be dealing with U metal is in the target fabrication area and we do not have active sprinkler systems in the target fab area.

MEMBER POWERS: Okay, so how do you handle fires from things other than metals in those systems?

MR. DUNFORD: So let me go back. So obviously, we understand the hazard. When we have a hood area to do the U metal cleaning activities, they will put it then into the dissolver.

So, I think we talked about this previously. Feed buttons, you know you have something

that you can put over the top if something starts to keep the oxygen out, to let it burn itself out, effectively, is what you have to do.

So, from an accident PHA and QRA, which are qualified risk assessment, we have to make sure that we've talked about uranium fires, have looked at that, and have evaluated the impact of that. We may have some more work to do in this particular area. So, we'll look at that as we do Chapter 13. We will talk about fires. We will talk about this in Chapter 13 and that might be the easier way to cover this discussion.

MEMBER KIRCHNER: That's a good question about the iodine recovery unit. So those will be flooded, as well as the HEPA filters. Is that how you would deal with fires in that particular containment?

MR. DUNFORD: Probably you're more expressing a concern about the carbon filters than our silver-mordenite or silver zeolite iodine control units. And they're either going to have to have isolation dampers or -- I do not -- right now I do not believe that there is a water deluge system in our design for this system. I know there's not right now.

MEMBER STETKAR: I thought that I read, and correct -- again, if we are getting into

proprietary, just cut it off.

MS. HAASS: Yes, I think we just kind of popped in there.

MEMBER STETKAR: We'll talk about it this afternoon because my recollection about what I read about the design is there may be.

MEMBER POWERS: One other peculiar fire hazard that you have here and that is in your glove boxes. How do you handle fires within the glove boxes?

MR. DUNFORD: So in the current design, there's a couple spots where we say there's no liquid fire suppression. The target receipt hot cell is one. In the other areas, we have a number that already are noted and then the other ones, we'll have to -- to be honest, I don't believe that we've identified the level detail about the glove boxes.

Let me back up. So we really only have -- we have laboratory glove boxes. We'll have to figure out what we want to do in the laboratory itself, analytical laboratory. We have two sets or a set of glove boxes in target fabrication. One of them is already inerted.

MEMBER POWERS: Which works marvelously until it de-inerts.

MR. DUNFORD: Until it de-inerts, right.

Well, we're welding in that glove box. So, yes.

And the others are more enclosures than glove boxes. And therefore, I believe they would be covered by a wet system in a target. I believe target has one.

MEMBER POWERS: I think it does. Your target does.

MR. DUNFORD: The target application does have sprinklers in it, which creates its own challenge when the fire water there because that doesn't drain any place. We have to collect it there. And I'm thinking we'd suck that up ourselves.

MEMBER POWERS: Well, I think we understand how you're doing that.

Okay, well glove box is a problem because you usually have prescribed wet firefighting in the glove boxes. A-line systems work marvelously except they don't remove heat. And so we have numerous incidences of -- one very tragic -- one in Great Britain, where the glove box cabling in there caught fire. And they put it out with halon. As soon as the halon dissipated, it burst right back into flames. So, it is a headache to deal with that. That is a major design challenge all of these systems have.

MR. CORUM: Yes, Jim, if you could just

continue now.

MR. MASTERLARK: I'm still on slide 12 here. A couple things that I'd like to mention on this is we will be doing some quantitative assessments. So we understand as part of our hazard analysis to come up with a loading in the area. We'll need to update the evaluation for the hazardous materials, radioactive materials and make sure we reassess those for each of the fire areas.

The other parts that will be looked at is more closely to evaluate the potential impact of the operation and high-value property for fire in each of these locations. That's taking a look at the consequence of both the suppress and non-suppress fire.

We'll also be doing some more analysis of this to take a look at the crane structure, review its qualification. And we'll do that further analysis for the design features, everything that -- you talked about quite a few of these things just recently, which is the fire water system, the supply system, the automatic fire suppression. And the other thing that's included in here is also taking a look at the life safety end and means of egress.

The fire hazards analysis does also take a look at the effect of smoke and smoke movement in

the facility. That also includes the means of egress.

The other part that goes into the fire hazards analysis is more detailed, once the details are worked out for the information for the fire department response, how they will support the systems that are in the facility and then how that ties into the overall emergency planning.

MS. HAASS: And as you know, later on this afternoon under conduct of ops, we will be going over the ERP, where we are to date and the discussions we've had.

MR. MASTERLARK: So that's to give you a bit of a look of what we have to do to move it from the pre-fire hazard analysis preliminary to the final.

A little bit more on the design, since I talked about the suppression system, the area will be subdivided into separate fire areas with the idea there is to limit the fire spread to one area, protect personnel, and also the consequences of damage to that area.

The boundaries that are put in there and those are in diagrams that are available here for this afternoon, are based on the type of hazards that are there, the quantities of combustibles, the density, and the specific location of the combustible materials

that will all go into designing the boundaries.

The location configuration of the equipment, again, looking at the consequences of the damage to the equipment, and that also is used then to put into place the location of the fire detection and suppression. And that all builds together to look at personnel safety and, again, the exit requirements.

So many of the areas that are in the diagram, just a little bit, there is a section for three-hour fire barriers. Most of the areas we expect to be bounded by two-hour barriers, specifically processing areas and radioactive material storage areas from each of their adjacent areas.

The areas that have higher hazards, like the electrical and mechanical equipment, to isolate those from adjacent area, protect the computer control room from the area. The maintenance shop, again, a hazard area, to protect it from the adjacent areas.

Combustible storage areas, the fan rooms, and then separating the office areas from the facility.

So those are preliminarily designed, these barriers, to the ratings. And again, those would all be looked at as we do the final.

MEMBER KIRCHNER: Can I ask a question? Perhaps, well, I'll say that just to put a marker down,

the chemical supply room, the loadings from that and its adjacent to the stack just raises a question in my mind about possible compounded damage from a fire or some kind of problem in the chemical storage room also impacting an item that you're relying on for safety.

MS. HAASS: Thank you. We will definitely evaluate that.

The next item, real briefly, is on communication. The key thing is is our communication systems are going to relay information during both normal and off-normal conditions, or normal and emergency conditions, if you had a fire. And we will be able to do it either through a public address system or through intercoms.

But I think the big thing is is our communication system is going to be designed to enable anyone, and I'm going to focus on operators or technicians, who are actually working the Zone II/III area, but they could go communicate with their supervisor, or rad protection staff, or fire, or whoever -- the plant manager, whoever it may be. And it's also not only to get additional information on procedures or technical specifications but it is to relay if there is any off-normal activity that needs to be dealt with.

And it is going to be a two-way communication. So it's just not going to be one way from the operators, technicians out. It's going to be that we can talk into them as well.

And then in Chapter 13, I know Gary will talk about it tomorrow a little bit but we did not identify any area that we would need to credit the communication system at this point in time. It will be designed in such a manner that it will be functional, whether there is a normal or off-normal -- whether there is an off-normal activity occurring.

Gary, I don't know if you want to say anything else right now or not.

MR. DUNFORD: No, other than the bullet is poorly worded.

MS. HAASS: Yes, that's why I said early on.

The next item we're going to talk about is the possession and use of byproduct, source, and special nuclear material. You know our goal is that there will be no uncontrolled release of radioactive materials. It doesn't matter if it's solid, liquid, or airborne, our goal is to be able to control that and have no releases. And that any personnel exposure will not exceed the limits of 10 CFR 20 and as we've

defined in Chapter 11. And it's also going to be consistent with our ALARA program that we will talk a little bit later this afternoon during our discussions on Chapter 12.

MEMBER POWERS: And that is a special headache for you for your metal fires issue.

MS. HAASS: I'm sorry?

MEMBER POWERS: That will be a special headache for you on your metal fires issue to comply with that design goal because they are notorious aerosol producers and they produce aerosols that are very fine, very fractal, and they go everywhere.

MS. HAASS: I understand.

MEMBER POWERS: And wherever they damn well please, not where you want them to go.

MS. HAASS: So what we've done here is you know we've talked about Chapter 4. You know we've already gone through Chapter 4 and for the majority of our system on special nuclear material, how these will be handled will be talked about a little bit later in the Chapter 11, I guess the next presentation.

Gary.

MR. DUNFORD: Okay, my job is to recover a little bit of time.

So the next section in 1537 is the

discussion from Chapter 9, NUREG-1537 is the cover gas for the primary coolant system, kind of more a reactor-based.

As we talked about previously, we do have a couple of chilled water heat exchanges and loop in the hot cells. And while that's not directly applicable the way it's written, those will have a place. So, if you're running cooling loop through a radioactive tank, you can still get some radiolysis into the cooling system. So that will have a tank where the gases can be released and go out of the system. So that is kind of how we've addressed that, just a release tank and sweep air to maintain the flammable conditions or below flammable conditions.

It says there's no IROFS. The only thing that's really an IROF is really is the tank geometry itself will have to be of that release vessel. That system is geometrically favorable. So there is not an IROF in the function itself but in the equipment there.

Process utilities, we have process steam. We have two chilled water systems, a process chilled water system and a facility chilled water system, demineralizers, plan and instrument air. There is gas supply, clean gas supplies for our process needs; helium

for welding, nitrogen during dissolver work, and also in target fabrication, and also oxygen and hydrogen for our reduction furnaces.

So pretty simple systems. We do envision still a boiler in the mechanical equipment room to provide medium pressure steam, which then will go step down loops to the hot cell cooling loops that are geometrically favorable, and also will be also used to actually heat hot water for the facility ventilation system their hot water heating loops.

So the loops have to be geometrically favorable.

Process chilled water, it's a concept of well three different loops. We do have one large cooling loop from one of our process systems that is actually not going to be geometric favorable. So, therefore, we have a series of active controls that we'll talk about later on that. And two primary smaller loops, one for target fabrication and one for the hot cells.

Air chillers are supplied MURR chillers, a two out of three concept. Three chillers, each to accommodate 50 percent of the load.

And we do have a couple other points where an air chiller won't be doing the duty we need in our

carbon beds, we cool those quite a bit more, so we will have a water-based or glycol-based units that will support that.

MEMBER STETKAR: Gary, is the complement of equipment in each of these systems considered proprietary information, the number of pumps and -- obviously, you've highlighted the number of chillers but it's not proprietary?

MR. DUNFORD: I would say no. We're planning for most of those is we're going to be go buying package units that meet our specs.

MEMBER STETKAR: Yes, okay.

MR. DUNFORD: That's coming from a question that you're thinking.

MEMBER STETKAR: Yes, and I don't want to venture into -- I don't want to say the words twice.

When I look at the drawings in Chapter 9 of the chilled water systems, the primary process chilled water system, the main one, if I call it that, does show three chillers, as you've mentioned here. And it shows only one pump. Okay?

If I look at the chilled water loops that fit from that system, the large geometry and criticality-safe chilled water systems in particular, each of those have two pumps.

So I'm curious about well, you wanted redundant pumps in the daughter systems, if you will, how come you only have one pump in the main system?

You have three chillers. You were really worried about redundancy in chillers. Why do you only have one pump?

MR. DUNFORD: I understand that's depicted on the drawing which I'm not sure that that would be the way the final design looks at all. I would think that you would have multiple pumps.

MEMBER STETKAR: Silly me, I only look at the drawings.

MR. DUNFORD: I understand.

MEMBER STETKAR: And I look at, as I usually do, as you recall, I looked at the electrical bus layout and there is a total of five pumps listed from the electrical bus layout, three primary chilled water pumps, and two secondary chilled water pumps.

MR. DUNFORD: Okay.

MEMBER STETKAR: That's what they're called. So it seems to me either that the story isn't quite integrated yet through the PSAR or the actual system design isn't quite worked out yet is where I'm trying to get to.

MS. HAASS: Well, it's definitely the

latter. Remember, we're not at 100 percent design. This is a system that you know is going to be finalized, once we get more of the facility design is done. We understand our piping --

MEMBER STETKAR: Earlier comments, though, about -- we tend to look at integrated facilities when we look at our reviews. So, for example, the effects of fires that can cause spurious signals and open signals that might take out your only primary chilled water pump, with the separation of the chilled water pumps because they're all in the same -- I'll be quiet here. We all know where they are.

MS. HAASS: Exactly. And we understand exactly where you're getting to and those things are being evaluated.

MEMBER STETKAR: Okay.

MEMBER BLEY: I think the one part of this that at the construction permit stage raises an eyebrow at least, is we know you're not in final design. You have some inconsistencies as you go from place to place here. You're going to pour concrete. Do you have enough room to put in two or three pumps if you're going to want them later? That's the thing I'd be concerned about.

MS. HAASS: We agree with that. You know

that is exactly where we are.

MEMBER BLEY: You agree that you have room to put them in?

MS. HAASS: We agree and we understand. You know we're still working on the flexibility of what each room is going to look like. Remember, even from a shielding perspective, you know it's going to be a graded approach, depending on what amount of activity is sitting in that room. So we understand that.

MEMBER BLEY: Okay. This is one that we talked about earlier.

MS. HAASS: Exactly.

MEMBER BLEY: This isn't a safety issue but by golly, if you pour concrete and then you want to change it, you're in a hard spot.

MS. HAASS: We completely agree with you. And you know that is one of the reasons --

MEMBER BLEY: I was just at a big, big facility somewhere in Europe and they got a whole building constructed for process systems that they've never been able to use because of problems like that. They built it, found out it wasn't quite enough and they don't have room to put stuff in. The whole thing has just gone to waste.

MS. HAASS: We understand those

experiences and lessons learned. I mean I think, as you know, a lot of us come from even the DOE system and we understand how much waste is done there and time.

So I know Margaret is really pushing for us to go forward so the NRC can come up. And I think the key thing is on this process utility systems is we've identified IROFS from a process steamed chilled water and then the purge sweep gas.

And maybe I'll have Gary spend a bit of time on the purge sweep gas, why that's an IROF. But we're going to be talking about that later as well. And then we'll move on to radioactive waste.

MR. DUNFORD: Which slide are you on?

MEMBER SKILLMAN: Before you do that, what choices have you made regarding refrigerants and using an ammonia system, using standard carbons?

MS. HAASS: That has not been determined yet.

MEMBER SKILLMAN: That's a heads up, by the way.

MS. HAASS: So, you want to go to 22.

MR. DUNFORD: So in Chapter 6, we went over the emergency purge gas system and its basis. Chapter 9 talks about the overall purge gas system. Chapter 6 talked about those 10-15 tanks that were part of the

emergency system.

So effectively, we want to maintain our hydrogen at 25 percent of the LFL. And so we have a purge gas system in the process ventilation system. A very simple system, right? In most cases, it's extremely low flows needed to dilute hydrogen to meet below the 1.125 percent or 1.25 percent.

So, the rest of these activities, the IROFS in here are talking about the feeding and the concentration monitoring, and emergency backflow for the rest of the emergency purge systems there, and then backflow prevention.

So take that last one, again, we talked about it last month. That if we have something going into a tank, we have to make sure we can't get a backflow off. So there has to be some design that we're not going to end up whether it's a seal loop, whether it is for liquid because obviously you can go to a disconnect on a frontal or a day tank, which is what we have. And that's what the last bullet here is talking about.

So plant air systems are not identified as IROFS, normal instrument air plant air. If we lose those, the plant's going to go to a safe condition. We'll be able to process but the front will go to a

safe condition. But the purge system is and will continue to purge those tanks that we have identified and are concerned about.

Demineralized water and the gas supply system, there's really nothing magic there. We have a no radioactive liquid discharge but we will have some liquid discharge, obviously, going into the sewers and stuff. And the demineralized water regeneration would be one that we would regenerate and discharge to the sewer system.

MS. HAASS: So on page 23, the control and storage of radioactive waste, I know we've talked about this a lot. You know you understand we have high-dose, low-dose liquid waste handling spent resin, all of those items.

The key thing is the next page, 24. We have identified a lot of IROFS and we will be going through those tomorrow with you and so I think we can go into detailed discussions then.

On page 25 on the analytical --

MEMBER STETKAR: I had one question about the waste systems.

MS. HAASS: Yes.

MEMBER STETKAR: And that is the marginal capacity in the low-dose waste tanks. So I ran out,

you know you list the sizes of the tanks for both high-dose and low-dose. And again, I don't know what's proprietary or not so I'll try to be careful and not say too many numbers here.

I noticed that in the low-dose system at design flow rates you only have a couple days of excess capacity; whereas, you have quite a bit more excess -- a lot more excess capacity in the high-dose.

I'll just make the comment that I worked at a nuclear power plant where they woefully under-designed the waste handling system and that became more than a heartache for us. It actually caused violations, NRC violations. And again, is it important for the construction permit? Yes, if you need room for a heck of a lot bigger tank.

So, I'll just make that comment. I don't want to -- I don't know what numbers are proprietary and what numbers are not proprietary but I did notice that the margin on those low-dose -- in particular, low-dose waste accumulation tanks were --

MS. HAASS: So we can give you a general answer right now.

MEMBER STETKAR: Okay.

MS. HAASS: Okay.

MR. DUNFORD: You're correct.

MEMBER STETKAR: Okay. I noticed a nodding of the head over there. So there is at least -- you know about it.

MR. DUNFORD: We actually haven't shared it with Carolyn yet. The process in here, as we have done some reevaluations have suggested that one tank be doubled in size and another very small feed tank be added, too.

MEMBER STETKAR: Okay, thank you.

MS. HAASS: He hinted at it to me. He just hadn't given me that.

MEMBER STETKAR: At least you know as long as you're aware of it.

MS. HAASS: Yes.

MEMBER STETKAR: And from what Gary said, you're working on it, that's all I care about right now. Space is important.

MS. HAASS: So on page 25, analytical laboratories. I think everyone knows what an analytical laboratory is for. It is to support our on-site analysis for our operational purposes.

To date, we have identified no IROFS here. Obviously, we will go back and evaluate the glove box issue that Dana brought up.

So on the chemical supply, we've already

talked about that briefly you know a bit ago. And there are two items that are -- two IROFS that have been identified. One is, as Gary stated earlier, the safe geometry of the tanks and one was the backflow prevention device. And we will go in a bit more detail with that when we go through Chapter 18.

And so we're done. That's all I had.

CHAIR CHU: Okay, I think we need to take a break.

We'll come back in 15 minutes. So, 10:55.

(Whereupon, the above-entitled matter went off the record at 10:38 a.m. and resumed at 10:55 a.m.)

CHAIR CHU: Now, staff, we'll continue on, it's after 9:00.

MR. BALAZIK: Thank you, Dr. Chu. This is the Staff's presentation of Chapter 9. A couple new presenters up here.

Steven Alexander from Information Systems Laboratory, who will be talking a majority of Chapter 9.

We also have Mollie Semmes from NMSS, who is the fire protection engineer, and she will be talking about fire protection. Okay.

MR. ALEXANDER: All right. Well, good

afternoon. So we've gone through the introductions and so on, and we'll get right into the regulatory basis and acceptance criteria.

And these are pretty much the same as they have been for most of the other chapters. Next slide.

The Northwest Medical Isotope Radioisotope Production Facilities, auxiliary systems provide support functions for various RPF main systems, and activities I should say, and described in other preliminary safety analysis report chapters.

Some auxiliary systems support safe shutdown of the RPF maintaining safe shutdown condition and limiting offsite release of radioactive in excess of regulatory requirements in postulated design-basis events.

The auxiliary systems, to the level they have been designed so far, are designed for high reliability and durability through redundancy and diversity, using quality assurance and design manufacturing procurement in installation.

And as I mentioned with Chapter 8, it's probably going to be, there's probably going to need, based on the fact that the design is not well ahead of plans for construction, yet, that there is probably

going to need to be a lot of inspection, NRC oversight of the process.

Next slide please. So these are the RPF auxiliary systems, as already has been gone over in detail by Northwest.

Next slide please. So we took a look at PSAR Chapter 9, the radioisotope production facility auxiliary systems, request for information and the responses to those RAIs and the way the RAI responses were incorporated into Revision 1 of the PSAR.

In addition to Chapter 9 only, we took a look at the areas of other chapters, especially Chapters 3 and 6, that were, and 7, that were referred to by Chapter 9, to see what was there that was relevant to the auxiliary system, which referenced that chapter.

We used the applicable regulatory requirements, the guidance, NUREG-1537, as you said before, and acceptance criteria. And we also occasionally took a look at codes and standards that were referenced in the regulations, the guidance and in the PSAR itself.

The idea was to assess a sufficiency of the preliminary design, to issue a construction permit. We looked into design criteria, design bases and the

information that was prevented, that described the design. And as the guidance says, unusual or novel design features and principle safety considerations.

The goal was to determine if there is reasonable assurance that the final design will conform to the design basis. No undue risks to the health or safety of the public and undue adverse impact on the environment.

Next slide. So HVAC systems. As was explained by Northwest, they want to confine hazardous chemical fumes, they want to prevent the release of airborne radioactivity, maintain ingestion.

Of course they want to prevent the release of all radioactivity, but HVAC systems deal with airborne.

Maintain ingestion of airborne radioactivity as low as reasonably achievable, provide conditioned air for the workers and occupants and provide makeup air and conditioned equipment, conditioned environment for the equipment that requires cooling, like computers and so forth.

They went over, in quite a bit of detail, the zone system description. The notion being that the Zone IV clean zone is a separate, positive pressure,

admin, utility maintenance and truck bays and spaces.

And that II and III, they will be occupied spaces, but they could be potentially contaminated if there is some kind of an event that releases radioactivity to the atmosphere. And also, possible noxious gaseous or toxic gaseous to the atmosphere.

And it's considered the tertiary confinement barrier.

Zone II, lower pressure than Zone III. And again, this air balance is maintained by the airflow and the dampers in between the zones.

And it also includes Zone II, would have structure enclosures of laboratories with gloveboxes and fume hoods, HEPA filter rooms in the Zone II ventilation exhaust system.

Zone I is where the hot cells are. It's the lowest pressure, potentially most contaminated, primary confinement barrier with gloveboxes, some of which are considered Zone I, vessels, tanks, pipings, hot cells, and the Zone I exhaust subsystem.

The boundaries of all the systems would comprise the pipings, ducts, dampers, filters, the structure itself and airlocks, which we mentioned earlier.

The supply air subsystem brings in outside air for heating and cooling and provides makeup air for those parts. For those zones that don't get enough flow from the higher pressure zone, the makeup air will be provided if necessary.

Exhaust air subsystems, Zone I, II and III and the laboratory exhaust systems are the three separate exhaust air systems. And those are fan-driven for the flow, a damper control and automatic and manual isolation, both, and the air is treated with HEPA filters and carbon absorbers.

There may be other measures too that are not mentioned, yet, in the PSAR.

The other part that's classified as part of the HVAC system is the process off-gas treatment system. And the main feature of this is iodine removal units for the target dissolution off-gas system.

For the moly and waste accumulation tanks, the process vessel ventilation system, waste handling and target fabrication ventilation system.

And then there is a cleanroom, separate cleanroom, subsystem. And the cleanroom being used, if I am not mistaken, for preparation of the product for delivery and it requires cleanroom conditions.

There's a separate system for that.

Okay. For operational analysis of safety functions, the analysis of normal and off normal, as was said before, is covered by Chapters 11 and 13. And again, there is this point of failure of air balance systems, not in itself an accident, but failure of mitigating system.

There are multiple levels of confinement. But another defense in-depth factor that they have presented in the PSAR is the uranium is not in a form that would contribute to the release of airborne radioactivity in of itself, recognize the act that there could be problems if there is any kind of a fire, and that uranium solutions are in closed systems. So, as impacting HVAC, unless there was a breach of a closed system, this would not be a problem.

The items relied on for safety are designated by the Chapter 13 analysis. And they include the Zone I, the ventilation exhaust subsystem, components of the dissolver gas off-gas subsystem and process vessel vent system. And of course the exhaust stack height.

The criteria determining the exhaust stack height were having to do with providing enough height

for disbursement and I think had something to do with, as explained in the PSAR, having something to do with providing enough time for radioactive decay. Now, that may not be a correct understanding of that, but that's what we got from it.

Safety functions. The confinement function of HVAC is in fact an engineered safety features. And IROFS have been identified and already explained. And in detail in Chapter 6.

Confinement function is an ESF. The boundaries or barriers and shielding included as part of the confinement. Surrounding radioactive materials and associated ventilation structure systems and components. Piping, ducting, dampers, filters, penetrations, floor, walls, ceilings, doors and airlocks.

Primary confinement, secondary confinement and tertiary confinement were all described previously.

Next slide please. The HVAC control and monitoring is discussed in Chapter 7. Mostly having to do with the building management system, which is what controls most of the HVAC system.

However, there is a table that summarizes

some of the key parameters in the HVAC system, and it indicates whether those parameters are monitored or alarmed.

Did not state whether any of those parameters would initiate automatic functions. And those are some design details which we'll be looking for in reviewing the final design.

PSAR Section 9.1.4 states that the system sequence operation will be developed and provided an operating licenses application. Again, that's where a lot of that detail is not there.

As in many of the sections of the Chapter 9, no text specs so far have been identified. If there were any to be identified they would be part of Chapter 14, as part of the operating license application.

Next slide. When reviewing Chapter 9, we did see some inconsistencies between the design bases that were discussed in Chapter 3 and those that were in Section 9.1.1 for the various parts of the HVAC systems.

And we issued that RAI. Northwest decided to consolidate the design basis information into Chapter 3 and refer to it from Chapter 9. That seemed to be an acceptable solution to the problem.

And the other area was that they mentioned that space temperature control would not be provided for Zone I, unless the thermal loads are expected to cause temperatures to exceed equipment operating ranges without additional cooling. They didn't explain the circumstances that result in temperature exceeding equipment operating ranges, but it's clearly something that they're still working on in their analysis.

MEMBER REMPE: In your discussion with them about the inconsistent design requirements, did you gain an understanding of how that occurred?

I mean, are there different groups within Northwest Medical Isotopes that are developing design requirements and they're not communicating with each other?

And then like today we heard about, well, we're going to be changing certain things about the design for the system and that will impact what other organizations are doing, and so is there, I mean, well, I was going to bring this up under the Q&A discussions later today, or tomorrow, whenever it occurs, but is there some sort of underlying root cause for some of these consistencies?

MR. ALEXANDER: Well, you've hit the

proverbial nail on the head. This is exactly the concern that we had when we were finding all these inconsistencies, was, did the left hand know what the right hand was doing.

And I think the answer is, is that a lot of these separate systems were input, and they're now at the stage of their design review where they're starting to integrate some of this stuff. And it was pointed out by us, to them, before they had had a chance to fix it themselves.

MEMBER REMPE: Okay.

MR. ALEXANDER: But I think we are satisfied that they are aware of these inconsistences and Revision 1 of the PSAR has resolved them.

MEMBER REMPE: Okay, thank you.

MR. BALAZIK: This is Mike Balazik. I just want to add on, Dr. Rempe, that I'll say that that was, in talking with a lot of the different reviewers in all the different chapters, that was kind of a theme that I heard, is kind of a little inconsistency.

Where one chapter would point to the entire chapter and you wouldn't know exactly where to find information at. Or there is very limited information. But I would say that was kind of theme.

And like Steve said, that was, a lot of the RAIs that we sent out were identifying consistencies throughout the application.

MEMBER REMPE: Good. So hopefully you've discussed this with them and they are going to start, there's a process that's being implemented to say, if we make one change in the design at one place, that all of the organizations will be notified and evaluated and --

MR. BALAZIK: Well, I think we can talk about that in Chapter 12 --

MEMBER REMPE: Okay.

MR. BALAZIK: -- on the Q&A.

MEMBER REMPE: Okay, thank you.

MR. BALAZIK: I appreciate that.

MR. ALEXANDER: Okay, next slide please. Mollie.

MS. SEMMES: All right, good morning. Now good morning. My name is Mollie Semmes, I'm going to be giving you an overview of the fire protection review that was performed.

This slide shows the design basis that the applicant used when designing the fire protection system. The design basis provides detection,

suppression of fires in the facility by providing notification and transmission of alarms of a fire event, to the central alarm station and control room, suppressing small fires and preventing small fires from becoming large fires.

Next slide please. Sorry.

MEMBER BLEY: Try not to hit that mic, it's tough on our courter reporter over here.

MS. SEMMES: My apologies, I'll be more careful about that. The staff reviewed the information presented in the Northwest PSAR Section 9.3, titled, Fire Protection Systems and Programs Supplemented by the RAI Responses.

The areas of review included the discussions of potential fires, provisions for early detection, methods for isolating, suppressing and extinguishing fires, passive fire protection features and emergency response capabilities. A preliminary fire hazard analysis was developed.

These areas were reviewed against the regulation and the acceptance criteria in NUREG-1537.

According to the acceptance criteria, the fire protection plan should discuss the prevention of fires, including limiting the types and quantities of

combustible materials, discuss the methods to detect, control and extinguish fires. And a facility should be designed and protective system should exist to ensure a safe facility shutdown and prevent the uncontrolled release of radioactive material, if a fire should occur.

So I'm not going to touch on some of the features that gave the staff assurance that the acceptance criteria had been met.

Next slide please. So, in Northwest PSAR Section 9.3.2.1, the application discusses the fire suppression system, which consists of automatic sprinkler systems, a HEPA filter plenum deluge system, glovebox fire suppression, fire extinguishers and fire hydrants.

The hot cell area will be sprinklered, according to the application. Not within the actual hot cells themselves, but in the hot cell area and enclosed with a two-hour fire barrier.

The NRC Staff asked an RAI about the type of fire suppression system that will be used in the specific hot cells themselves. And the Applicant indicated, in their response, that the suppression system for the hot cells will be selected and finalized in the FSAR of the operating license.

The Staff determined that it is acceptable to defer this decision to the FSAR since it will not affect the initial construction and must still be reviewed and approved in the FSAR.

Next slide please. In Northwest PSAR Section 9.3.2, the application discusses, sorry, 9.3.2.2, the application discusses a fire detection and alarm system, which consists of smoke and heat detectors, manual pull stations, smoke detection for ventilation systems and glovebox heat detectors.

HEPA filters will be equipped with duct heat detectors that will activate the plenum deluge system to cool duct air before it reaches the HEPA filter. A manually activated fire water spray system is available for HEPA filters as well, if they catch on fire.

In response to an RAI, the Applicant indicated that a combustible loading administrative control program will be provided in the FSAR and the operating license. The Staff determined that this was acceptable, since this is an administrative control and doesn't affect construction.

Next slide, please. The emergency response capabilities for the facility are described

in a PSAR Section 9.3.2.2 as well.

The Columbia Fire Department will respond in the event of a fire. They also provide response to the University of Missouri, which has a research reactor, and so they are aware of the hazards at the facility.

The fire department will be notified automatically --

MEMBER POWERS: Does the research facility deal with uranium metal?

MS. SEMMES: Excuse me? Can you repeat that?

MEMBER POWERS: Does the research facility, the research reactor, deal with uranium metal?

MS. SEMMES: The University of Missouri Research Reactor?

MEMBER POWERS: Right.

MS. SEMMES: I'm not sure.

MEMBER REMPE: But there will be different hazards associated --

MS. SEMMES: There will be different hazards.

MEMBER REMPE: -- with this facility then

the University of Missouri Research Reactor.

MS. SEMMES: Yes.

MEMBER POWERS: My question --

MEMBER REMPE: So I think the point here, and they will be trained to deal with those new hazards before they would ever accept it.

MS. SEMMES: Yes. I assume all that will be worked out in the operating license. They will have to have an agreement. This is something we'll look for in the operating license, is have an agreement with the governing fire department.

MEMBER POWERS: How do we know that you'll look for it in the operating license?

MS. SEMMES: Can you repeat that again?

MEMBER POWERS: You have not looked at all the fire metal fires here at this stage, so what makes me think you'll look for it in the operating license?

MS. SEMMES: For metal fires specifically?

MEMBER POWERS: Yes.

MS. SEMMES: Well, we'll look at the capabilities of the Columbia Fire Department, in regard to the specific hazards, at the plant.

MEMBER POWERS: Now again I'm asking, how am I assured that you will look at that, since you

haven't looked at it here?

MS. SEMMES: Well, that will be part of the acceptance criteria, in the operating license, once they have finalized the design more. We'll have a better idea of exactly what hazards to look for.

MR. ADAMS: Can I add something here? Al Adams. Obviously that, you've made us, you've heightened our awareness of this issue --

MS. SEMMES: Yes.

MR. ADAMS: -- and we'll make sure to look for it.

If uranium metal is used within the production facility, it sounds like it at least will be primarily used in the target fabrication area, which is technically outside the scope of what we're looking at, however, the folks that are looking at that part of the facility obviously have to look at that aspect, so I think that we have an awareness of this issue and we will keep our eyes open for it.

And your question, the University of Missouri, that if they do handle uranium metal, it is in very limited quantities.

MEMBER POWERS: And I would venture to say that most fire departments are not well equipped to

address metal fires. Especially with 20 percent enriched metal.

MR. ADAMS: I agree with you. I think the point we're trying to make about the fire department is the knowledge of the fire department in handling radioactive material in general, that we're not starting from zero here. That the department already has some background in this area as being the response force for the research reactor.

MS. SEMMES: Yes.

MEMBER SKILLMAN: Mollie, let me ask this. It's building on Dr. Powers question. Do you have on your question list, for the operating license phase, examining the fire preplan for this facility?

MS. SEMMES: Absolutely.

MEMBER SKILLMAN: Okay, thank you.

MS. SEMMES: Yes.

MEMBER SKILLMAN: Okay.

MEMBER BLEY: Al, I know we talked about this in an earlier meeting, and I keep looking at this as an integrated facility where everything is going on, I know that the reactors, the research reactors are licensed separately, but target production is part of the facility and the Part 70 stuff, whose reviewing

that and why aren't they talking to us?

MR. ADAMS: Well, a couple of issues here. One, is that that application has not arrived yet. And when it does arrive it will be primarily, NMSS --

MEMBER BLEY: So that will be a separate application, even though the PSAR goes through all of the processes and that part of the plan.

MR. ADAMS: There is --

MEMBER BLEY: So there will be a separate application for the --

MR. ADAMS: It will be a separate application. There is nothing in the regulations that stops an application from discussing more than the minimum at --

MEMBER BLEY: They're constructing a facility that includes the system, so I'm a little confused here. Although I remember we did talk about it.

MR. TITINSKY: This is Dave Titinsky. It's a little bit of an unusual application, because again, there will be three pieces eventually. There will be the construction permit, which is what we're reviewing, operating license application for the product facility, and they'll be a Part 70 application

for the target fabrication facility.

MEMBER BLEY: But we're building that under the construction permit.

MR. TITINSKY: We are --

MEMBER BLEY: Yes, I'm sorry, we, they.

MR. TITINSKY: They were building --

MEMBER BLEY: Northwest is building that building.

MR. TITINSKY: They are building the production facility, so at this point, what we're concerned about, if there was any impact from what eventually will be the target fabrication facility on the production facility. But we're not looking at the specific issues, at this time, for what would be in the Part 70 target fabrication facility. Because we do not have an application.

So even though you see information in there, that's in this application, that really is more extraneous information for the construction permit to provide descriptions. But it's not really the Part 70 application, which will, at least what Northwest has told us before, will likely come in around the time of the operating license application.

MEMBER BLEY: I'm going to interrupt the

flow of our meeting just a little bit, if I may, and ask Northwest to kind of clarify this for me, if somebody can.

Because you're getting a construction permit, and as part of this, the front-end stuff is described within the PSAR. And I assume those rooms will be built and the stuff will be there.

And we've asked you questions about it. And the ISA addresses it as well. So we seem to have a little, I have confusion here.

MR. REESE: And it's completely understandable. I think the Staff and Northwest Medical Isotopes wrestled with this of about a year.

The conclusion we reached was, we were going to submit a Part 50 license application for construction, because the rules for Part 70 and Part 50 are different. But --

MEMBER BLEY: But you are building the Part 70 stuff at the same time.

MR. REESE: It's clear, right. But the rules associated with when --

(Off microphone comment)

MR. REESE: Steve Reese, I'm sorry. But the rules about what you're allowed to do under Part

70 and under Part 50 are different.

So the compromise that we've struck with the Staff --

MEMBER BLEY: There's no construction permit under Part 70?

MR. REESE: As one of the issues related to it, yes.

MEMBER BLEY: Go ahead, keep going.

MR. REESE: Yes. So the idea is that we are going to submit, under Part 50, this construction application. We did include that as their information, as Dave correctly pointed out, to inform them on what kind of activities might affect the, in the Part 70 side of the house, might affect the Part 50 side of the house.

It's not, it's sort of not done in a vacuum. Our intention is to, when we submit the operating license application, our intention is that that application will be for both Part 70, the Part 70 side of the house, and the Part 50 side of the house. So it will be one application. They will look at it for both license applications.

MEMBER BLEY: Well, we'll keep looking at that side as we go through this --

MR. REESE: Okay.

MEMBER BLEY: -- and ask you questions about it when we look at the ISA tomorrow.

MR. REESE: That's fine.

MEMBER BLEY: I guess at some point, and like we only have a couple more meetings, I would appreciate it if the Staff could get somebody from NMSS here to let us at least ask them a question or two about this. Even though they have no application --

MR. TITINSKY: I am from NMSS.

MEMBER BLEY: Okay. Can people just go build a Part 70 facility and the come in and say I want a license for it?

MR. TITINSKY: So there is, as part of 70.21(f), there is a requirement that you can't start construction of a Part 70 facility until it relates to submittal of environmental report and waiting for a period of nine months.

MEMBER BLEY: Okay.

MR. TITINSKY: So there is that part of the regulations that restricts when you can actually construct the facility.

You know, normally if this was a Part 70 facility itself, we would review it, provide a, we would

do a license review --

MEMBER BLEY: Yes.

MR. TITINSKY: -- and provide a license and then they would begin construction afterwards. This is a little more complicated because it's sort of like a room within a building kind of thing. But there are restrictions of when they can actually start construction.

And again, the intent of those was to give the NRC the ability to look at the environmental report and the application --

MEMBER BLEY: So they have to have the environmental report in, but there are no other restrictions.

MR. TITINSKY: So the environmental report and the EIS, at least it was designed to cover both the Part 70 target fabrication facility as well as the construction permit. But the regulations call for nine months, unless an exemption is asked for and granted. But at this stage we don't have that.

So even though they would be issued a construction permit, that part of, the Part 70 part, those restrictions would still apply. The nine month would still apply.

MEMBER BLEY: Okay.

MR. TITINSKY: So they might have it and they still would not be able to construct them.

MEMBER BLEY: So they'll be meeting the requirements over, under Part 70, but --

MR. TITINSKY: They will have to meet all the requirements for Part 70. And again, it's a little bit different.

The terminologies are different from what you have to do for Part 50. So even though they're using methodologies from Part 70, for the construction part of it, the regulations are different and the Staff's findings are different.

MEMBER BLEY: Okay. Well, I think I kind of get it, but we will keep asking about that material now and see if there is any issues that we would flag before you go to the construction stage.

MR. ADAMS: We had a lot of discussions and struggled with this. And basically, it's sort of the, can you put a box around it theory and turn it into a separate facility. And in this case, you can.

That they can build another, you know, they can have a different building on the other side of the site that just fabricates targets and would have no

physical connection with the production facility. So it is, from a licensing point of view, a separate facility.

It's sort of analogous to SHINE, which was a separate utilization facility and a separation production facility that happened to be under the same roof.

MEMBER BLEY: This whole thing is a chemical processing facility, which is why it's a little confusing to me. Let's go ahead.

MS. SEMMES: Okay, next slide please. Okay, in conclusion, the level of detail in the application is sufficient for the purposes of issuing a construction permit.

The Applicant has adequately considered fire protection systems in so far as their facility is currently designed. Future consideration of selection of systems must still be finalized and approved in the FSAR, along with the combustible control program.

And here is NFPA 801 in the FSAR, is not required, but it's recommended to address the remaining elements to be finalized in the operating license and the FSAR.

MEMBER STETKAR: Mollie, you heard the question I asked NWMI earlier, I assume, regarding their fire hazards analysis and the methodology that they've used so far, and again, we've not seen the preliminary fire hazards analysis so I don't know what's actually in there. Have you? You haven't?

MS. SEMMES: No.

MEMBER STETKAR: Oh, there's a report. I'm curious why you haven't seen it.

Is it the Staffs expectation that NWMI will follow the guidance in Reg Guide 1.189, regarding the evaluation of fire induced multiple spurious signals?

MS. SEMMES: Are you talking about --

MEMBER STETKAR: When they do their final fire hazards analysis.

MS. SEMMES: For the final fire hazards analysis in the FSAR and the operating license?

MEMBER STETKAR: Yes.

MS. SEMMES: I'm not familiar enough with the regulation for the final FSAR and operating license to make a judgment on that now. I do know that 1.189, and I'm in NMSS so I am not that familiar with it, is for reactors, and I would have to look at it further to see if --

MEMBER STETKAR: I seem to recall that they said they were going to follow the guidance in Reg Guide 1.189, so therefore I would expect the Staff to be familiar with their own regulatory guidance when you're reviewing submittals. I'll just put that on the record, that's disappointing to me.

MS. SEMMES: Okay. It's definitely something we would look at with the operating license, if they say in the operating license that they are going to adhere to that, we would definitely look at that.

At the stage that the application is at now, for the issuance of a construction permit, it's not something we've considered.

MEMBER STETKAR: Okay, thank you. It's at least on the record.

MEMBER KIRCHNER: Mollie, I would like to go back to, I don't have the slide number, I can't see it, your Staff review fire protection slide, several back. Yes, that one there.

You made, or maybe it was the proceeding one, you made a statement, I'm referring to the hot cell area, has sprinklers, two-hour fire barrier. And then you inquired about what fire suppression system would be used. What do you mean by that?

There is an enormous impact of using a water fire system from a criticality safety standpoint as to how they layout the equipment, the size of the cells that they use, et cetera. Are you suggesting here that something other than water system would be used, like Halon chemical or --

MS. SEMMES: I --

MEMBER KIRCHNER: Because that would, like a Halon system can be self-contained within a compartment. A water system is not likely going to be designed and constructed that way, so there's a big impact here on what kind of fire suppression system is used for the hot cells.

MS. SEMMES: Right. And that's why I asked the question in the RAI initially, is I want to get a sense of what type of fire suppression they were using, because you're absolutely right, there is a big difference between a sprinkler system and a gas use suppression system.

And they indicate in their response that they haven't gotten to that level of detail yet in their application, in their design. I'm sorry, in their design.

So when they submit their operating

license, that is something that you'll definitely have to consider and we will have to look at. But you're right, it does make a difference in terms of, I'm not familiar of how it would affect the size of the hot cells and things like that.

MEMBER KIRCHNER: But there are criticality analyses, which we're going to hear about later, all depend on spacing size, amounts of water, amounts of nuclear material in process, et cetera. But it does come back to your selection of a fire system and spacing and such, or vents or drains and so on.

MS. SEMMES: You're absolutely right, it does. And when they submit that level of detail for the FSAR and the operating license, that's something we will definitely have to look at. And the criticality analysis, we'll have to include that as well. But at this stage we don't have that level of maturity in the design to consider that.

MEMBER KIRCHNER: I just raise my concern, it's like. It's like my concern about the seismic. These are things that I would recommend be finalized at this point.

Just leaving it open, I mean, that's a, I'm going to make something up, I'm not sure the

Applicant is proposing or even considering other fire suppression systems than a water sprinkler system, but that has ramifications throughout the PSAR and FSAR.

MS. SEMMES: I agree that it will have effects on the criticality analysis and the analysis we do, in terms of fire protection for the FSAR and the operating license, it will make a difference. And we'll have to look at that once --

MEMBER KIRCHNER: Have you looked at it from the standpoint of what chemical processes are going on in the hot cells and what fire potential they would create? Which would have an impact on what kind of sprinkler system or fire suppression system you choose.

MS. SEMMES: At this stage, no. Because they have not, when I asked RAI they have not thought of a fire suppression system yet.

MEMBER KIRCHNER: Did you ask their fire people or did you ask the general designers, because they know a lot of this at this point. They know what their chemical processes are. They know the inventory of chemicals they'll be using.

MS. SEMMES: I haven't discussed it specifically with our fire people. I'm sure that their fire people, or I'm not sure. I would assume their

fire people want to answer the RAI, but I haven't specifically discussed it with them.

MEMBER KIRCHNER: Thank you. I'm not going to let it go.

(Laughter)

MEMBER KIRCHNER: You got to nail this down. It has tremendous ramifications for design and construction of the plant.

MEMBER REMPE: I'll paraphrase what Al told us earlier. I'll they're giving them permission to do is pour concrete, and if they never do anything with that concrete, the public safety and health is at impact, what can the Staff do, right?

MR. ADAMS: Can I ask, can Northwest add any details of the questions being asked?

(Off microphone comment)

MR. ADAMS: Because I thought we discussed, for example, criticality of the hot cells if they're flooded.

MR. CORUM: Yes, the criticality analysis have assumed that water --

MEMBER BLEY: Since you've just come back --

MR. CORUM: I'm sorry, Mike Corum from

NWMI. Sorry.

The criticality analyses did assume water in fully flooded conditions in all cases and that's why we've developed the spacing requirements that we have for all the tanks and all the equipment. So we looked at fully flooded conditions as the most conservative bounding analysis.

MEMBER KIRCHNER: Are you thinking of any other fire suppression systems for the hot cells, other than a water-based sprinkler system?

MR. CORUM: Not at this time we're not. Unless it comes as a recommendation from our fire protection engineers in the final design phase.

MEMBER KIRCHNER: Thank you.

MR. TITINSKY: Yes, this is Dave Titinsky, I can add a little bit more to the discussion here, related to this. Now, I know there's a lot of questions that relate to things that are more in the final design that we don't have, but the regulations don't require that.

So when we issue them a construction permit, they can build a facility that's sort of like what they say in their preliminary safety analysis report, but they'll be developing the final safety

analysis report.

And I believe, and I don't want to speak for them, I think they mentioned in one of the earlier meetings that they would not actually build the facility until their final design was ready so they knew exactly what they were building.

But it is, at the risk of the Applicant, if they build something that is far from what we've seen in the PSAR or that doesn't meet the regulatory requirements, in the operating license review, they would not receive an operating license from the NRC. So it was really the risk of going sort of out there in terms of what they're doing.

From what we see now is on Northwest and their ability to get a license.

MR. BALAZIK: And we'll continue on with Chapter 9. And I think now we're going into communication systems.

MR. ALEXANDER: So this is Steve Alexander again with ISL. Communication systems have been developed, the design is developed to pretty much a conceptual stage at this point.

And so the design basis is very general, system description was very general. It was gone over

by Northwest. Does any of the Members have any questions on this for the Staff?

Okay, let's go to the next slide then. Cover gas system. Again, we're looking at the fact that two of the three process chill water systems involve exposure of the process chill water to radioactivity or radiation at some point, and there's a potential for some radioanalysis, or radioactive decomposition, of the processed chill water.

And the way the system works is that the processed chill water tanks would collect any entrained gases. And hydrogen is a particular concern. Hydrogen oxygen mixtures would be collected. And then air would be added to that to keep the hydrogen and oxygen mixtures diluted to below the 25 percent of the LFL for hydrogen 5 percent.

Again, oxygen analysis in detail in Chapter 13. And there were no preliminary IROFS identified for this process function, although certain parts of the process vessel vent system are IROFS.

Next slide please. Utility systems. Are there any questions on the utility system? We've gone over these pretty much, I'd be happy to -- okay.

Next slide please. Okay, Analytical

laboratory. Again, they need to support onsite analysis for production of molybdenum-99 and target fabrication, also for recycling of uranium.

The sample will be analyzed in gloveboxes or hoods as required for mass concentration, purity of special nuclear materials, concentrations of molybdenum-99, product and product impurities, processed steam chemical and radionuclide concentrations, chemical and radionuclide analysis for waste handling disposition.

They need to verify acceptable molybdenum-99 products to ship, confirm uranium content, determine adjustments for feed tanks and other associated adjustments to verify the recycled uranium complies with product specifications and ensure their compliance with waste acceptance criteria. All those kinds of analyses done in the lab.

Next slide please. The system description pretty much talks about the hoods for sample preparation, waste handling, standard preparation.

Hoods for special instruments, gloveboxes for some of those instruments. Gloveboxes for sample delivery and preparation prior to sample transfer.

Countertops, storage for chemical

laboratory supplied, benchtop systems. There is a diagram in the PSAR of the lab layout and the instruments.

Next slide please. Chapter 13 analysis talks about lab accident sequences, particularly chemical burns from contaminated solutions during sample analysis, and also chemical safety process upsets, so spills and that sort of thing, without significant fissile or high-dose license material present. And that's true of both in the chemical storage area and the laboratory.

There were no laboratory IROFS, as Northwest has said. But there will be defense in-depth protocols on sampling analysis. Including locations, technics, containers, transport routes, analysis procedures, reagents equipment, residue disposal, procedures evaluated for standard safety protocols for chemicals and equipment.

Next slide please. Overall, the RAIs that were issued on Chapter 9, which had to do in the fire protection area and in the waste management area, and also in ventilation area, were inconsistencies between PSAR Chapter 9 and Chapter 3. We talked about those.

Also, some of the terminology was not

standardized yet, which made it a little difficult to look at system boundaries. Because you were talking about facility ventilation versus ventilation, and that's been cleared up and standardized.

And so we looked at Revision 1 to the PSAR and found that they acceptably, or satisfactory, incorporated their proposed resolutions to the RAI concerns in Revision 1.

So therefore, we concluded that Chapter 9 described an adequate design basis for the auxiliary systems. And by the criteria in the guidance, was sufficient for satisfying standards for issuance of a construction permit.

We evaluated the descriptions and discussions of the NWMI RPF auxiliary systems, including probable subjects of technical specifications, of which those are being deferred, as described in Chapter 9 and supplemented by the RAI responses in PSAR Revision 1, find that the preliminary design of the auxiliary systems, including principle design criteria, design bases, information relating to general arrangement, major structure systems and components, and a high level functional description, provides reasonable assurance that the final design

will conform to the design basis. And meets the applicable regulatory requirements and acceptance criteria referenced in NUREG-1537.

Design of RPF auxiliary systems, as documented in the PSAR, then is sufficient to satisfy the standards for issuance of a construction permit. And again, a lot of the responsibility then is on the Applicant for pouring concrete that's not sufficient to house things that they end up finding that they'll need.

But parts of auxiliary systems are, or support IROFS. And their preliminary design provides reasonable assurance that those IROFS should remain functional for the protection of health and safety of the facility personnel and the public and protection of the environment.

And said, based on engineering judgment, and really, that engineering judgment is not really just vague in general, it boils down to trying to decide if the detail level that was provided is sufficient to meet the criteria of, is a reasonable assurance that the final design will meet the design bases, understanding that there's not enough detail in many of these areas to conclude that they can build something

as preliminary design and it would be absolutely perfect.

So, our engineering judgment was based on how well they met the criteria. And they met the, in all cases so far, the minimum criteria for acceptance.

So they have described the facility, including, but not limited to, the principle architectural engineering criteria for the design. They have identified the major features and components, incorporated for protection of health and safety of the public.

And we believe that further technical or design information may reasonably be left for later consideration in the FSAR. We believe the facility can be constructed and operated at the proposed location without undue risk to the health and safety of the public or impact on the environment.

Do you have any questions? Okay, that concludes our presentation on auxiliary systems.

CHAIR CHU: Any questions?

MEMBER BROWN: Yes, I just have one observation. Go back to Slide 27. Why is my slide different? Analytical laboratory.

MR. ALEXANDER: Ah.

MEMBER BROWN: Yes, that's the one right there. They're all 27's, all right, good work. I like that.

(Laughter)

MEMBER BROWN: That's good. It says, I&C, they refer to the PSAR Chapter 7.0. I just observed it, it says absolutely nothing. It's a paragraph that says there will be vendor packages.

MR. ALEXANDER: Yes, sir.

MEMBER BROWN: As opposed to, it would have been nice if you had said they will identify what they're going to have in the final FSAR when they get there. There is literally no definition. And I'm not saying that's unsatisfactory, I'm just saying it doesn't say anything at all.

MEMBER BROWN: No, it doesn't. And we've noticed this actually in quite a number of the sections.

MEMBER BROWN: Yes.

MR. ALEXANDER: It simple refers to Chapter 7, and so I went to Chapter 7 and say, well, what's there about it.

MEMBER BROWN: It just says, we'll have something.

MR. ALEXANDER: It usually says that will

be, not much there now.

MEMBER BROWN: Yes. Okay. Just put it on the record that we do expect some information to be provided in the final FSAR, that's all.

MR. ALEXANDER: Now, in the HVAC section it did have some information that wasn't referred to Chapter 7 but then raised the question about parameters that would initiate automatic protective functions. And other than what's discussed in general, under building management system, that's all there is right now. So we'll be looking for that.

(Off microphone comment)

MR. ALEXANDER: Yes, sir.

MEMBER KIRCHNER: On that same slide, yes, it's correct. No laboratory IROFS were identified, but the laboratory is connected to the Zone I.

MR. ALEXANDER: Exhaust from it, yes, sir.

MEMBER KIRCHNER: To give them credit, under defense in-depth, the fact that events to Zone I is an important design feature for their --

MR. ALEXANDER: The laboratory exhaust system, it's got its own exhaust system but it does vent into the Zone 1 exhaust system. Yes, sir.

MEMBER BROWN: On that thought I'll make

one other observation. That under I&C in Chapter 9, Section 9.1.4 they refer to Table 9.2. And that's all the indications. That's the alarms and monitors. And dampers seem to be an important issue, relative to air balancing and stuff, and yet there's no alarms on any of the dampers.

MR. ALEXANDER: Well --

MEMBER BROWN: So I'm, we don't need a decision, I'm just saying about the only blank in that entire table and it just seems, I'm just hoping there will be some thought as to why we don't need any alarms on the dampers when we get around to the final FSAR.

MR. ALEXANDER: The dampers will have an indication on them.

MEMBER BROWN: It says monitor, but there is no alarm if they --

MR. ALEXANDER: No alarm if a damper opens or closes --

MEMBER BROWN: That's right.

MR. ALEXANDER: -- right now. Yes, sir.

MEMBER BROWN: That's all.

MR. ALEXANDER: It's something we're looking at.

MEMBER BROWN: It seemed incongruous.

I'm done.

MR. ALEXANDER: Any other questions? Okay, thank you.

CHAIR CHU: Okay, I'm going to propose, let's take a lunch break now for an hour. Until 12:45.

Because some of the Members have assigned meetings they have to go to from 1:00 to, no, 12:00 to 1:00, right? Yes.

And I'm hoping, we're kind of behind, I'm hoping Chapter 11, which is radioactive waste thing, we can catchup a little bit. I'm hoping the total time will be an hour, instead of an hour and a half. And then we'll catchup a little bit.

MEMBER POWERS: You can hope.

CHAIR CHU: Yes. Thank you.

(Whereupon, the above-entitled matter went off the record at 11:46 a.m. and resumed at 12:46 p.m.)

CHAIR CHU: Okay, we're resuming the meeting. Chapter 11.

MR. REESE: All right, so my name is Steve Reese, I'll be doing Chapter 11. Carolyn has stepped out, she is tending an ear infection right now, I think. She's had to deal with it all morning and she couldn't hear off this ear. It's getting worse.

MEMBER POWERS: She's tired of listening to the ACRS --

MR. REESE: Or tired of listening to me because it was this ear.

(Laughter)

MEMBER POWERS: I see, you're the one.

MR. REESE: So, it also should go on the record that I, in no way, could ever replace Carolyn.

(Laughter)

MR. REESE: Let's make sure that's clear. So I'll try to do this as expeditiously as possible. In general, what this is going to describe is the requirements in 10 CFR 20. So if you go through everything that's in 10 CFR 20, this is what we tried to address.

Essentially what we put in the document in Chapter 11 were all the things specifically identified in NUREG-1537 or Chapter 4. Chapter 11, and it's essentially a description of the radiation protection program.

So it requires you to list all the expected sources of radiation, whether they're solid, airborne, liquid and the expected doses, from normal operations to both the public and occupational.

Now, one thing that's very clear is that we have to incorporate ALARA during this entire process. And we'll try to address that as we go through.

From the sources within the radioisotope production facility, we've got a pretty good idea the physical chemical form, curie strength and exposure rates, energy levels, encapsulation. So we've got some pretty good isotopic detail from calculations performed by the reactor, which provide the source term for essentially the facility.

Airborne radiation sources, so this is not, yes, okay. So largely consists of radioactive gaseous. We could expect to see potentially some in the target fabrication area and also in the target hot cell area.

Although we do believe that those levels should be very, very low. But we assume that they'll be, that they can exist there. And also in the waste management area.

Mostly, we think it's low because most of the products, most of the fission products will be encapsulated within the piping systems and the tanks. So we don't expect, under normally operations, for there to be an airborne radiation source but we plan to deal with it regardless.

What the airborne releases are based upon is the eight University of Missouri Research Reactor targets instead of 30 reactor targets from Oregon State. And I'll talk about more of that later as to why.

And the idea is that we design the off-gas system to capture as much material as possible so that we can keep within 10 CFR 20 limits.

So what we did for the airborne radiation sources, we essentially figured out it's a batch process, so we're looking at how much fission product inventory we're bringing in the facility per week, multiple that by 52 weeks per year.

Now, when we did the calculations for offsite doses, what this next bullet is trying to describe is this. We essentially took credit for only one HEPA filter. And we assume that the noble gases and the iodine releases were not reduced by the system that we had in place. Okay.

And then we took COMPLY. That was the code that we used. However, COMPLY doesn't have all of the unique fission product isotopes that we're producing.

But many of these aren't as high as dose significant as, dose significance as other isotopes that were captured in the COMPLY calculation.

MEMBER SKILLMAN: Steve, is COMPLY a code that the NRC recognizes, and also --

MR. REESE: Yes.

MEMBER SKILLMAN: -- the State of Missouri?

MR. REESE: It is, I can't speak for the State of Missouri, but it is certainly an acceptable code for reactors to use to provide off, it was written by the EPA so that you can show that you're in compliance with the 10 millirem per year airborne.

MEMBER SKILLMAN: Okay.

MR. REESE: And it's an acceptable form of calculation for the NRC.

MEMBER SKILLMAN: Okay, thank you, Steve.

MR. REESE: Yes, you bet. So we do the calculation, we get something in the order of 3 millirem per year, which means we are below the, it's not limit, it's constraint, the 10 millirem per year constraint on airborne emissions.

MEMBER STETKAR: Steve, I --

MR. REESE: It originates from these shafts. Yes?

MEMBER STETKAR: I don't do any of this, so just tell me I'm stupid. No, seriously, I don't.

But I did read --

MR. REESE: Well, that's not going to be good for my career.

(Laughter)

MEMBER STETKAR: No, that's okay.

MEMBER POWERS: Oh, we'll appreciate it a lot.

(Laughter)

MEMBER STETKAR: It's fine. I'm old enough, I'm stupid. I'm past the peak.

Seriously, on some of the safety analysis reports that I was reading, I thought those were showing maximum doses from releases about a kilometer, roughly, from the site.

MR. REESE: Yes, 1,100 meters.

MEMBER STETKAR: Yes. And I'm curious why this is only 30 feet.

MR. DUNFORD: So this is normal releases, and this is just we did essentially ground level releases at these evaluations and went to our fence line. So these are conservative, but they're normal releases, not accident releases. So it's what's coming out day in and day out.

MR. REESE: So you can either look at it

coming out of the stack or you can just assume a ground level release, which is more conservative because there's less dilution.

MEMBER STETKAR: Okay, so, okay. Okay.

(Off microphone comment)

MEMBER STETKAR: It says --

MR. DUNFORD: Normal releases.

MEMBER STETKAR: But the fourth bullet says, maximum goes to the public from normal operational stack releases. Well, that's what got me confused.

MR. REESE: Yes. Yes, 30 feet. Thirty feet ground level release.

MEMBER STETKAR: Ground level release. Okay.

MR. STONE: It will be lower if we did it through the stack.

MEMBER STETKAR: Well, it was, stack releases were lower close in, they were higher out to about --

MR. STONE: That's correct.

MEMBER STETKAR: -- roughly 1,000 meters and then they tailed off again.

MR. REESE: That's correct.

MEMBER STETKAR: Just because you loft it.

MR. REESE: Yes.

MEMBER STETKAR: But this is a ground level release at the fence line?

MR. REESE: Correct. That's true, yes.

MEMBER STETKAR: Thank you.

MR. REESE: Yes.

MR. DUNFORD: Not a stupid question.

MR. REESE: Absolutely not.

MEMBER POWERS: Well, I think it's totally debatable here.

(Laughter)

MR. REESE: I'm getting pinched. Okay, so when we look at solid radioactive sources, really looking at fresh LEU, which isn't a very high radiological concern compared to other things we're dealing with in the facility.

The big one is irradiated LEU targets with all the byproduct material. In the LEU target material, obviously in the solid solidified waste, which is going to contain the byproduct material.

During normal operations, the solid sources will be contained within shielded hot cells, all within restricted areas of the facility. And we'll talk more about what constitutes restricted area in

the facilities later in the talk.

Our source term was based upon 8 MURR targets, eight hours post of radiation in a one-week period. And basically, what we did is we propagated that through the facility. And their shielding calculations were based upon that.

We think it's pretty conservative because it will be higher than OSU, that's what I'll talk about here next, will definitely be higher than OSU, because although we get about the same amount of, and I believe we say this, yes, it's about, I'm not getting into proprietary space, we get about the same amount of radioactivity within the targets in total, between MURR and OSU. MURR having eight targets, OSU having 30. By the time OSU gets it there, there is quite a decay.

So the other thing that we assumed is that the eight targets were, it took eight hours from end of radiation to get, from end of radiation to the process facility, which is ludicrously fast. It can't really probably be done.

MEMBER REMPE: I was confused sometimes when I was reading through various chapters of the submittal --

MR. REESE: Okay.

MEMBER REMPE: -- because didn't we, I skipped the last meeting, I apologize, but didn't we learn in the first meeting that you could actually do 12 targets at MURR, so why did you pick eight here and then in another analysis you picked 12? I couldn't follow the logic.

MR. DUNFORD: Well, I think we talked about it earlier, but I prefer to explain it in closed session, it's just much easier to talk about.

MR. REESE: Yes.

MR. DUNFORD: I don't have to worry about --

MEMBER REMPE: If there's a logic it would make it easier for me to follow it when I was reading --

MR. DUNFORD: It is. And it deals with timing. And when the 12th target comes in the plants it's not even close to where the first batch comes into the plants and things. So we can walk through it.

MEMBER REMPE: Okay.

MEMBER SKILLMAN: Steve, you mentioned that the eight hours is, I'm making a colloquial statement here, is a stretch, it's really hard to do that.

MR. REESE: Yes. It's probably physically impossible.

MEMBER SKILLMAN: But, that's what I was going to ask. If push comes to shove and this facility turns out to be extraordinarily profitable, can the system be tweaked to force you to move more quickly, such that you are actually moving the facility into a different tempo or a different cadence?

MR. REESE: Probably not.

MEMBER SKILLMAN: And why is that?

MR. REESE: So the whole facility is designed -- it takes time to load the targets at the reactor, and there are procedures associated with using that cask, how many targets you can load in a cask is limited.

So the number of physically, and this goes to some of the discussion we'll have this afternoon about how many targets can be moved between each facility, but there are just physical limitations associated with use of the cask, loading of the cask, unloading of the cask.

Obviously, the transport is pretty straightforward, it's only a few minutes away, and it's a batch process. So, it's not a continuous feed

process.

And so all of those things going together, we should probably save part of this answer for the proprietary side.

MEMBER SKILLMAN: Yes, okay. I get the drift. You're just saying, serious process and there are physical limitations on each one of those, the segments of this process.

MR. REESE: That's correct.

MEMBER SKILLMAN: Copy that. Thank you.

MR. REESE: Okay. So we most certainly will have, as per the regulations, we most certainly will have an ALARA process, excuse me, an implementation an ALARA statement. And, essentially, the idea is for ALARA, as well as reasonably achievable, is to keep all of the occupational and general public doses to as low as reasonably achievable.

Now, we're going to get a little redundant on this, and I'll skip some of these slides, but, in general terms, we're trying to do that not only from an operational sense, but we're also trying to do that in the design sense, too, as well. So we'll talk about this as we go through. Yes, I'll have more details later.

So we're trying to incorporate ALARA principles in the design. So when we're looking at the shielding, so here's the classic example. So when we're looking at the shielding, just how low should we go? What is reasonable, and what are our ALARA, how is that shielding in relation to what we have established as initial ALARA criteria and administrative limits. So things like shielding, where facilities are laid out, can you lay out facilities in places that are in low dose or you can at least, if something is broken, you can move a skid to a low-dose area so you can perform maintenance on the equipment on the skids without entering a high-radiation area.

So these are all the guidance documents that are out there on how do you apply ALARA, and we're certainly going to take all of these things into consideration. Some of these deal with explanation of ALARA philosophy during initial radiation safety training at a facility, but we most assuredly will be taking ALARA into consideration and take it very, very seriously.

We are going to have a, we'll make sure that the program meets all of the requirements of 10

CFR 20 and 10 CFR 19 with respect to the notices, instructions to workers. I'll skip that real quick so we can get to some of the other stuff.

So these are what, are first-draft administrative limits. I think we're pushing a concept to have an administrative limit of 2 rem per year without an administrative dose investigation level of about 500 millirem per year. We'll likely, although it's not, we'll get to it a little bit later, we're likely to have quarterly dosimetry, maybe monthly dosimetry. Not quite sure at this point.

Certainly, none of the very high-radiation areas will be occupied by people, and even the high-radiation areas should not be normally occupied by individuals. So when we look at dose rates based upon some of the shielding, at least for the guidance that we put forward on the shielding, excuse me, the parameters we set forth on the shielding, you can see we're trying to keep things down to about a half a millirem per hour. We think with those exposure rates off the surface of the hot cells that we can maintain these administrative limits.

We've identified all of our controlled access areas, restricted areas, radiation areas, and

I believe I have -- no, that may be in the proprietary side. It's in the proprietary side, isn't it? Yes. So in the proprietary side, I can show you where we've laid out controlled area, restricted areas, high-radiation areas, very high-radiation areas.

Of course, dosimetry will be required in any place past the administrative portion of the building. We're going to have an area monitoring program.

So these are the roles and responsibilities of the radiation protection manager. So you can see these are pretty standard for radiation protection manager: services the radiation safety officer, maintains and generates the restricted procedures, audits, complies with possession limits. This is the go-to gentleman for anything dealing with materials and radiation and radiation safety.

Training program will encompass all the requirements of Part 19, instruction to workers. And when we do set up the training program, we'll take into consideration all of these guidance documents in the generation of the training program for workers.

Part 19 basically identifies the things that you need to talk about when it comes to radiation

protection so that workers are informed of the risks and the materials involved. This provides a summary here for these things. So, first, people should always be aware of storage transfer use of all the radioactive material; instruct on the health protection problems associated with exposure to radiation, essentially risk; NRC regulations, provisions; the ALARA concept; the concepts, you know, you start to get a little bit into safety culture, so who has stop-work authority, what is the responsibility in Part 19 of the worker, what is the responsibility of the administration of, say the management of the facility when it comes to safety?

MEMBER POWERS: Have you given thought to pregnant workers?

MR. REESE: Absolutely. So there is, I think -- it's not there. If I go back, I believe it was one of the guidance documents. There it is. Concerning prenatal radiation exposure. So that will have to be, undoubtedly, a part of not only the training but the specific set of instructions associated with how to handle declared pregnant workers.

MEMBER POWERS: I've had enormous problems with that.

MR. REESE: I'm sorry?

MEMBER POWERS: I've had enormous troubles with that. It's a personnel issue, not pertinent here.

MR. REESE: Oh, yes, because the regs are pretty clearly laid out.

MEMBER POWERS: Yes, and they conflict with various protections and things like that. Radiation workers typically get a premium.

MR. REESE: Yes, yes.

MEMBER SKILLMAN: So you're penalizing them.

MR. REESE: Yes, you're not allowed to -- although the regulations are fairly clearly laid out, you're not allowed to discriminate. It's also Part 19.

MEMBER SKILLMAN: Please go back to 12 for a second.

MR. REESE: Yes.

MEMBER SKILLMAN: I realize we're at construction stage, and this is a question that really is for way in the future, but I just note that you've bundled under your safety, health, and licensing manager the safety, security, and emergency preparedness.

MR. REESE: Yes.

MEMBER SKILLMAN: And I would offer that this, since we're in subcommittee, this man's opinion by myself, that probably needs to be someplace else, not under RADPRO. Those of us who have been through big facility organizations have realized two things: how important that role is --

MR. REESE: You're talking about this person here?

MEMBER SKILLMAN: That one right there. That really needs to be independent from the line organization for RADPRO. That's --

MR. REESE: Well, he's not under the radiation protection manager.

MEMBER SKILLMAN: He's under the safety, health, and licensing manager.

MR. REESE: That's correct. So to your opinion, he should report to the plant manager or --

MEMBER SKILLMAN: No, no, independent from plant manager and independent from RADPRO.

MR. REESE: Because the idea here is that all the safety and the compliance are separate from operations on this side. That's what we tried to capture in here.

MEMBER SKILLMAN: I would just say EP, emergency preparedness, is almost a discipline onto itself.

MR. REESE: I could appreciate that.

MEMBER BLEY: Steve, you mentioned who has stop-work authorization. That always raises an interesting issue. There are sometimes where stopping work isn't the safe thing to do. If you're in the middle of a process, you do not just stop work. And is that clarified well in -- have you thought about that?

MR. REESE: Yes, yes. So, you know, when you talk about having stop-work authority, if someone says I don't like this process, I don't like what we're doing, we need to stop and think about it, it's not as though you could stop that very second in some cases. In some cases, you can.

MEMBER BLEY: I've seen arguments with regulators and other things in spots like that. That's why I asked it. And even within an organization.

MR. REESE: Yes, you'd have to have some provision for providing some sort of, if you shut it down or stop the system, you can set it down or stop it in a safe manner.

MEMBER BLEY: Just so you think about it.

That's all.

MR. REESE: Right, yes, yes. That's appreciated. Sir?

MEMBER SUNSERI: I have one question, and I know you're trying to get through these slides. On this radiation protection manager's responsibilities --

MR. REESE: Yes, sir.

MEMBER SUNSERI: -- I may have just missed it, but who's overall the authority for transportation? That's going to be a big part of your business, radioactive materials transportation, and who's got that? And the reason I ask is we're starting to see an increasing number of issues in the industry with shipments and manifests and quantities and dose rates and things of that nature. So --

MR. REESE: I don't remember off the top of my head. I'm guessing, but Gary has --

MEMBER SUNSERI: Well, we can move on and you don't have to look for, but I would commend you to make sure that there's a clear single point of authority for that particular activity because it's very important.

MR. REESE: Yes, transportation

regulations are sort of a field on their own, so I can appreciate that. All right. So we're going to have a set of procedures which describes actions and things that are allowed to go on in the facility. We're also going to have radiation work permits that define special or unique descriptions of work that are not routine. These radiation work permits identify things like PPE that's required, stay times, dose limits, stop-work authority, under what conditions is an RWP complete, who signs off, training, dosimetry, so on and so forth. And that's really what posting, yes, didn't include that.

Radiation monitoring and surveying. We obviously know that we're going to have a pretty extensive radiation survey monitoring program. The language in the regulations say something to the effect of you have to have this program commiserate with the level of activity, and we certainly will have a lot of activity. So we very much anticipate having things like daily, weekly, monthly surveys in different portions of the facility. We'll have written procedures that will provide guidance and stipulate how these kinds of surveys need to be performed. We're also going to be doing air surveying, excuse me, air

sampling, excuse me, throughout the facility, in addition to the stack monitoring air monitoring systems that exist.

Personnel monitoring. We're looking at portal monitors, hand and foot monitors, you know. The exact manufacturer we have not identified, but there's a number of units that would meet our needs.

That's also true of the CAMs. We know there are several manufacturers out there that can produce continuous air monitors to meet our needs and meet our regulatory obligations. And I think this came up, maybe it didn't, but we also know that we're going to be responsible for noble gasses, particulate, and iodine, so those are the three things that we're considering when we're sampling the air.

In the interest of time, I will very quickly say that these provide examples of ALARA and how they're applied in facility design and process design, things like layout, the types of materials that will be used, how they're mounted on sleds, going on.

Okay. So control of entry. So the entire facility will be a controlled area from 10 CFR 20 perspective. And then, within that, we'll have restricted areas and then the radiation areas within

those.

We anticipate that, within the restricted areas, there will be two credential, some sort of access control. We don't know what that access control looks like now, whether that's a fob/PIN, biometric dose, details we'll be working out with the operator license application. And, of course, dosimetry will be required any time you're in a restricted area.

We will have, of course, the full suite of personal protective clothing up to and including respiratory protection. Now, we don't know if we're going to have supplied air or SCVA, but we will most definitely have a Subpart H program for respiratory protection.

Restricted areas. These, I don't really need to repeat these. These are right out of the regulations. It just says we know what a radiation area is and a high-radiation area is and a very high-radiation area. We have all of these in the facility, and we will declare a couple of areas airborne radioactivity areas. Even though they shouldn't be, there's a high potential for them to be. But these are essentially the regulatory definitions of these areas. The only thing I will say is we do anticipate

having a very high-radiation area within the hot cells themselves.

Yes, okay. Well, here's one. Here's an example of the controlled area. So what this shows you, the graphic here shows you the site boundary and then the controlled area, which is the grayed portion of that diagram within the site boundary. So for area monitoring and compliance, you know, we assume that everything outside of this controlled area is accessible by the general public. So when we do our accident calculations for direct radiation exposure and plume shine and plume exposure from accident and routine operations, this is the paradigm at which we are describing.

We anticipate having area -- well, we talked about area monitors before. It's going to be a combination of active arm system plus passive TLDs, probably not OSL but probably TLDs.

Well, the unrestricted areas, everything outside the controlled area, from our point of view. From internal dose, things that we'll be concerned with are uranium uptake and certainly CAM activity and establishing a bioassay program for such activity when it's deemed appropriate.

External doses. So we have an administrative ALARA limit that we're shooting for, and we also have a dose investigation level that we're also shooting for, and that's at 500 millirem. So if you basically reach 125 millirem in a quarter, it would cause us to determine what's going on and perform an investigation.

These are where we're going to start. Obviously, we have the ability to change things as needed. But this is our shot to start with.

We'll be very concerned with contamination control, especially on the waste side of the house, and making sure that our surveys and our survey program does incorporate and capture the risks thereof.

I'm going to skip this. I'm going to skip this. We will have an environmental monitoring program, you know, one that meets -- so there's a couple of reg guides out there that we can use as a method for setting up this environmental monitoring program, but it's essentially going to be a combination of water sampling, you know, grass sampling, soil sampling, direct surveys, and probably passive TLDs.

And with that, I'm going to turn it over to Gary really quick. He's going to cover the waste

management.

MR. DUNFORD: So this is Gary Dunford. So this discussion is the programmatic aspects of the waste management program. It starts off with, you see the waste management manager who actually has shipping responsibility for the waste side. The reality is we probably have three shippers, as we have three different organizations, and we have to probably consider your guidance on that. We're shipping targets off, we're shipping waste off, and we're shipping product off. So right now I would tell you they're in three different organizations in the way this is laid out. But the primary shipping would be, well, targets every week and waste every week, so those are probably the big -- and moly every week. I guess everything is weekly.

So basic responsibilities for the waste manager. We do have Class A, potentially B and C. We expect not to generate any greater than Class C waste. And the B and C, I think we talked about previously, just really bounces on how far we think we can concentrate our high-dose waste stream, so that's just the boundary that we want to put as an operational endpoint for concentration.

So we'll have a pollution prevention

program, waste minimization. Even as part of the design process, we're already looking at some of these activities. We've been looking, we have some solvents. We've been trying to figure out are there less hazardous replacement solvents that could be used and still perform our needed function? We've done the work. We haven't necessarily been successful in finding something that works.

So as I mentioned -- I'm on the next slide, Steve. Keep going. I'm past you again. And one more. Okay.

We don't generate any, we don't dispose of any liquid radioactive waste. Okay. So that's our goal, that's our plan. So that's in here. This isn't really a discussion about our process. We did some of that in Chapter 9, and we did some of that in Chapter 4 previously. And as somebody might have mentioned, we actually have decided that our low-dose waste evaporation tanks, holding tanks, could be just a little bit bigger, and that's already been part of our mass balance updates that we've been working on.

The next slide has a table of our different kind of wastes and kind of where we have generated. This is probably more on the high end in most cases.

We generated this as part of our EIS package and our environmental report package, so some of the numbers are a little bit high and some of them, to be honest, we don't have a really good handle on. The facility-generated waste, some of those we had to make some estimates.

Next slide, Steve. Types of solid waste. Obviously, we have the solidified low and high dose. We have spent targets that we're going to throw away. We've got equipment. We'll have HEPA filters, and we also have spent resin from our moly columns and from our other processes.

And then the last slide, Steve, is there are a lot of IROFS associated with the overall waste. A lot of them are generated from the criticality concerns, and so they actually are applying to the streams coming into the waste system. But because we have high-dose waste, you end up with the same concerns on a spray or anything like that, so you end up with the confinement, the shielding walls, the process vent system, and, again -- and we also have heavy lifts. We have HIC containers, maybe not super heavy, high-integrity containers of waste, so there's actually an overhead crane aspect that applies to this, too.

So that's pretty much --

MEMBER BLEY: Are your solidified wastes going to be stored on site?

MR. DUNFORD: Our high-dose solidified waste will probably have to be held -- it depends -- if it's an OSU batch or if it's, if it turns out it's a combined batch, we might produce one high-level, doing mere target processing, we'll produce 1,000-gallon container a month. So it's going to have multiple weeks in it.

That will have to be held to meet the A2 values for the shipping container for, again, it depends, it could be four weeks, it could be six weeks.

MEMBER BLEY: Not so long.

MR. DUNFORD: No, not so long. We have current plans for eight to ten, and we talked about as part of our optimization stuff on early meetings how we're thinking we're getting the waste storage from the basement up into the waste management area and reducing the amount of storage space we need.

So for the low level, the Class A drums, we're going to, we've got a truck and ship them off, a truck full. But we produce quite a few of those when

we're processing the OSU just because of the extra volume of water needed for the uranium recovery processes.

MEMBER BLEY: Thanks.

MEMBER SUNSERI: This is really a conduct of operations question, but, since you mentioned it, I'll ask it here. High-integrity container lifts, you said you consider them a heavy load, and so my question is are you going to have a heavy loads program to protect your IROFS so that you don't --

MR. DUNFORD: Yes.

MEMBER SUNSERI: Okay. I didn't see it anywhere.

MR. DUNFORD: The second to the last IROF, FS-01, is called enhanced lift procedure.

MEMBER SUNSERI: Okay, all right. I didn't recognize that. Got it, thanks.

MR. DUNFORD: Okay. Good question.

MR. REESE: So the last two slides in the radiation protection program essentially covers Subpart H, the requirements of respiratory protection program. So we are very clearly mindful that we are past administrative or engineering controls at this point because we're dealing with respiratory

protection, and we'll certainly have ALARA considerations buried in all of these RWPs that would be required for the use of respiratory protection. And these are all the standard respiratory protection requirements or respiratory protection program requirements, things that you're going to have to do: monitoring, appropriate bioassay, air sampling supervision, fit testing, you know, rescue, and, of course, the record-keeping associated with all of that.

And with that, I believe, we are five minutes over our allotted time.

MEMBER POWERS: Well, obviously not living up to standards again.

MR. REESE: Clearly. Like I said, I'm not Carolyn.

MEMBER POWERS: Well, I mean, you should have allowed a little margin in there to meet the regulatory limit.

MR. REESE: Of a half an hour?

MEMBER POWERS: Yes.

MR. REESE: Okay.

MEMBER KIRCHNER: Steve, what about the actinides and such that will be mixed in your process stream?

MR. REESE: In the waste?

MEMBER KIRCHNER: Yes.

MR. DUNFORD: Yes, so we've evaluated the concentration and it will fit, fits in the category. Really small, we really do have small burn-ups.

MR. REESE: But it doesn't get you the -- yes.

MEMBER KIRCHNER: You don't build up enough actinides. It's just trace quantities?

MEMBER POWERS: They have really tiny burn-ups.

MEMBER KIRCHNER: They should be really tiny. Just checking, asking.

MR. BALAZIK: Good afternoon. This is Mike Balazik. This is the staff's presentation on Chapter 11 on radiation protection. A couple new presenters up here. Ty Naquin from NMSS who looked at radiation protection, and we also have Stewart Bland for us from Chesapeake Nuclear Services that looked at the waste management.

So I'll turn it over to Ty.

MR. NAQUIN: Hi. Good afternoon. Just a couple of things about myself first just so you know a little background on me. I've been with the agency

for about eight years now, hired on as a health physicist, and I work as a project manager in NMSS. I oversight one of our fuel fabrication facilities. I'm actually a little bit of a stakeholder in this whole thing in that I'm a project manager for Oregon State, as well, and another university, NIST. I've had a few Homeland Security licensees, as well.

Prior to coming to the agency, I was 24 years Navy, health physicist, in a variety of environments, including, you know, this one here had kind of an interest to me because when I was a little junior officer and a medical RSO in a medical Navy hospital down in South Carolina, I came to learn that the U.S. was losing its ability to produce its own technetium-99 and such, so I was surprised. So I took great interest in being able to be a part of the review.

So in the Navy, I worked in a variety of environments: industrial, shipboard certainly. I was certified by the American Academy of Health Physics in 2000, so I'm very happy to be here.

Anyway, so I started with this application in 2015, and receiving the Rev 1 a couple of weeks ago was great because there are some great editions that I would have been looking for. And I won't try and

dwell too long on some of these things, but here we have some of the boilerplate material here.

And so I evaluated, you know, reviewing the radiation protection piece. Certainly, Chapter 11 was core, but this involved a lot of other things: Chapter 4 for the RPF, Chapter 6 for engineered safety features, Chapter 9 regarding ventilation, Chapter 12 with conduct of operations. A lot of these things played into the review.

And so these are just kind of some of the higher features that I just want to address here in terms of issues addressed here. Really what I'm trying to do in this is, you know, Part 20 is the radiation protection centerpiece and just to kind of highlight how Northwest addressed these things.

Next slide, please. Under radiation sources, I felt like they have done a very adequate job of addressing materials and the processes to produce molybdenum-99, resulting fission and activation products. It's very well defined where things are handled and the resulting products. And from a source management strategy, I call it there just because they address all the different pieces: your airborne sources and the big strategy there is hold and decay. Liquid

sources, not going to release any as liquid and solid sources storage and disposal. So I felt like they did a great job with that.

One of the issues in my review, and it's been discussed a couple of times, of interest to me was, and they discussed this up in the early part of the chapter of the processing of 8 targets and then in Chapter 4 you saw 12. You saw other references to 30. Some of the language in the update to the chapter kind of addressed those things, which was particularly, as Steve Reese was mentioning about, talking about the decay of 30 targets from Oregon State. We don't have all those fine details, but it is addressed as to the expectation of decay and easier for handling.

Can we go to the next slide, please? Okay. So in addressing the 10 CFR Part 20, and this one here, programmatic management commitments, and this I really kind of focus on Subpart B of Part 20, which is everything else, all the other features of record-keeping and exposure and all those things, it all starts with Subpart B. I think that Northwest expresses a clear management commitment in their application. The features that we look for under the commitment to implementation commiserate with the scope

of activities, that's reiterated in several places throughout the app, the use of procedures and engineering controls and, of course, you heard them address the ALARA facets of the program, the annual program review and the constraint on error missions.

I also wanted to say something about the, you know, one thing that was under the management commitments there, establishing the independence of the radiation protection program, that's always something, you know, from a radiation protection standpoint, you want to see. Also, Northwest addresses the access of the radiation protection manager to the COO. You saw that dotted line path in the org chart. That's another thing you look for in Chapter 12. While they address it in Chapter 11, as well, the role and the makeup of the radiation safety committee, their intent for them to be meeting on at least every six months. I think they'll have their work cut out for them.

Next slide, please.

MEMBER SUNSERI: Hey, Ty, so you heard my earlier question, what's your take on the low visibility of the transportation responsibilities? Because they're going to have a lot of stuff on the road, and

they look like they're doing a good job of protecting inside the fence, but how about outside the fence?

MR. NAQUIN: I think, I think that's a great point to bring up. It's certainly not directly addressed in this here, but it certainly is a big deal, particularly if we start looking at the idea of transportation of material from the university to Discovery Ridge, Oregon State. So, yes, that's certainly something that needs to be fleshed out. I'm not sure if there was a Part 71 review in the app.

This next slide on technically-qualified staff, they do a great job of discussing training and it's always emphasized commiserate with what's going on and what the person's job is, what the risk might be. Certainly one of the slides that Steve Reese put up here actually showed the bulletized things that we often see out of 10 CFR 19, instructions to workers, and the level of training is going to define the access, escort requirements if necessary. Certainly the radiation protection manager, they define, at least to some degree, the training and experience requirements they're looking for in that person.

So I felt like the training program is well defined. They address records, testing, refresher

training, audits of the training program. These are good features.

Next slide, please. The ALARA --

MEMBER SKILLMAN: Ty, let me ask this. I'm kind of looking through 11 here, Chapter 11, the revision to Chapter 11, and I see TEDE well described, I see ALI, and I see DAC. I don't see effective dose equivalent. Why?

MR. NAQUIN: Well, you know, that was one of my kind of questions, too. Certainly, where they address the use of the COMPLY code for normal operating procedures, they do talk about the TEDE. I'm not sure why, at this point, why it is. That's probably more of an accident consideration, normal operating procedures as described. You would be able to assess that, and they do address internal monitoring either in vivo testing or in vitro testing.

So I believe they express, I don't remember if they express the limits or not for internal exposure, but they certainly do allude to the bioassay for internal monitoring. You would certainly come to a dose of record from that.

MEMBER SKILLMAN: It just seems that a program as thorough as I would expect this program to

be, I would expect that to be represented somewhere, and it just seems to be AWOL.

MR. NAQUIN: That's a great point. I would expect that they, you know, the application hits all the high notes, as far as I'm concerned. But there are a lot of details that will have to go into an operating license application in almost all of these areas. It all sounds good, but, I mean, the way I think of it is, at one point, I was project manager for Louisiana Energy Services, and, before they got their application and they had a great application and everything was right there, and after they got their license, they began to amend their way out of some things because it was a high bar to stay on top of. So there are a lot of details that will have to come into place in all these aspects of the radiation protection program.

Let's see. Okay. Under the ALARA program, and their policy is in Chapter 11.1.3, and you get the philosophy and that's all correct. And, however, you know, I find that there are a lot of other sections of the chapter that really address the how-to, how they're going to do ALARA. You can see I kind of listed some of these to the side: their exposure limits,

the radiation work procedures. These are addressed in other things, but these all are part of an ALARA program.

Things were listed in the Northwest procedure for addressing ALARA in processes, as well as facility design. These are all good things.

I felt like also the revised application kind of bolstered their stand on exposure controls, kind of fleshing out more the whole idea of this investigational level they had already established in the original app that they would have an administrative control level of 2 rem per year but in kind of spelling out a little bit more what this investigational level of 0.5 rem per year would mean. And they address public limits through an environmental monitoring program.

Next slide, please. Access control. This, too, is quite well a part of the ALARA story, and what Steve mentioned about the two credential access, that's actually a new feature. It wasn't in the original app. It's not spelled out, but it does add to the security of access to the facility. Areas are defined, and the radiation work procedures I think they are well defined, as well, in terms of all the information required: access requirements, PPE

requirements, postings, dosimetry, all those kinds of things. Those are really important to the program.

They talk in monitoring and survey requirements. Dosimetry requirements, they will use what we call NVLAP. If you're not familiar with the term, National Voluntary Laboratory Accredited Program dosimetry. Instrumentation stationed at restricted area exits, friskers, portal monitors, all these kinds of things.

I will say that, you know, this is one area where there were probably 15 regulatory guides and industry standards that were cited as a part of this section, which is a lot of material. It was a point of interest with me is making sure we see eye to eye on what we're talking about when we say consistent with. A lot of, you know, generally, we look for when someone wants to use a regulatory guide as a matter of practice, we're looking for a lot of details, and there's a lot of details in there. So that, too, will be fleshed out in the operating license.

Next slide, please. Records and reporting. Those things are all in place. Record-keeping commitments are specified, reporting commitments specified, program reviews, audits, and

environmental surveillance. There was a little bit of a tweak in the application from environmental surveillance being kind of a part of the monitoring until its own section expanded in a couple of places to address how the program would move forward. The things that Steve mentioned, the different things that will be surveilled, these are things that you'll typically see in any industry, any regulated industry of environmental TLDs posted, evaluation of IODA, air sampling, these kinds of things.

And let's try the next slide. What do we got here? Okay. Just a little bit at the end, but maybe, rather than to come back to throw the ball back to me, respiratory protection, the respiratory protection program, as defined, it has all the hallmarks of Subpart H of 10 CFR Part 20, all the right things, performance testing, physician oversight, all those kinds of things. So, obviously, all those details have to be put into procedure to work.

And one last slide I think I have. And this one here is, it's not meant to tell the whole story, other than just from a high level. You know, these are all a lot of the critical parts of Part 20. They're all addressed in the Northwest app. Now, each of these

subparts have details that will have to be fleshed out, but they certainly do address these throughout the app for radiation protection. In my own evaluation, I found the program, as described, for a construction application is certainly adequate and meets the requirements we would be looking for in a construction application.

Oh, yes, so I've already kind of made reference to this one thing here, this first comment which was edited a little bit from what I submitted, and that was my concern about regulatory references and technical standards. And, you know, throughout the chapter, there were 27 agency guides and industry standards, so there's just a lot of material to say we're going to be consistent with and we just need to all understand what that will mean. And a lot of those things are detailed that are not appropriate to be evaluated in a construction app. We'll evaluate them when they come in in an operating license application.

The other thing, irradiated targets I made some reference to. I, you know, did a little bit of evaluation on the basis of some of their fission products to see their COMPLY code evaluation, see if I came up with consistent data, which I did. So I just

wanted to -- I really don't have, you know, any outstanding issues for the operating license where there's a lot of details, nothing that remains from the construction app.

MR. BLAND: I'm Stewart Bland, and I'll be presenting this on behalf of Jim McIlvaine who actually did the review but was unable to attend.

Radioactive waste management from a very quick broad perspective. We know that it's going to produce a lot of fission products which will result in solid waste products that will span from Class A, B, and C to the different DOT transportation classes from LSA to type A and B type packaging.

The facility does rely extensively on decay in order to resolve in a suitable product solid waste for shipping and disposal. But the design of the waste storage and processing facilities will be provided for the FSAR type review, so, at this level, it was mostly a programmatic type level review, looking back at the processing systems as described in Chapter 9.

Next slide. PSAR 11.2 does describe the management programs, the overall controls to ensure a suitable final solid waste product for transportation and disposal. And as identified, the waste processing

systems that were looked at that resulted in the waste products were addressed in 9.7.2.

Next slide. Examining the waste management program, staff concluded that the program objectives, the management, the supervisory type responsibilities, the types of audit reviews, administrative type controls had been adequately identified in terms of the scope of the program. These elements of the program and the details of the implementation will be conducted as part of the integrated review for the FSAR for operations.

Next slide. Solid waste controls. It did include the audits and evaluation of the different methods for minimizing waste and waste generation. We did examine briefly in terms of the tank conceptual designs, the tanks and pipings to control systems. A key item that was looked at and evaluated from the adequacy of the management controls was the system is operated in a batch-like process. From this, you know, there was a conclusion that they had identified the type of controls that were necessary for construction permit issuance.

Next slide. One of the key items in looking at it, it was clear it needed to be identified

that this, indeed, is quite different from a nuclear power plant. So in looking at the liquid and chemical characteristics, the ability to process those and result in a solid waste product recognized that difference.

There was a response to an RAI addressed in 9.7 where we did have issues and concerns related to the processing capability and the storage capacities to ensure suitable products. And in response to that, the response adequately addressed the ability to batch control processes, providing for suitable storage, holdup, and then the administrative controls to ensure the types of analysis to confirm a suitable waste product for disposal, transportation and disposal. And, again, the design of the packaging and storage and the handling will be done at the FSAR stage.

Next slide. We've talked about that there will be and there are no anticipated liquid waste. All the liquid waste will be volume reduced and solidified. The gaseous wastes are addressed previously, and, from this, we concluded that they had identified the type of packaging, processing and packaging requirements necessary, the management oversights to ensure a suitable product to comply with

the 20.2006 for transportation and disposal.

Next slide. So in conclusion, the staff finding was that the level of detail provided was adequate in terms of a management program from an overview perspective to determine, indeed, the adequate controls that were needed for the appropriate processing and packaging for transportation and disposal and, as identified, is the implementation of this program, management upper-level programs identification, the procedures and implementation, the integration of the actual design of the systems will be done at the FSAR stage.

Mike?

MR. BALAZIK: This is Mike Balazik. I'll just go through the evaluation and some conclusions that, based on the information during the review of the PSAR, the staff made the following conclusions on issuance of construction permit with 50.34, 50.35, 50.40, and, in this case, 10 CFR Part 20 that Northwest has described the proposed facility design for radiation protection and waste management, including the principal architecture engineering criteria for design, and has identified major features and components incorporated for the protection of health

and safety of the public, and that further technical information required to complete the safety analysis can be considered in the FSAR and that there's reasonable assurance that the facility can be constructed and operated without undue risk to the health and safety of the public.

That ends the staff's presentation. Are there any questions?

MEMBER KIRCHNER: Do you, Mike, do you do independent, like, audit calculations on shielding? Where I'm going with this is they've laid out a nice program for ALARA. Have you looked at whether the first order is achievable with the shielding design that they had and the occupancy since number of batches, number of man hours or lady hours at the, you know, operating outside the hot cell and such to see that that goal that they've set is achievable?

MR. BALAZIK: I guess I'm not exactly understanding what you're asking.

MEMBER KIRCHNER: Did you look, did you have any of your subject matter experts look at the shielding? The first order, it looks like sufficient shielding. It's comparable to other facilities that I've seen, but I'm just curious whether you, through

the course of your review, look at that.

MR. BALAZIK: Well, I think we, for criticality, we looked at that for criticality.

MEMBER KIRCHNER: Yes, I checked my notes. You had someone looking at criticality. But I didn't find anything in my notes of independent, like, audit calculation of shielding.

MR. BALAZIK: Yes. I can't say that we did, no.

MEMBER KIRCHNER: Thank you.

CHAIR CHU: Any more questions? If not, we'll go on to Chapter 12, conduct of operations.

MS. HAASS: So I'm just going to do a little bit here, and then I'll let Steve take over. And if I can't hear, he can yell at me or something.

But I know Steve probably didn't talk too much about our overall organization. This org chart shows up several places, so I just wanted to kind of do a general overview. But the facility operations reports up through the chief operating officer, and we've got four primary managers: the engineering manager, QA manager, construction, and startup. Oh, I'm sorry. We actually have six because I can't even read my own org chart. I apologize. Then we also have

the plant manager for operations and then an independent safety, health, and licensing manager.

And underneath the plant manager, the safety, health, licensing manager are probably the most significant things that we're talking about today. Under the plant manager, that's where we have the operations manager, we have waste management, procedures and training, material control and accountability, and maintenance. And all of those, each of those people, their roles and responsibilities have been defined at a top level, and you've seen that.

Under the safety, health, and licensing, you know, we've got safety, security, and emergency preparedness, the nuclear criticality, licensing and compliance, and then rad protection. And as you see here, the rad protection manager does have a direct line to the COO. And the other main item here is that the QA manager does have a direct line to the COO. And one thing that's not here, it doesn't show a dotted line, the QA manager can actually go up a level, as well, to the president and COO or to the board if they need to.

The other item we have is the chief financial officer which has general counsel finance

human resources that reports both to the COO and to the CEO. But, obviously, the financial part, from an audit perspective, reports directly to the CEO.

So I just kind of wanted to give you a brief overview of the organizational aspect of our company. Do remember that I believe that this is going to change a little during the process of design and construction. You know, it's our first shot of this. A lot of us have experience in developing organizations, but they have to mature based upon the people who are in it and what areas of expertise people have. But I think, generally, this is how it will work.

So I'm going to hand it over to Steve.

MR. REESE: Thank you. So outside of this org chart is this concept of having a review and audit committee, which is a pretty important committee, certainly in my world. So, essentially -- I don't know if you folks are familiar with this kind of committee, but, essentially, this committee serves as a group of people who have technical expertise to review details of the facility. So things that are reviewed by this committee, you know, proposed change of equipment tests, experiments, new procedures, new experiments, proposed changes to tech specs or operating license,

violation of tech specs or any of the reporting requirements thereof, facility modifications under 50.59, radiation protection program, operating abnormalities have safety significance, reportable occurrence, audit reports.

So this is a safety committee that we would make sure that when we write the charter, while it may have people on the staff on this committee, they certainly can't be in a position to outvote the outside membership because that's the point of the review. So those kinds of quorum rules will have to be established in procedure.

But the idea is that these are sort of the eyes and ears of the NRC when the NRC isn't there, to be honest with you. So they would meet on a certain frequency basis, review these things, and also audit, you can see down here, audit facility operations. So they're looking at the routine stuff, not the least of which was emergency preparedness and also, to a limited extent, probably security as well.

But it's a pretty important committee. We take it very, very seriously. Certainly, in the research and test reactor community, it's one of the most important things that you can have and need to

really honor. So it's appreciated.

Other activities. Obviously, we'll have procedures. You know, we're required by regulation to have certain operating procedures, and they'll be reviewed in a timely manner. We'll have required actions, so, in the occurrence of a reportable event, most likely these will show up in the tech specs. Tech specs will also require reports to be submitted usually on an annual basis, and the tech specs will also describe what records need to be kept, in addition to that which already exist in regulation.

Emergency planning I'm going to talk about in the next slide deck, so we'll skip that. Security planning. So we have drafted a physical security plan. It's missing all of the sensitive parts, but we do have a draft together and we know how to bootstrap our way up to an effective security program.

Quality assurance. We're going to discuss that later in the slide desk. This section also addresses operator training re-qualification, so those kinds of procedures will be provided in the operating license application.

The way 15.37 is written, it's really oriented towards, when we talk about operator training

re-qualification, reactor operator training re-qualification, so we're not operating a reactor but certainly hot cell technicians will require training and qualification amongst several things. But that's what that was trying to address.

We'll have a startup plan. So what is it going to look like when we start up the facility and what are the expected, you know, we'll have things like expected dose rates, you know, flag points to say if you hit this limit we need to stop and think about it, and, in the end, we'll have to produce a report to the NRC that summarizes all that we saw during the startup.

And, of course, there's the material control and accountability program. We have a draft version of that. The details on this are not there yet, but we do have a draft program written up, and that will be provided in the --

MEMBER BLEY: Just in kind of an aside, something you might think about, I know internationally at least one processing and re-processing facility joined WANO. I don't know if that's possible here with INPO. They were pessimistic about it, but, after doing it and going out and visiting other places, they found a lot of the things that were going on in reactors were

helpful to them on their site. I don't know if you participate in anything like that but just mentioning it.

MR. REESE: Well, I'm from the research and test reactor world, and we have sort of an equivalent to that. Certainly not -- well, maybe I should take that back. Not as formal as WANO. But there are a handful of these kinds of facilities around the planet that now do things a little bit differently and they're all a little bit secretive on the proprietary stuff. Everybody has got their sort of special sauce. But there is, I've seen some cooperation between these entities. When we get to the numbers, they get a little -- understandably. It's a business. They get a little bit hesitant.

So we would certainly welcome that, but there isn't sort of an equivalent for this kind of facility.

MEMBER KIRCHNER: Steve, something equivalent, say, I'm not proposing it be this qualification, but an SRO-like function in the staffing? So let me tell you where I'm going with this. So the blank hits the fan, come up with any complicated scenario you would like, who's the person on the staff

on shift who really knows the way the systems interact with each other? Who would be the person who would say, okay, let's isolate the HVAC, it didn't isolate, let's manually do it, whatever? Do you see where I'm going with this? Scenarios where you have fire in part of the facility, someone who has the wherewithal and the knowledge about how these things interact and then -- is that plant manager or --

MR. REESE: Well, it's going to be a team of people. It's going to be the engineering manager, the plant manager, and the operations manager that are going to have to work together to solve those things. So you get to the emergency plan, which is the next slide deck, we have this title that's called emergency coordinator, but that's, more or less, coordinating the first responders. That's when you've got to call for help. But you're talking about a scenario inside the facility --

MEMBER KIRCHNER: I'm talking about somebody on-site who really has the, you know, the training, the background, the perspective of how all these things interact. So that's the plant manager?

MS. HAASS: Yes, it will be the plant manager, but they'll also be doing integration, you

know, with the ESH and the licensing manager and quality assurance and all of that. But if something occurred, the plant manager is the one that has the majority of the knowledge with input from everyone else. And, obviously, if the plant manager is not there, he's always going to have his designee.

MEMBER KIRCHNER: So there will always be someone --

MS. HAASS: That's correct.

MEMBER KIRCHNER: -- 24/7 on-site who has that broader perspective than, say, just a technician who you trained to do one step or function at a hot cell or --

MS. HAASS: They can't -- technicians can't be the only people there that only know their little bitty part. You're always going to have supervisors, and then you're always going to have that supervisor's manager and, depending on how you set it up, I'm not quite sure how many layers will be between the plant manager and the actual technician, but there has to be someone who's overall in charge of the facility and has the knowledge of that facility.

MEMBER KIRCHNER: Thank you.

MR. REESE: Any other questions on that?

I went through really quickly. So the next thing I'm just going to talk about was the emergency response plan. So we have drafted up what we think the first draft of the emergency response panel looks like and attached it as Appendix A to Chapter 12.

So, essentially, it follows ANSI 15.16, which is emergency planning for research reactors. There's other guidance out there that informed our program. Obviously, 15.37, Reg Guide 2.6, emergency planning for research and test reactors, basically endorses 15.16 with a couple of extra, with some emphasis on certain areas, so they're actually not altogether that different.

And then we also certainly looked at the standard review plan that the NRC uses to review emergency plans, and there's this Information Notice 17-34. The reason why that's important is because that essentially established what the emergency action levels are for research and test reactors. And I'll show you what those look like a little bit later.

So the outline, you can see these are essentially the chapter headings. So introduction, definitions, organization, emergency class systems, emergency action levels, planning zones, response,

equipment of facilities, and maintenance.

So when we look at the organizational responsibilities, I guess what I want to draw you down to or draw your attention to is the way we wrote the plan is that we established these emergency positions, and each of these emergency positions have certain responsibilities, probably best described in this flowchart which shows the relationship between the facility, local, first responders, county first responders, state and federal assets.

So the emergency coordinator is essentially the person who is responsible for interfacing with the first responders in conjunction with the radiation safety officer, who is working with fire and ambulance services, hospital services. We would establish something called a radiological assessment team, which is essentially people in the facility who understand, certainly understand radiological risk and are trained radiation workers. And the emergency director essentially is trying to keep the media and the higher-level reporting requirements out of the hair of the emergency coordinator. This is essentially how it was set up.

So back to the information notice. This

is what comes out of that information notice. So we've defined -- this is our proposed emergency classification system. We're going to have personal operational emergencies that fall below the level which the NRC's, the reporting requirements for NRC. But it's things that we need to be cognizant of and may affect facility operations.

And then we're following the standard nomenclature for power reactors even. So the first level is notice unusual events, except for you'll see that actual projected radiological evidence of concentrations resulting in an unrestricted area total TEDE of 15 millirem accumulated in 24 hours. So this and for the alert, you'll see there's effluent emergency action levels, and those come out of that information notice that I pointed out earlier.

We don't have enough inventory and we can't release an emergency shown in Chapter 13 to reach the criteria in that information notice for site area emergency or general emergency. We just simply can't get to the doses. And you'll notice that these doses are a lot lower than what the power reactor guidance is.

Emergency response broken down by class

of emergency. It essentially identifies corrective actions, protective actions, you know, how you assess it, emergency dose limits, access control, dosimetry, how that's controlled. Did we duplicate a slide? Oh, he went backwards.

Okay. Maintaining emergency preparedness. So, certainly, all the facility personnel, initial and annual training will have to happen. All the medical folks at the hospital, the fire department, the police department, we can all expect initial and annual training. We'll have annual emergency drills that will require on a biennial basis participation with one of these first responding agencies. We'll be reviewing the plan annually, and we'll have a maintenance and surveillance program associated with that equipment, so inventories, inspection of emergency equipment, and operability of emergency equipment.

So in conclusion, we've got a draft plan. We think it's consistent with applicable guidance. There are some details not included, specifically you'll see in brackets TBD. It mostly has to do with specifics on instrumentation.

Regarding our interaction with -- this

generated a couple of RAIs and perhaps a staff will talk about this, but there was a lot of curiosity on the part of the staff about how much interaction we actually had with these organizations. So I can tell you that we don't have MOUs established with any of these organizations yet. We thought it was very, very premature. But we have had initial discussions with them. Certainly, the emergency management group, the fire and ambulance, and police to a limited extent. I've been sort of holding off on the police a little bit, but the others we've had very initial conversations, very good conversations, especially when I said the emergency plan should look almost, well, nearly identical to what MURR has. So as soon as I say that, they sort of know how to wrap their head around it. Now, there's obvious specific differences between our facility and MURR, but, you know, those are the details that need to be worked out later.

So initial conversations have gone really well when we essentially left it. When things mature, we'll come out and give some presentations to folks and postulate some response procedures on their part. But, essentially, what we're going to do is we're going to take the response procedures from MURR as a starting

point and modify them to meet our needs, as well.

MEMBER STETKAR: Steve, can you go back to your slide number 10? Okay. Kind of following up on Walt's question.

MR. REESE: Sure.

MEMBER STETKAR: So you're going to have a person called a shift supervisor who reports to an operations manager and facility operators report to the shift supervisor, so the shift supervisor seems to be a focal point. Where on this picture does the shift supervisor live?

MR. REESE: They don't necessarily show up on, they may not specifically show up on this chart.

MEMBER STETKAR: Okay.

MR. REESE: How it happens is each one of those emergency positions, these here, procedurally, we're going to establish -- these are by position, not by individual. So by procedure, we'll have people that will plug into these positions, so it may be the shift supervisor could be emergency coordinator.

MEMBER STETKAR: Well, the reason I ask this is we had an event called Fukushima, and we've had questions for power reactor licensees since Fukushima in terms of, given the fact that something

bad happens right now in the plant, like a fire starts, is there clear direction of who has the responsibility at that instant? I'm not talking about picking up the phone and talking to some sort of large organization who may or may not be home at the time. I'm talking about who has the ball at that point, and it's really important because, you know, depending on speed at which an event occurs, there needs to be clarity that everyone knows who's in charge without any uncertainty. And that's why I asked my question, and you didn't answer it the way I was hoping you would answer it, which was the emergency director is the shift supervisor or the shift supervisor is the emergency director until relieved. But I didn't hear that, which means you may not have thought about that.

MR. REESE: Well, in the plan we actually identify the first, second, third options for each one of these positions. And if you look in there, the shift supervisor does show up in the --

MEMBER STETKAR: Okay. I have not looked at the plans.

MR. REESE: The other thing is, to your other point, which is well taken, this is all after an emergency is declared. So in the plant, it actually

specifies who has the authority to declare an emergency.

MEMBER STETKAR: Okay. Thank you.

MEMBER REMPE: So earlier today you heard Dr. Powers mention about this is a different type of facility with different challenges for firefighting. In your initial discussions with the fire department, you said, well, the emergency plan is going to be just like the MURR and everybody is happy. Have you talked to --

MR. REESE: Similar.

MEMBER REMPE: Well, similar to it. Have you talked to the fire department and said, well, it could be a little different than how you're going to have to fight the fires if we have one here?

MR. REESE: I haven't gone into details, but I have verbally told them that. I said we're not identical because we're not a reactor. But the fact is MURR does have a lot of radio -- well, I shouldn't speak for MURR. There's potential at MURR for there to be significant quantities of radioactive materials as a part of research in addition to just the fuel. So --

MEMBER REMPE: Uranium metal is one of the things --

MR. REESE: Yes, but we're going to have much larger quantities of that in particular, and we will admittedly have much larger quantities of byproduct material. Their byproduct material is still wrapped up in their fuel.

MEMBER REMPE: Right.

MR. REESE: So it will be different, we know that. But how they need to, the specifics on what they do once they reach the facility, we'll have to work with them on that. They understand that they're going to be working with radioactive materials. They understand the obligations and the needs to create an MOU and actually respond to the facility. Those kinds of things I think are well socialized with them, but we haven't gotten down to the point, because we think it's a little early, on exactly procedures set up to what they do once they show up to the facility. And that's helping them write procedures for their response.

MEMBER REMPE: Okay. And I think Dana's point is you don't have to figure it out now. With the staff, he was trying to push them is how do I know you thought of it and he wants it in their draft SE, but also I heard earlier today you're going to be

identifying more issues in your submittal as you revise it. And so somewhere in the text it will say we realize that there's different challenges here, and we'll be working with the fire department to train and have them appropriately deal with such challenges.

MR. REESE: I don't think it exactly says that.

MEMBER REMPE: But it might be worthwhile to --

MR. REESE: Yes.

MEMBER REMPE: -- acknowledge those kind of things.

MR. REESE: No argument, no argument.

MEMBER REMPE: Okay. Thanks.

MEMBER SKILLMAN: If I understand the term correctly, when I asked the fire protection engineer from the staff if they were going to review the pre-plan and she said yes, my background would tell me the pre-plan for this facility will identify clearly that it's uranium, it's metal, and what the firefighting technique will be for that specific type of fire, at least that is the experience I've had. So it's in the pre-plan, and the NRC will review that pre-plan. So I think that's the answer to the question. It's in

the pre-plan.

MR. REESE: Yes, I agree. It's also good to find out not only for that specific scenario but also where other, you know, the fuel-loading is for fires and conflagrations.

MEMBER SUNSERI: So this may be a follow-up to John's question. I didn't miss the first part. But I'm looking at the line of succession of some of these positions you have, and I notice that some of them are, like the chief operating officer has multiple roles and --

MR. REESE: Potentially.

MEMBER SUNSERI: Yes. And so how are you going to deal with that? Usually, you don't assign multiple roles to the key people.

MR. REESE: Well, what we like to do is usually, in the research and test reactor world, you find that the staff levels, you can run into that. And, you know, the staff of this facility is not going to be something commiserate with a power reactor by any stretch of the imagination.

So what you'll notice on there is people that need to make decisions may be the second option on one role or the third option on another. And the

idea was to create the situation where you could fill those slots if somebody wasn't present without having overlapping responsibilities. However, it is implied in the plan that you could have a situation if one person wasn't there or, for whatever reason, were unavailable, you could run into a situation where one person has multiple responsibilities.

MS. HAASS: But, remember, the COO is the level one manager, and then you get down to, you know, the engineering manager, QA, and plant manager, safety and health, construction, and what was the other one? Startup. They're all level two managers. I mean, ultimately, the COO has to make the decision.

MEMBER KIRCHNER: More likely than not, you'll probably be here in Washington talking to the NRC when something happens, so that doesn't sound right to me.

MR. REESE: But that's why you have multiple people --

MS. HAASS: You do have to have one decision-maker, and that's where you're going. But the plant manager runs, you know, has to run that site. They're going to be the knowledgeable one, and you're always going to have some type of succession planning,

no disagreement. We haven't gotten to that level yet, though. I have to be honest with you. I mean, we understand what our methodology for conduct of offices, but we have not gone into the full succession planning and those types of things.

MEMBER SUNSERI: Yes. Well, I mean, my point is just take a look at it because, I mean, if I'm just looking at the parameters here, if the plant manager is not available for whatever reason, then the COO fills in as the emergency director, but the COO is also the backup for the chief executive officer for public information, which how often is your COO going to be right there --

MS. HAASS: See, I look at it a little differently. The plant manager is going to have a designee if he's not there because you always want someone 24/7. Someone has got to be that plant manager. It's going to be the primary one and then there's going to be someone else, and someone will always be there for that. I don't see the COO becoming the plant manager. I don't read it that way.

MEMBER SKILLMAN: I would like to weigh in on this. I had comments very similar to Matt's and to Walt's, but I'd like to offer a little different

take. As I read it, it appeared to me that there could be a contest between the plant manager and your safety, health, and licensing manager for decision-making. So my thought is this --

MR. REESE: How so?

MEMBER SKILLMAN: The way the text is written, it appears that both individuals have a say in what's going on radiologically, and there needs to be a trumping decision.

MS. HAASS: And you're saying because of the waste management role and the rad protection role.

MEMBER SKILLMAN: That's correct. And I would go further. I saw an organization identical to this after TMI-2, and it took months to sort it out. And the reason was because of personalities and because of the way the text was written for the positions. And what finally sorted it out was the plant manager had the last say, period. Now, how that plant manager implemented that role was critical in getting the right people in the right place and individuals that were qualified to do that work.

But I would at least offer a thought. Within the INPO E&A, and, Steve, I think you probably know what that is, the evaluation, there is an

organizational effectiveness module, and there are individuals that are really good at organizational effectiveness.

MS. HAASS: Agree.

MEMBER SKILLMAN: And NWMI might want to ask could we have an audit of our proposed organization by the OE team, just the OE team, and they can flesh this out in a manner of hours because of a huge amount of experience in terms of who's the right level to make the decision for these types of events. And they're identical events. They're radiological, they are health and safety, a fall, dropping a cask, having a crane get loose. Those types of things that are very real in a facility very similar to this, whether it's producing electricity or producing a chemical product. And it could be that for a couple of hours of a visit or a day or two, some of the types of things that we are asking gets sorted out very quickly, including Matt's question: who is really the decision-maker? It can't be a financial person --

MS. HAASS: Agree.

MEMBER SKILLMAN: And it can't be an admin person. It has to be a line organization, engineering or rad con person, and the organization has to say we

anoint this person as the decision-maker.

Let me make one more comment. Whoever the decision-maker in the plant cannot be the decision-maker for your emergency planning because when you do get into that casualty you've got someone who's got to keep eyes on the facility and, if you've worked your way from an unusual event to an alert to where you're communicating with off-site for whatever the radiological emergency is, that individual has to be independent from the facility but communicating with the facility. Otherwise, both portions of the organization get diminished. I was --

MS. HAASS: No. Actually, we appreciate that input, and I like your suggestion.

MEMBER SKILLMAN: And those OE people are very good. They're trained in human factors. They know what the plants are supposed to look like, but they also know how testy the emergency preparedness interface can come with the local media and the local politics.

MS. HAASS: Agree.

MEMBER SKILLMAN: Thanks.

MS. HAASS: Thank you.

MEMBER SUNSERI: So I think Dick has some

good points I would just add to. I think once you start exercising this organization through some drills and exercises, you're going to see that some of these things are going to be unworkable and then you're going to probably, my guess is going to go from a position assigned to an individual, assigned with a training and qualification for emergency director is this and here are the three people that we designate for that and what have you because I think you'll find when the plant manager is absent, whoever that person assigns as their alternate, may not be trained and qualified for the emergency response role, as well. So just final comment. Thanks.

MS. HAASS: Well, also, I think when you start getting into personalities and you're dealing with everyone else, you know, the city, the county, the fire department, police, I think you're also, that's going to kind of shape you, as well, based on who is going to be that best person for that because it is a personality-driven type thing, technical as well but it's got to have the right personality.

MR. REESE: Any other questions? How are we doing on time? How far behind is the better question? Okay. Continuing on, talking about quality

assurance -- yes, sir?

MEMBER SUNSERI: One more question. As far as the facility goes, and I noticed that the control room is the designated emergency support center, is that going to be appropriate under a radiological scenario? I mean, is there an alternate place where people can go to direct the emergency if the place starts to become uninhabitable?

MR. REESE: In the plan, we don't identify an alternate emergency operations center. That's well taken, actually.

MEMBER STETKAR: Even start a fire in the control room.

MR. REESE: Yes, exactly.

MEMBER STETKAR: Forget the radiological emergency.

MR. REESE: That is actually not there. Yes, yes. Homework.

MR. DUNFORD: I just wanted to address an issue that came up in discussion between inconsistencies between Chapter 9 and 3. Joy, you indicated that was that a QA issue, a quality assurance, a design requirements issue, and I just wanted to address that. I know you asked that of the NRC staff.

But the underlying thing, rationale for what happened there was two different authors not talking to each other. Not the engineers. Neither one of -- the Chapter 9 author was not an engineer, so when he got to the reading 15.37, and he said, oh, I have to put some design requirements here, he wrote what he thought were those design requirements, as opposed to a Chapter 3 person went to the design requirements document and wrote those there. So there were some differences, and it just then all kept -- there were some inconsistencies that necessarily weren't material. So in one case there may have been a requirement in one and not in the other. And in some cases they were duplicate or an extra requirement that wasn't necessarily a design requirement, it was an operational requirement. So we took care of that by taking those extraneous design requirements out of six and moving them into one location and ensuring that they were complete for what the needs were at that --

MEMBER REMPE: I do understand that because I did read that that was what was done. But the question I was trying to get to was what was the underlying root cause for it and has it been addressed? Because, believe it or not, that's happened with a

Part 52 application where somebody changed a thing in one part of the design, and then they noticed it when another plant was coming in to try and build it. And so it doesn't just happen with Part 50 construction permit applications, and so, again, the QA program ought to have a way to make sure that if somebody does something with one part of the design, it gets appropriately transmitted to all parts of the designs that are effective is what the point was in the question.

MR. DUNFORD: But what I was trying to say was there wasn't a design change in either case. It was just an author writing something --

MEMBER REMPE: I understand that, yes. What I read, though, was that, again, it came from the staff's review that they were different requirements and they weren't duplicates or something is omitted, that there were actually some changes. But, again, the root cause is going to be fixed and this won't happen again because, as you know, we're going to be talking later about how many targets are assumed when you do a source term. And, again, maybe it was my uncareful reading, but it seems like there ought to be a logic that's pretty easy to understand if it's geometry

related or why you didn't take the maximum number of targets when you were trying to do the source term. Okay.

MR. DUNFORD: We did, but it may not be obvious.

MEMBER REMPE: Okay. Or I'm just a poor reader. I'm willing to admit that.

MEMBER SKILLMAN: Before we jump over to QA, I'd like to ask another question, please. Steve, you mentioned that there cannot be a site area emergency or a general emergency, because you can't get a source term high enough to get to those glasses.

MR. REESE: Perhaps I misspoke. It's not necessarily the source term, but it's the doses to the general public.

MEMBER SKILLMAN: Okay, excuse me, you did say doses.

MR. REESE: Okay.

MEMBER SKILLMAN: Here's my question: normally you get to a SAE or a GE through your EALs.

MR. REESE: Right.

MEMBER SKILLMAN: Only if your EALs are written the way you have described the trigger can you conclude that there cannot be a site area emergency

or a general emergency.

MR. REESE: That's correct.

MEMBER SKILLMAN: It depends on how your EAL is written.

MR. REESE: That's correct.

MEMBER SKILLMAN: So, here's my question: supposing you have a major traffic accident involving one of your casks, right on the threshold of your property line, right at the intersection of your NWMI and your brand new road that's going north next to NWMI.

MR. REESE: Un huh.

MEMBER SKILLMAN: If your EAL for site or general ignores something like that, then I would suggest that your comment, Because you can't dose the public, you cannot be in an SAE is accurate.

MR. REESE: Well --

MEMBER SKILLMAN: But if your EAL is written in a way that suggests that there's a threat, in other words, not a confirmed release but a threat of a release, you could conceivably be in a site area emergency for a casualty of some sort.

MR. REESE: True.

MEMBER SKILLMAN: It depends on how your EAL is written. So I'm at 84.4 of your Chapter 12,

where you say we can't have a site area emergency in the next paragraph because you can't a general. It all depends on how your EALs are written.

MR. REESE: That's true. So the logic behind that is that if, in our worst case accident, we can't reach those EALs that are defined for us in that information notice, then we, it's not possible to get to those levels.

Now, you talk about a cask overturning on the road, that's a little bit different, because that follows a different emergency plan associated with transportation. And security plan probably.

MEMBER SKILLMAN: What happens if it's on your property? Again, I'm way off in left field. I understand. All I'm trying to say is your statement is accurate as long as your EAL is written consistent with what you just said. But if your EAL is more vague, you may in fact have a circumstance where you can be in site.

MR. REESE: They're pretty specific.

MEMBER SKILLMAN: Okay. I'll stop, thank you.

MR. REESE: All right, quality assurance. So we have a quality assurance program plan. What

it, it essentially follows ANSI-15.8, quality assurance program requirements for research reactors. We have provided this to the staff and they've reviewed it. As a matter of fact, it was one of the very first documents they asked from us.

And it basically follows 15.8. If you'll notice, the QA manager is located here, with the idea that they can bypass all of the other operational and emergency response, and frankly any other input, and get right to the chief operating officers. So the idea is that this person reports directly to the chief operating officer.

This is how it's broken out with the, sorry, the sectional references and the areas of focus. So we talked about assurance or, excuse me, quality assurance program; design control; document control; procedures, instructions, drawings, how we documents those and maintain those.

Document control, excuse me. Procurement document control, excuse me. And normal document control identified control items, so on, so forth, etc.

So what we've tried to is identify all of these things. And please remember that we are not only thinking about operationally how this plan needs to

work with us, but we're also think about this in terms of during construction.

So we're implementing the plan now, and we are highly cognizant that we need to, and I'll talk about this a little bit later, need to use this during the construction phase.

MEMBER SUNSERI: I had a question about it. In your actual submittal, you have three tables that are very like that one for 50.34, which references Appendix B, which is the detailed list of the requirements. 70.64, which just basically says, You'll show how quality assurance requirements for IROFS, basically. And it points to Appendix B, because I guess you're two different facilities, right?

So that eliminates some of the confusion in my mind. But then there's the third table about ISO9001, so what's the relevance of that and why'd you bring that in and complicate it even more?

MS. HAASS: Well, and that has to do with GMP and moly production and sending --

MEMBER SUNSERI: I was wondering if it had to do with the medical side.

MS. HAASS: We may have, oh sorry.

MEMBER SUNSERI: It's on the product side.

MS. HAASS: Yeah, it's on the product side of the house. Maybe one of the things we should do from this perspective is, you know, maybe eliminate that table and eliminate that confusion. We do have to deal with it, though. And it's only there for completeness.

MEMBER SUNSERI: Okay, I understand that then, and that's, because I got it with the 10 CFR50 and the 70 and how that blended together, okay. Thank you.

MS. HAASS: Yeah, and we probably just didn't explain that very well. I apologize for that.

MR. REESE: So specifically with respect to during construction phase, here are some concepts: reviewing and approving implementation procedures; reviewing and approving supplier QA programs, so ensuring that suppliers have an appropriate level of QA associated with their programs; providing oversight of supplier QA programs, so that means doing audits, inspections; performing, oh, reviewing, technical reviews, procurement documents; maintaining approved suppliers list; administrative corrective action non-conformance process; monitor implementation of the program and assessing its effectiveness through audits

and surveillance and reviews; investigating any aspect of the program with its execution; stopping unsatisfactory worker control and further processing when warranted for safety considerations.

All of these things. Attending status meetings,; inform day-to-day activities; ensure adequate oversight of activities affected by the plan, design activities obviously; quality effective procurement activities; fabrication activities. The list, I could go on.

So, one of the things that we have chosen to do is have a graded approach, and I'm going to be talking about that, I believe, in the next, yes, in the next couple of slides. So, and this has come up in conversation previously, so this is where we divide things out in QA 1, QA 3, QA 3 levels.

The idea is that we want to have a QA level that is commensurate with the security or safety of the facility, and how that intertwines with, you know, just due diligence on the part of running a company. We've divided, we've already talked about what safety-related is in previous conversations.

Just as a reminder, we have these three areas. We have safety-related IROFS, we have

safety-related non-IROFS, and non-safety related entirely. So just in summary, the safety-related IROFS are there to meet Part 70 requirements. And then there's a gap between the Part 70 and 10 CFR 20, so we try to capture that with safety-related non-IROFS.

Clearly, there are things that are important to safety that don't show up in the Part 70 space. So we know we're going to have safety-related non-IROFS, that's what we're calling them for lack of a better way of describing them.

And then everything else, so things that aren't safety-related, have their own quality assurance level just based on due diligence of a company.

So the QA 1 basically captures the safety-related IROF group. So these are the things, the designs items to prevent criticality accidents is an example. Items accredited to withstand credible design-basis external events, item to prevent degradation of structural integrity.

All of these things are basically Part 70 space, so we need to make sure that the IROFS that show up are treated at the highest quality level.

However, in addition to that, because we do need to meet other regulatory obligations, probably

the most important of which is 10 CFR 20, we recognize those are safety-related, but they don't show up as IROFS in the Part 70 definition of an IROF, so that's why they're called safety-related non-IROFS. And we call that quality level 2.

Examples of this are fire protection safeguards and security material control and accountability are examples. And then finally quality level 3 is the business or the non-safety related activities that we would do in the facility.

We also very much believe, and we've had discussion on this, on stop-work authority. Now it's recognized that, you know, and this really comes about training.

People have to have an understanding that it's an appropriate situation to have, to declare stop work. But the idea is that if work doesn't immediately stop, we can put things in such a condition that we can safely, or render the system safe and pause and discuss the issue at hand. That's really what's meant by the third bullet.

And then --

MEMBER SUNSERI: I think it would be important there just to, I mean, yeah, the quality

assurance folks need to have an explicit responsibility for stopping work. And just to say everybody has it, I get it. But make sure you don't dilute the authority of the quality people by that broad statement.

MR. REESE: No, absolutely not.

MEMBER SUNSERI: Okay, thanks.

MR. REESE: Design control. So this turns out to be fairly important, as we've discussed previously, right. And especially going forward because, and we've had a lot of discussions, actually, with the organization that will likely be responsible for constructing the facility.

So one of the things that we spent a lot of time talking with them about is what happens if during the building, a pipe just won't work and you've got to make a change. How does that change system, how does that capture and how does that information get passed on from the construction side of the house to our side of the house?

And so we've spent a lot of time talking about how that interface is going to look like. We're pretty, as an example, we're pretty happy with their quality of procedures associated with those change and how that's get documented, how that gets transmitted,

passed on, and reflected in what ultimately would be at some point a committee would get together and decide via a 50.59 process whether it's affecting your facility as described. The activity, I should say, not the change.

MEMBER SKILLMAN: Steve, let me ask this.

MR. REESE: Yes, sir.

MEMBER SKILLMAN: So, you have this incident that you're speaking about. You can't implement the design as the drawings --

MR. REESE: It just doesn't work, it won't work right.

MEMBER SKILLMAN: And so you do convene this tribe and they say, It's not a 50.59, we're not, we really haven't buggered up our design basis. But still you changed the configuration.

MR. REESE: Yes.

MEMBER SKILLMAN: What you really have is not so much a 50.59 issue against your license, you have a configuration control issue that you need to make sure is about as tight as it can be.

MR. REESE: And we've talked to the organization, I'm trying not to say their name. But we've talked to the organization how that happens.

And yes, you're absolutely right.

The other thing that's odd about this is that, you know, a couple of us had a lot experience with 50.59 process and know how that works. We don't have a license, we're kind of outside 50.59 space because there's no operating because this is happening in the construction phase.

So what we envision is this design control and this change control process will essentially mimic 50.59. You know, if we get to the point where it screens in and we do an evaluation and we realize, no, this does change licensing basis.

You know, we've talked to the staff about what does that look like, because we're not really, we don't have a license amendment because there's no license yet, right.

But it does probably look like an amendment to the construction application or something along those lines. So they've been very reasonable about working out the details on that, because the regs are kind of silent in this, at least for our situation in this space.

So that's, I mean, design control and changes to the facility, well, mostly changes to

facilities is where people tend to get themselves in trouble. So we recognize that it's a really important facet of this and we need to be on top of it.

MEMBER SKILLMAN: Do you have that same metal orientation regarding changes to computer programs that have been used, either to design or analyze the facility?

MR. REESE: Yes, absolutely, yup. So, and that, you know, one of, that gets -- all right. The answer's yes.

MEMBER SKILLMAN: Thank you.

MEMBER REMPE: One last question. All of this is in future tense, and aren't you --

MR. REESE: We're doing it now.

MEMBER REMPE: Now, so this could be that processes implemented are being done this way is the right way of talking about it.

MR. REESE: This is our plan, yes.

MEMBER REMPE: You have adopted whatever your QA plan is.

MR. REESE: That's correct.

MEMBER REMPE: And as you've seen that it's got adequate in certain areas, you've improved it as needed is the last question.

MR. REESE: Yeah.

MEMBER REMPE: Thanks, okay.

MS. HAASS: So just to let you know, you know, we have detailed procedures in each of these areas already written up. And we are implementing the ones that are associated with design. Obviously, not all of these are associated with design.

That's why we're kind of doing some highlights here, we didn't want to go through all 19 areas. And Margaret would probably get upset with us if we did because we don't have enough time. But we really wanted you to know design control, document control, those types of things are very, very important to us right now.

MR. REESE: So like as an example on document control, if we have a calculation, this has happened a couple times. Gary can speak to this, because it's usually his group that's most involved with calculation.

But you know, sometimes there are things that cause that calculation to change as the concepts mature. And so their calculation rev X, Y, and Z, I'm just making it up, and those things are tracked so we can specifically identify what changes were made and

why those changes were made.

MEMBER REMPE: Thank you.

MR. REESE: Yup.

MEMBER KIRCHNER: In general, how are you handling design verification?

MR. DUNFORD: I'll take that pause as mine. Okay, so we have two methods right now that we're implementing and have implemented. Peer reviews, any kind of evaluation. So we actually have a design verification procedure.

And then while we haven't thrown them on full-bore yet, Carolyn has a plan laid out for 30, 60, 90% type reviews, 60 and 90% site review processes, with an external team to come in and do a review of where we are too.

MR. REESE: Yeah, records management, I think that's obvious we have to keep everything at this point.

MEMBER SUNSERI: Hold on a second there. I noticed in the processing of the information here that it said, The records management system would be provided during the operation phase or something like that. And the staff agreed with that in their SERs.

So my question is is, you generate a bunch

of records, I mean, you just talk about records you're generating with this design control. What are you doing now to control those? And I mean, was that this slide there?

MR. REESE: We've got -- Gary, you want to talk about this? Want me to get it. We have documents that we maintain as a group, and people have certain control over the storage and location of those documents.

MEMBER SUNSERI: So I, okay.

MR. REESE: As part of --

MEMBER SUNSERI: Well, good, I'm glad for that. But how come that wasn't described then? I mean, how come you didn't describe that in your submittal? It says later, I think, or to be provided during the operating license or something.

MR. REESE: Well, I think that was not so much associated with the QA plan, but it was, was that in Chapter 12 that you're referring to or?

MEMBER SUNSERI: I don't remember where I saw it. Yeah, it had to be 12. That's what I was really looking at.

MR. REESE: Yeah, so you know, what that's really referring to is during the operational phase,

you have to have a records management system. This is to help us get through the construction phase to that operational license.

MEMBER SUNSERI: But that's all part of your quality assurance program, isn't it?

MR. REESE: It could be, yeah.

MEMBER SUNSERI: It should be. I guess I'm just curious why that was just, kind of just not being, it doesn't appear to be being controlled, and the staff seems to be totally happy with that. The construction records, in my view, are some of the more important ones that you have.

MR. DUNFORD: So if there was construction records, that would make sense that we -- that's to be, right? We don't have the construction, all the procurements, all the, you know, the submittals.

That's the system that I think we're talking, if we're talking the same spot, the future tense, where we haven't actually selected, maybe Carolyn has, the program that the operations guys are going to use for the life of the facility.

There are multiple different databases and different ways to go. With all those submittals, what are you going to put them in? Our vendor constructor

has a program. I'm not sure that you've selected that as the final program that the plant's going to operate with for 30 years. And I'm just not sure where you're.

MEMBER SUNSERI: Well, I guess where I'm going is is that you're talking about design documents right now that would become records.

MR. DUNFORD: That's correct.

MEMBER SUNSERI: You're talking about construction drawings that will become records, right. Then those will turn into travelers someday that will build something, and those will turn into records.

MR. DUNFORD: That's correct.

MEMBER SUNSERI: And then those will turn into records.

MR. DUNFORD: That's correct.

MEMBER SUNSERI: And then somebody will operate those equipments and there'll be records on that probably kept too, right. So all I'm suggesting is is the records management process has started now.

MR. DUNFORD: Yes.

MEMBER SUNSERI: And I don't see any description of how that's being controlled so that I can assure myself when we'll ask the question, What was the design verification that applied to this

calculation, we can go back and confirm that.

MS. HAASS: We agree with you. I think we need to go describe what we're doing now. Because we are maintaining, you know, we do a document control, we do do records management. And that it's not formalized like it would be during construction and operation, but yes, we do have that system in place.

MEMBER SUNSERI: Okay, thanks.

MR. REESE: So I believe, okay, so assessments, process and expectation. Implemented a the system of audits, assessments, surveillances associated with the quality assurance plan. It's going to be a continuous stream of audits processed and assessed, or audits and assessments processed through the life of the facility.

For facility operations, obviously procedures and conduct operations are going to fall under all this. Requirements will be applied to any equipment or operation that's consistent with potential safety impact program goals.

And there is a note that there are going to be some QA requirements, QA program for operations may be found in other documents. So like the technical specifications, they may show up there, they may show

up in security plan, emergency plan. And we won't duplicate those.

In the end, Northwest Medical Isotopes is committed to establishing and implementing the quality assurance plan that we're using now. That all activities and processes are planned, reviewed, controlled, verified in compliance with federal regulations and standards and contractual requirements, excuse me.

We're definitely committed to fostering a culture that provides sustained and continuous quality improvement atmosphere, and that is absolutely respected. We appreciate that the applies to all nuclear quality-related projects and activities. Certainly associated with the construction license and the final operational license.

And we're going to use the graded approach. We think that is the proper way of approaching it for our circumstances. And I believe that should be it.

MEMBER SKILLMAN: Good question. In your Appendix C, and I'm at C221.1. Under engineering manager, you describe this individual or a different individual as the chief engineer. I don't know if that's a carryover from a prior?

MS. HAASS: That's a carryover that we originally had the engineering manager as a chief engineer.

MEMBER SKILLMAN: Okay, but let me finish what I'm going to ask about. This individual, whatever their title is, is responsible for developing, reviewing, approving, and qualifying changes to the QAPP. Is it really the engineering manager, or is it a QA manager that has that responsibility?

I think earlier, you really intended it to be the QA manager, not the engineering manager. So I think you better check your document. It's C221.1, it is your Chapter 12 with appendices R1, and it's on page C-51. Thank you.

MS. HAASS: Thank you.

CHAIR CHU: Okay, we're going to take a very quick break. Everybody comes back at 3:05.

(Whereupon, the above-entitled matter went off the record at 2:53 p.m. and resumed at 3:04 p.m.)

CHAIR CHU: Okay, now we're going to continue on.

MR. BALAZIK: This is Mike Balazik, this is DAS presentation Chapter 12, conduct of operations. First thing we're going to do is step through this

chapter, and we'll also talk about QA. And then after this, Dan Barss from NSIR will go through the EP. So we'll go ahead and get started.

MS. RAMIREZ: All right, good afternoon, everybody, my name is Anna Ramirez, and I'm going to talk to you today about the data preparations. This include organization, review, and audits activities, procedures, reports records, required actions, emergency planning, security planning, quality assurance, operator training, requalification, and material control and accountability.

For the purpose of this review, which is for a construction permit application, I will focus on the areas of organization, review, and audit procedures, and the quality assurance program. The other areas are either presented by other technical staff members, or deferred to the final safety analysis report.

As you can see the regulatory requirements for this review, they're pretty similar to the rest which you have seen, with the exception of 7064, which is a requirement for new facilities or new processes at existing facilities that apply under Part 70.

Here is the acceptance criteria that I used

for the review. It was a combination of different NUREGs. The highlight will be the different one, which is the NUREG-1520, which is the standard review plan for fuel cycle facility license applications, and NUREG 2.5.

For the first section of organization, the staff performed an evaluation of Chapter 12, Section 12.1, and Appendix B. Using a combination of the guidance and acceptance criteria provided in NUREG-1537, the ISG, and NUREG-1520.

The areas of review for organization section include organizational structure, responsibility of individuals and groups, organization aspects of radiation production program. The areas regarding staffing considerations for facility operations and further details on production facility program are to be detailed in the FSAR supporting the operating license application.

The staff found this acceptable since the areas covered a number of administrative controls that will not affect the design and construction phase. These are not needed to support the construction permit.

The staff evaluated the preliminary structure of Northwest's organization and described

that the section, who had determined that Section 12.1 has the level of detail needed for the support of a construction license permit. The staff found the deferral of organization details related to staffing positions of facility operation of this section to the OL application is acceptable.

For the Section 12.2, review and audits, the staff evaluated this section include the controls, establishing the area of review, such as role and responsibilities, and the independence of audits. Specific details for audits regarding facility operation and the scope of these audits are detailed at detail defer to the FSAR supporting the operating license application.

The specific programmatic details of these sections will strictly depend on formal operations that's, were not needed. In addition, Appendix C of Northwest's quality assurance program describes the programmatic controls available applicable to review and audit regarding the construction phase, the Section C 2.18 assessment.

These section cover the design construction phase for the facility. Efficiencies identified during the audit will be entered into the

Northwest's corrective action program, which is part of their QAPP.

The staff evaluated the preliminary program that Northwest provided for review in audits and activities, as described in the PSAR Section 12.2 and Appendix C, and has determined that the level of detail provided in this section is acceptable to support a construction permit. The details deferred are also acceptable.

Section 12.3, procedures. Northwest described the requirements applicable to procedures of the facility and explained how these controls are applicable to the construction phase of the facility in their QABP, including descriptions of document control, design control, and inspection program for procedures.

Specific details regarding procedures for operation will be provided with the operating license application. These details will include administrative controls regarding operations that have not been established at a time, and the applicant's still working to provide them with the operating license application.

For this reason, the staff finds that these

details are not necessarily to support a construction permit.

The following sections that we have here, Chapter 12, they have been included in the application. However, the details of these sections have been deferred to the FSAR supporting the operating license application. The content of this section is more applicable to administrative controls of the facility and its operation and will not affect the review of the construction permit application.

However, some of the details of this section, such as records, are covered in the Northwest Medical Isotopes QAPP in Appendix C. The QAPP expanded how the controls are in place for these sections during the design and construction phase of the facility.

So Section 12.9, quality assurance. The staff performed an evaluation of the information presented in the Appendix C of Chapter 12, as supplemented by RAI responses, in order to assess the adequacy of the Northwest QAPP. The staff, they -- I'm sorry. In support of the issuance of construction permit. Using the guidance outlined in ANSI/ANS 15.8, quality assurance program requirements for research test reactor.

The standard provides criteria for a Q quality assurance in the areas of design, construction, operation, and decommissioning of research reactors, and is endorsed by the regulatory guide 2.5, quality assurance requirements for research in test reactors.

It was also deemed to provide an acceptable method for complying with the program requirements in 10 CFR 50.34.

Northwest committed to ANSI 15.8. In Appendix C, Northwest described how its QAPP will follow the ANSI standard. The staff generated several RAIs to clarify the extent of commitment to the standard and how this is reflected in the QAPP.

Northwest provided an adequate description of the quality assurance program plan, following the standard. They commit to the full standard and describe the applicability of the standard to their facility with the graded approach.

The graded approach is a process established to determine the level of analysis, documentation, and actions that are necessary to comply with specific requirements, commensurate with the safety significant of the item.

They provided a definition of

safety-related, non-safety related, and safety-related IROF and non-safety related IROF that we deem acceptable, and in accordance with performance requirements established in 70.61. The QAPP in Appendix C described in detail the quality assurance program plan and the approach and how the Northwest planned to follow this.

Keep in mind that some of these criteria overlap with the previously discussed sections, such as organization, review and audits activities, records, and procedures, but focus in the design and construction phase of the facility.

Northwest discussed in detail the description of the QAPP in accordance with standard and how it applies to the design and construction phase of the facility. Northwest stated that the QAPP would also apply to facility operations and decommissioning. However, Northwest stated that they will provide more details of these sections in the operating license application.

The staff finds that the content of these sections are not necessary to support a construction permit and have found acceptable to defer them to the OL application.

In evaluating Northwest QAPP, the staff determined additional information were needed to clarify the applicant commitment to ANSI. So I will provide some of the highlights, RAIs, and what was the purpose and why we find them acceptable.

The first RAI. The purpose of the RAI was to clarify the applicability of the QAPP to IROF since there were no mention of an initial application. Northwest stated that all IROF will fall under QL1, and the full QAPP requirements will apply to them.

The staff finds the response acceptable, since Northwest stated that the applicability of the QAPP to IROF and structure system and components in integrated level approach.

The RAI 2 was to clarify the scope of commitment regarding an ANSI standard in the design and control phase, specifically assure the specific design requirements regarding structure system and components and IROF are captured and established in the QAPP.

Northwest clarified that they are committing to the standard requirements and they modified the application to reflect this. The applicant described that controls such as qualification

testing to simulate the most adverse conditions for design and process of functional testing will be part of the control established for the QAPP.

In order to verify the design requirements for structure system and components in IROF are incorporated, evaluated, and documented and ensure requirements have been satisfied. This response seems is acceptable and consistent with the standard.

Third RAI. The intention of the RAI was to clarify if the (coughing) to capture design changes through the construction process.

The applicant confirmed that there will be controls within their QAPP to ensure that design changes are tracked and captured into original documents, which are maintained and revised to exist, quoting their words, design. Therefore, the answer deemed acceptable and consistent with the standard.

The intention of the RAI, the fourth RAI, was to, further was to clarify if there will be any type of controls in place for acceptance of software, specifically to determine that the software requests are acceptable for their function.

Northwest stated that in their QAPP will include methods to control and approve

supplier-generated documents regarding software, depending on the complexity of the product, even the input software. The answer establishes that controls will be in place, depending on the safety importance of the item. And we also apply to their suppliers.

The intention of this question was to clarify the applicant intent to follow ANSI 15 point guidance regarding type of records to be considered under their quality record section. The applicant confirmed to follow the full extent of the standard and incorporate the type of documents specified in the standard and some additional one.

Some of the records to be considered are tests, signed document, calculations. We also ask for the retention period of such records, since was not described. They clarify that they will plan to follow the standard. Suggested period of retention which is the lifetime of the item.

Relation of findings and conclusions. The operations Section 12.9, quality assurance program, and Appendix C, quality assurance program plan, is adequate for the purpose of the assurance of the construction permit.

The staff determined that the information

to be included in sections 12.9, quality assurance, and Appendix C is sufficient, and adhere to the ANSI/ANS 15.N 1995 standard to support the issuance of a construction permit.

Given that a complete description of the facility operations and decommission is not necessary to support the issuance of a construction permit, the staff found acceptable to defer these sections to more detailed evaluation in the FSAR supporting and licensing application, because the review of these sections will not affect the review of the construction permit.

In addition, any required changes to the QAPP due to the operating license application are subject to review and accepting prior to issuing of the FSAR.

In conclusion, the staff finds that the information in the Chapter 12 Conduct of Operations and Appendix C included in the Northwest PSAR is sufficient and meets the applicable regulatory standard requirements in the guidance to support the issuance of a construction permit, in accordance with 10 CFR 5034, 10 CFR 5035, 10 CFR 5040, and 10 CFR 7064.

The information is adequate for the

issuance of a construction permit, with the acknowledgment that the staff will perform a more detailed evaluation of the sections 2.4 to 2.6 regarding the conduct of operations.

FSAR supporting the OL application. These sections are more applicable to administrative control for the operating phase of the facility and will not affect the review of the construction permit application.

A complete description of the facility and the commissioning facility operations and decommissioning have been deferred to the FSAR as well, supporting the application license application, since these are not necessarily to support the issuance of a construction permit. Any questions?

MEMBER SUNSERI: Anna, I just want to have a follow-up question with you. I think, you know, many of us in the industry, NRC, on the commercial side have experienced difficulties in obtaining the operation license because of quality assurance problems during the construction phase.

So I just want to get your view, I guess, on how the staff finds the quality assurance program so adequate based on some of the gaps that we've seen,

like the records, which is a very important part of the quality assurance program.

I mean, I worked at a plant where we literally had to take it apart and rebuild it to verify it was built right the first time. And that's unacceptable, and can you comment on that?

MS. RAMIREZ: Well, it's a good question, first of all. When I performed the review, at the beginning, I noticed that there were two sections of records. And that seemed to be a little bit confusing, because one is the records regarding the conduct of operations and the other was the records covering construction.

So I specifically asked in RAI, asking what did they deem a quality record, because I used to be a vendor inspector before, and I know the quality of records is a big issue. So and on the, I know the standard provides some guidance of what will you deem a quality record.

They provided an answer that they will satisfy the standard, and they also provided a procedure that they have in place to what they deem as the quality record under the construction phase of the facility. They provided a list of what those records are, because

that's the most relevant information, and that list included tests, reports, calculations, drawings.

So I will say as experience I had as an inspector that those records will be there during the construction, but it will be retrievable for the operating part of the facility.

MEMBER SUNSERI: So do you anticipate that the PSAR will be updated prior to the issuance of the construction permit to describe some of those details?

MS. RAMIREZ: They provided an updated version that I just received, and I was in the process of looking. They have incorporated most of the RAI responses. I didn't get the chance to go there, but if they incorporated the rest, it's my assumption that they will.

MEMBER SUNSERI: Okay, because I saw, and I mean just saw the, your response to the RAI, and I mean all these applications would be very straightforward if all they said is we're complying with the ANSI standard, I mean, you know, that's.

MS. RAMIREZ: Oh, I'm sorry. The response that I couldn't summarize, but the actual response I have a list of all the documents.

MEMBER SUNSERI: Yeah, I saw that. But

you know the, a list and we're complying is far from a adequate description of the program and the details in my mind, but. Okay, you've added some more clarity, so I think more information to come prior to the final construction permit, right? Is that what I heard you say?

MS. RAMIREZ: I need to look at it.

MEMBER SUNSERI: An update of the --

MS. RAMIREZ: An update of the, yes, you're right.

MEMBER SUNSERI: Okay, thank you.

MR. BALAZIK: If there are no further questions, I just introduced him a little bit ago, Dan Barss from NSIR. He's going to go through the emergency preparedness presentations.

MR. BARSS: I'm Dan Barss, team leader in the Reactor Licensing Branch of the Division of Preparedness Response, the Office of Nuclear Security, hence response. And unless there's been a reorganization in the last couple of hours, I don't work for NMSS, although I do cooperate with them. I'm in NSIR.

Just a point of interest to the committee, Kara McCullough was the lead reviewer for this review

with the Northwest Medical Isotopes. Normally, she would be here doing this presentation as part of her professional development. Unfortunately, she's on a year's leave of absence. She is currently the reigning Ms. USA,

(Laughter.)

MR. BARSS: And I was not able to arrange to bring her back. I know that having such a, what was the word I wanted, celebrity here would be a change of pace for the committee, but I still was unable to arrange that for you, unfortunately.

MEMBER STETKAR: Yeah, but I heard you were runner up. (Laughter.)

MR. BARSS: I did get a nice thank-you letter from here for allowing me to work on this and the development she got out of it. So some value added I believe in her career. But just for your curiosity, yes, she is the one. She was the one that did, was working on this review and other projects we had her on. But she was the main reviewer for this task.

This slide, slide 3, identifies the areas which are pulled out of 10 CFR 50, Appendix C, Section 2, where it tells us and the applicants the things that we need to look for as we're trying to determine whether

or not we should approve a construction permit.

I don't know if you want me to read through the slide or you can see them. I'm short on time and we can move through it. But these are the items that are listed there, and I'm going to kind of shorten this up I think to help us on our timing.

Slide 4 please, the regulatory requirements. 10 CFR 50.34(a) tells that there should be a discussion of the preliminary plans for coping with emergencies. That then points you to Appendix C in 10 CFR Part 50, and Section 2 of that where the preliminary safety violation report is identified.

And then the acceptance criteria which the staff used primarily come from the interim staff guidance augmenting the NUREG-1537 Part 2. I won't read the long title there, but it was the part that deals with the licensing of isotope production facilities. So that's where our focus was on in the review.

Our review process, slide 5, basically we did a section-by-section review of what was provided in the preliminary safety analysis report and the emergency response plan, referred to as the ERP. We asked RAIs, they supplemented their application with

responses to those RAIs, and we then did our technical evaluation.

We were looking for or trying to assess the adequacy of the preliminary emergency plan to support those things which are required for issuance of the construction permit as identified in 10 CFR 50.34(a)10.

Summary of the application. I would note that we did our review based upon Rev. 0 of the application, and our safety evaluation is written to Rev 0. The applicant did very recently submit a Rev. 1 of the application, which had changes in it to address the RAIs. I did look through that revision and saw that they had incorporated pretty much what they had said they would incorporate.

We were not expecting a revision, thinking that could be done when they come to the operating license phase, but they did provide that revision, and have already incorporated what they said they would in the responses to the RAIs.

That emergency response plan that they have, it describes the organization, the training, the maintenance, the emergency equipment, and the plan of actions for responding to emergencies and minimizing

the consequences of emergencies at the radio isotope facility. Their presentation covered this pretty well.

The production facility, these are things that we, the guidance -- as I walk through this now, this is the things that the guidance that comes out of the ISD augmenting 1537. These are the things it tells us to look for as we do the guidance. So it asks for where the location is. Clearly we know that it's going to be lot 15 in Discovery Ridge, Columbia, MO.

They provided figures and maps that provide the site layout, the boundary, the access routes. And it provides a plan of action for responding to emergencies at the radio isotope production facility.

The organization and response, and I will make a comment here, well, it provides a description of the responsibilities for the applicant's 24 hour a day coverage. I was impressed with many of the questions which you asked of the applicant in their presentation.

This was an area where we had RAIs as to how the 24 hour per day coverage was provided. Many of the questions which you asked after, I don't know how many hours you spent doing your review, but after

our thorough review and the RAI process, you asked many of the same questions that we had covered in the RAIs. So I thought you were very astute in your assessments, and I give you that compliment.

MEMBER POWERS: Flattery will of course get you almost nowhere with this --

MR. BARSS: I know that. It was worth a try, but I. It describes the onsite emergency organization and it also talks about how they will be augmented by offsite agencies for things such as the medical, the fire, and the law enforcement.

The emergency classification system, next slide please, tells us how they are going to classify emergency situations and alerting and activating different, progressively larger segments of their emergency organization as necessary.

As was mentioned by the applicant, they have a notification of unusual event, an alert classifications. They did not have the site area emergency or general emergency because the assessment was that they would not reach those levels. Next slide, number nine.

They do have a table, which provides kind of a basis for the emergency action levels. It

describes the different kind of accidents and what the emergency classification for them would be, and what emergency action levels they would use to make those classifications.

Next slide, the emergency planning zone. The emergency planning zone 4, the radio isotope production facility. This establishes the area within the site operational boundary. And the guidance we refer to on our slide here is ANSI 15.6, provides the comment that that's an acceptable size for a facility and a operational boundary for an EPZ for this type of facility.

Someone asked the question or made that comment that that really deals with reactors, when you look at that ANSI standard. And if you trace through the guidance document, the ISG on 1537 points us to NUREG-0849, which is also for reactors, and it also points to 15.6, and they all have the same criteria. They're all fairly well coordinated together. So that is, in our view, the right process and the right criteria to use.

Next slide, 11, the emergency response. It describes the emergency response measures that have been identified for each emergency. They identify and

describe actions to assess the release of radioactive material, and also they describe the notification process, the actions they'll take or that could be taken to correct or mitigate a problem, and the protective actions that should be implemented.

Next slide please, slide 12. Emergency facilities and equipment is discussed, in that they do identify the emergency support center that will be in the control room. And you are correct that they do not identify a backup, I heard that question asked of them. There is not a backup identified.

They have various systems, the criticality accident alarm system, the radiation area monitoring system, continuous air monitoring systems. These are used, and you know, these are systems that are identified that can be used to indicate abnormal conditions, and that could lead to the declaration of emergencies and initiation of emergency actions.

They also describe decontamination, first aid and medical transportation, and treatment for those involved in an incident. There is a section describing recovery, slide 13, that calls for the establishment of a task group to determine what recovery actions they would take, identifies who's going to fill those

positions from the Northwest Medical Isotope staff.

And slide 14, maintaining emergency preparedness. They go through and identify the emergency response organizations, initial training requirements, and how the training will be offered to offsite response organizations. I say offered because they can't really make them attend, but it is offered.

There are provisions for emergency, annual emergency drills, and also a biannual exercises that will be conducted and the invitation of offsite emergency response organizations to come and participate in those drills. That is not a requirement, but it is an expectation. Well, it is a requirement, I think, that they invite them, but not that the offsite people participate.

They do allow for an annual review of emergency plan. It was discussed in the QA program, and they have quarterly communication, equipment checks that have been called for to make sure that equipment is there and the communication systems function and the phone numbers are all still correct and operational.

Slide 14, slide 15, I'm sorry. This is number -- 15, there we go. Our evaluation and conclusion, we asked 19 RAIs and they have resolved

them. I kind of listed a quick listing of what most of those were. Do you want me to go through those in detail for you, or you're familiar? Maybe I'll just highlight a few of them.

One of them was the contacts and arrangements with the local and state emergency responders. We've felt that their initial application was, well, it was kind of confusing to the staff because it had indicated that the, had already established memorandums of understanding.

In discussions with the applicant they replied that well, it's kind of written forward-thinking that the emergency plan will have those, but we don't really have them now. You heard them say that in their presentation, that they do not yet have them, memorandums of understanding.

Once we had understanding or clarification, we understood what they were doing. And we did note what was identified as an error in that they had identified or misidentified the main organization in the State of Missouri that they would be coordinating with for radiological emergency responses. The has been corrected.

We asked questions about the 24 hour

on-shift staffing positions and how they would handle that. The application was, it did not identify the time requirements of 15 minutes for notifying offsite entities of concerns and within an hour of notifying the NRC. We mentioned that in one of our RAIs, that's been corrected.

We asked for clarification of duties between the emergency director and the emergency coordinator because there appeared to be redundant things. I heard that mentioned by you folks today too, that there sometimes look like there's redundant things. We did identify some of those. They're resolved those in the revisions that were provided.

We asked about the site area emergency and the general emergency because in their initial application, they did include those criteria, and they were basically the same in that it would appear you could declare an event as either.

They've corrected that in stating that they no longer see where they can meet that criteria, so they don't have those classifications any more at all. So the importance of security and security events in declaring alerts. That was missing but has been now added to their EAL listing.

As I said, most of these things have been resolved at this point, or all of our RAIs were resolved. The revision of the emergency response plan and the emergency plan implementing procedures and the final safety analysis are all to be submitted with the operating license application.

We don't at this time have any implementing procedures, nor do we really need them at this state. Part 50 requires a discussion only of the preliminary emergency plans for a construction permit. Further evaluation will occur after the submission of that operating license application.

Based upon that, the information that we had available in the application, and the preliminary emergency response plan, the staff finds that they've met the requirements in 10 CFR Part 50, Appendix D, Section 2, and comply with, or not comply with but address the planning standards and criteria provided in the applicable guidance document sufficient for issuance of the construction permit.

And with that, I'll open for questions.

MEMBER KIRCHNER: Just one for clarification. For radiological areas, they have something defined as controlled areas. Is that the

same as the EPZ for this site?

MR. BARSS: No, the EPZ is basically the operational site boundary is what they have identified.

MEMBER KIRCHNER: And that's defined as just the legal site boundary, or where they have the fence, or?

MR. BARSS: The fence is what I believe. Correct me if I'm wrong, but the fence is what they've identified as their emergency planning zone.

MEMBER KIRCHNER: Okay, thank you.

CHAIR CHU: Any questions? Okay, thank you. According to the agenda, now is a public comment period. First, I would like to know if there's anybody in the audience from the public who would like to make a comment. No, okay.

Then I'm going to go to the phone line, see if there's any member of the public who would like to make a comment. Please identify yourself.

MS. SCHWARZ: Sally Schwarz. I'm from the Society of Nuclear Medicine and Molecular Imaging.

CHAIR CHU: You wish to make a comment, right?

MS. SCHWARZ: Yes.

CHAIR CHU: Okay, please go ahead.

MS. SCHWARZ: First of all, as past president of the Society of Nuclear Medicine and Molecular Imaging, I just wanted to kind of speak of behalf not necessarily of Northwest, but generally of the project that they are undertaking.

I think that certainly we consider our patients as prime individuals who will benefit from the production of technetium-99n. We are a society -- technetium remains the most commonly used radioisotope in more than 20 million diagnostic studies performed annually in the United States.

The United States uses over 50% of the world's technetium supply, and yet has no current approved U.S. supply for technetium. We know also that the U.S. Government does have proliferation concerns regarding the use of highly enriched uranium, and they, our current generators are in process of reducing, you know, the use or eliminating the use of high enriched and moving to low enriched uranium.

Also, these new processes that are coming onboard, such as Northwest Medical, I think would allow, again, an additional benefit to have a more diverse and greater supply of radiopharmaceutical radioisotopes, specifically technetium.

And again, to have more reliable, to have reliable domestic sources of technetium. I think this is very important for you to consider, that the bottom line for this production really is to have patient access to technetium-99 N.

So I am definitely speaking for the Society in favor of that.

CHAIR CHU: Thank you. Can you repeat your name and your organization again, since the phone line kind of cracked up.

MS. SCHWARZ: I'm sorry. Sally Schwarz. I'm the past president of the Society of Nuclear Medicine and Molecular Imaging. We're a member -- our membership is about 17,000 people in the United States and abroad. We're an international organization.

CHAIR CHU: Okay, well, thank you very much.

MS. SCHWARZ: Thank you, appreciate the opportunity to be able to at least state our interest and concerns for our patients.

CHAIR CHU: Okay, thank you.

MS. SCHWARZ: Thank you.

CHAIR CHU: Now, turning to -- are there any more comments from anybody else? No, okay. Now,

according to our agenda, we are going to the closed session. So now we have to clear the room and then close the public phone line.

(Whereupon, the above-entitled matter went off the record at 3:41 p.m.)

U.S. Nuclear Regulatory Commission
ACRS Subcommittee Review

Northwest Medical Isotopes, LLC
Public Presentation
August 22 and 23, 2017

U.S. Nuclear Regulatory Commission
ACRS Subcommittee Review

Chapter 9 – Auxiliary Systems

August 22, 2017

RPF Auxiliary Systems

- Heating and ventilation, and air conditioning (HVAC) systems
- Fire protection systems
- Communication systems
- Possession and use of byproduct, source, and special nuclear material
- Cover gas control in the closed primary coolant system
- Utility systems
- Control and storage of radioactive waste
- Analytical laboratory
- Chemical supply

Heating, Ventilation and Air Conditioning Systems

- HVAC system is designed to provide confinement of hazardous chemical fumes and airborne radiological materials and conditioning of environment for facility personnel and equipment
- RPF will be ventilated such that airflows travel from areas of lower potential for contamination to areas of higher potential
- Ventilation system functions will include temperature and air quality control to meet production and worker needs
- HVAC safety functions will serve to protect workers, the public, and environment by maintaining confinement barriers in a multiple confinement barrier system
- Supply air will be conditioned using filters, heater coils, and cooling coils to meet requirements of each space
  - Will meet 10 CFR 20 limits and constraints
  - Three air supply handling units will be sized at 50 percent capacity each, for redundancy
    - Two of three units will be operating, while third is on standby
  - Isolation and backdraft dampers in the supply duct system at zone boundary will close when required to provide confinement at zone boundary
  - Will be operated through BMS

Operational Analysis and Safety Function

- Exhausted Air System → Four subsystems
  - Zone I exhaust system
  - Zone II/III exhaust system
  - Laboratory exhaust system
  - Process vessel ventilation (PVV) treatment system
- Each exhaust system will be provided with two 100 percent capacity exhaust fans and filter trains for complete redundancy on all exhaust subsystems
  - Both will ensure confinement ventilation pressure differentials are maintained at all times
- Each exhaust filter train will consist of prefilters, two stages of HEPA filters, carbon adsorbers, and isolation dampers.
- Exhaust ducts upstream of filter trains will be round to minimize areas where contamination can accumulate and are sized to minimize particulate settling
- Each exhaust system will have a separate stack, with the exception of PVV subsystem, which will merge with the Zone I exhaust stream
- Stack monitoring and sampling system will be provided on each stack to demonstrate compliance with applicable requirements

Heating, Ventilation and Air Conditioning Systems

- Ventilation system will maintain a series of cascading pressure zones to draw air from the cleanest areas of the RPF to the most contaminated areas
  - **Zone I** – Initial confinement barrier
    - Includes gloveboxes, fume hoods, open front gloveboxes, vessels, tanks, piping, hot cells, and Zone I exhaust subsystem
  - **Zone II** – Secondary confinement subsystem
    - Includes walls, floors, ceilings, and doors of laboratories containing gloveboxes, HEPA filter rooms, and Zone II ventilation exhaust subsystem
  - **Zone III** – Tertiary confinement barrier
    - Includes walls floor, ceilings and doors of corridor that surrounds operating galleries and mechanical mezzanine
  - **Zone IV** – Nonradioactive or administrative areas

RPF Areas and Respective Confinement Zones

Area	Zone
Hot cells (production)	I
Tank hot cell	I
Solid waste treatment hot cell	I
High dose waste solidification hot cell	I
Uranium decay and accountability hot cell	I
HIC vault	I
Analytical laboratory gloveboxes	I
R&D hot cell laboratory hot cells	I
Target fabrication room and enclosures	II
Utility room	II
Analytical laboratory room and hoods	II
R&D hot cell laboratory room and hoods	II
Waste loading hot cell	II
Maintenance gallery	II
Manipulator maintenance room	II
Exhaust filter room	II
Airlocks[a]	II, III
Irradiated target basket receipt bay	III
Waste loading truck bay	III
Operating gallery and corridor	III
Electrical/mechanical supply room	III
Chemical supply room	III
Corridors	III
Decontamination room	III
Loading docks	IV
Waste management loading bay	IV
Irradiated target receipt truck bay	IV
Maintenance room	IV
Support staff areas	IV

[a] Confinement zone of airlocks will be dependent on the two adjacent zones being connected.

Confinement

- Confinement is an engineered safety feature of RPF HVAC system
- Design objectives:
  - Protect on-site personnel and the off-site public
  - Minimize the reliance on administrative or complex active engineering controls to provide a confinement system as simple and fail-safe as reasonably possible
- Process vessel ventilation system will serve as primary confinement pressure boundary and is safety-related
- Hot cells confinement will be achieved through both confinement ventilation system and shielding provided by steel and concrete structures comprising the walls, roofs, penetrations, and covers of hot cells
- Secondary confinement will be accomplished by:
  - Zone boundaries, associated ventilation systems, and HEPA filter plenums to filter exhaust air prior to discharge at ventilation stacks
  - Use of bubble-tight isolation dampers → Isolates ducts at the zone boundary under certain scenarios to ensure that all potential releases have been HEPA-filtered prior to exiting RPF (i.e., release to atmosphere)
- Safety aspects of the confinement system are discussed in Chapter 6.0

HVAC Safety Analysis

- Normal and off-normal operation of HVAC system
  - Chapter 11.0 (Section 11.1.1.1) – Normal release analysis.
  - Chapter 13.0 (Section 13.2) – Evaluates various accident sequences that involve failure of ventilation components, radiological spills, and release of high-dose solutions, vapors, or gases from within hot cell liquid confinement, secondary confinement, or shielding boundary
- Defense-in-depth
  - Failure of air balance system is not in itself an accident, but represents failure of a system designed to mitigate other accidents that lead to an airborne release of radionuclides
  - Systems that mitigate these releases include the primary confinement and primary offgas treatment system (e.g., slow airborne releases following decay to more stable isotopes)
- Item relied on for safety
  - IROFS RS-03, "Hot Cell Secondary Confinement Boundary" (Zone 1 exhaust ventilation)
    - Operations, equipment, and components of this system will ensure confinement of hazardous materials during normal and abnormal conditions, including natural phenomena, fires, and explosions
  - Components of dissolver offgas subsystem and the process vessel ventilation system
  - IROFS FS-05, "*Exhaust Stack Height*"
    - Passive engineered control – designed with a fixed height for safe release of gaseous effluents

Fire Protection

- Fire protection system design provides detection, notifications, and suppression of fires, and prevents small fires from becoming large fires
- Notification of personnel will be achieved by:
  - Automatic detection devices
  - Manual pull stations
  - Automatic sprinklers
  - Use of alarm devices that broadcast within the building and transmit signals to central alarm station and RPF control room
- Suppression of fires will be accomplished through use of automatic sprinklers where appropriate
- Suppression system will include all piping, valves, and fittings from water supply (i.e., water storage tanks or municipal hydrants) to automatic sprinklers and standpipes

Fire Protection System Description

- Fire protection system will provide detection and suppression of fires within the RPF, generation of alarm signals indicating presence and location of fires, and execution of commands appropriate for the particular location of the fire
- Complete addressable fire alarm system, with both automatic and manual initiation, will be designed
- Detection devices will report to a local alarm panel
- All alarms (fire, supervisory and trouble) will transmitted to site central alarm station and control room
- Fire protection system components will have fail-safe features and audible/visual alarms for operability and trouble indication
- HEPA filter plenum deluge will be also supplied by the 20.3 cm (8-in.) piping network and will be part of a larger filter plenum fire safety design that includes fire screens, demisters, plenum drains, and plenum dampers

Fire Protection System Description (continued)

- Fire protection system is divided into two major subsystems
  - Fire suppression subsystem includes:
    - Automatic sprinklers
    - HEPA filter plenum deluge
    - Glovebox fire suppression
    - Fire hydrants
  - Fire detection and alarm subsystem includes:
    - Controls (e.g., fire alarm control panel, subpanels, or devices used for control of devices)
    - General area detection (e.g., room smoke and heat detectors, manual pull stations)
    - Duct smoke detection for non-nuclear ventilation systems, glovebox heat detection
    - HEPA filter plenum heat detection
    - Fire suppression subsystem monitoring devices (e.g., waterflow switches, tamper switches, fire pump, and water storage monitoring devices)
    - Occupant notification
    - Alarm transmission to the central alarm station and RPF control room

Fire Protection Safety Analysis

- Chapter 13.0
  - Identifies fire hazards and evaluates adverse events and accident sequences
  - Provides an evaluation of accident sequences that involve either combustible solids or liquids, or explosive gases, in close proximity to high uranium or high-dose process streams
  - IROFS FS-03, “Process Vessel Emergency Purge System”
    - Emergency purge gas system was identified to prevent flammable concentration in process vessel headspaces
- Chapter 6.0 identifies impact of fire suppression water in its analysis
- Preliminary fire hazards analysis (PFHA)
  - Assessed fire hazards at the RPF, support facilities, and surrounding project site
  - Assessed fire safety criteria identified in NRC Regulatory Guide 1.189, *Fire Protection for Nuclear Power Plants*
  - Provides a consequence evaluation of a design basis fire scenario within each fire area, assuming loss of automatic and manual fire suppression
  - Identifies facility design features and fire hazard mitigating features for personnel safety and property protection commensurate with NRC requirements and criteria

Fire Hazards Analysis

- Fire hazards analysis (FHA) will:
  - Update analysis to reflect RPF final design
  - Address gaps identified from PFHA (e.g. details in target fabrication, laboratory areas)
  - Revalidate criteria and assumptions from PFHA
  - Reevaluate fire hazards and consequences in each fire area
  - Provide quantitative assessments of combustible loading
  - Provide updated inventories of radioactive/hazardous materials and reassess potential for on-site and off-site release
  - Evaluate potential impact on high-value property
  - Assess fire hazard scenarios for crane structure and review qualifications for its design
  - Provide further analysis and review of design features including:
    - Fire water system
    - Automatic fire suppression system
    - Means of egress
  - Provide more detailed information on fire department response and emergency planning

Fire Areas/Barriers

- RPF will be subdivided into separate fire areas
  - Limiting spread of fire
  - Protect personnel
  - Limit consequential damage to RPF
- Determination of fire area boundaries based on:
  - Types, quantities, density, and location of combustible materials
  - Location and configuration of equipment
  - Consequences of inoperable equipment
  - Location of fire detection and suppression systems
  - Personnel safety and exit requirements
- Fire areas typically bounded by 2-hour fire-rated barriers to separate:
  - Processing areas and radioactive material storage areas from each other and adjacent areas
  - Rooms with major concentrations of electrical and mechanical equipment from adjacent areas
  - Computer and control rooms from adjacent areas
  - Maintenance shops from adjacent areas
  - Combustible storage areas from adjacent areas
  - Fan rooms and plenum chambers from adjacent areas
  - Office areas from moderate and high fire hazard areas

Communication Systems

- Communication systems will relay information during normal and emergency conditions for general operations and emergencies
- Includes public address system and intercoms
- Systems designed to enable operators on duty to be in communication with supervisor on duty, health physics staff, and other personnel required by procedures and technical specifications
- Communications system enable operator, or other staff, to announce existence of an emergency in all areas of RPF
- Two-way communication will be provided between all operational areas and control room
- Chapter 13.0
  - Identifies and evaluates adverse events and accident sequences
  - Accident analysis has not identified the need to credit the communication system
  - Communication system is designed such that it will function in a manner, whether operational or not, consistent with occupational safety and protection of workers, public, and environment

Possession and Use of Byproduct, Source, and Special Nuclear Material

- Facility designed to ensure that:
  - No uncontrolled release of radioactive materials (solid, liquid, or airborne) from RPF can occur
  - Personnel exposures to radiation, including ingestion or inhalation, do not exceed limiting values in 10 CFR 20, as defined in Chapter 11.0, and are consistent with RPF ALARA program
- Special nuclear material (SNM)
  - SNM will be handled in all areas
- Byproduct materials handled in the RPF include ^{99}Mo and radioactive waste materials
- Detailed inventory of byproduct materials within each main systems provided in:
  - Target fabrication → Chapter 4.0, Section 4.4.2 (trace)
  - Target receipt and disassembly → Chapter 4.0, Sections 4.3.2 and 4.3.3
  - Target dissolution → Chapter 4.0, Section 4.3.4
  - Molybdenum recovery and purification → Chapter 4.0, Section 4.3.5
  - Uranium recovery and recycle → Chapter 4 0, Section 4.4.1
  - Waste handling → Chapter 11.0, Section 11.2

Cover Gas Control in Closed Primary Coolant Systems

- Process chilled water system accumulation of combustible gases will be controlled by "sweep" gas system
- Gases entrained in chilled water system will be released in cooling water collection tanks
  - Hydrogen, which is the primary component of evolved combustible gases, diffuses very rapidly and will be diluted by the airflow provided by sweep gas flow
- Accident sequences that involve either combustible solids or liquids or explosive gases, in close proximity to uranium process streams or high-dose process streams (Chapter 13.0)
  - If purge air system was not operational, a hydrogen-air concentration in selected tanks could rise above 25 percent of lower explosive limit (LEL), and an ignition source could cause a deflagration or detonation → Result – release of radionuclides into air
  - Tanks associated with cooling system are not anticipated to require items relied on for safety (IROFS) controls

Other Auxiliary Systems – Process Utility System

- Process utility system → Provides heating, cooling, process water, compressed gases, instrument, motive force, and other functions to support uranium recovery, waste handling, and ventilation
  - Subsystems include:
    - Process steam (IROFS)
    - Chilled water (IROFS)
    - Demineralized water
    - Plant and instrument air
    - Gas supply (e.g., nitrogen, helium, hydrogen, and oxygen)
    - Purge/sweep gas (IROFS)
- Process steam subsystem
  - Process steam system will be divided into a medium-pressure central heating loop and a low-pressure secondary loop within hot cell
  - Medium pressure steam will be generated by a natural gas-fired boiler
  - Low-pressure steam in secondary loop will be generated by medium-pressure steam in a shell-and-tube heat exchanger
  - Secondary loops have geometry control → IROFS

Other Auxiliary Systems – Process Utility System (con't)

- Chilled water subsystem
  - Process chilled water
    - One central process chilled water loop that will cool three secondary loops:
      - Large geometry secondary loop in hot cell
      - Criticality-safe geometry secondary loop in hot cell
      - Criticality-safe geometry secondary loop in target fabrication area
    - Primary process chilled water loop will rely on three air-cooled chillers, each sized to accommodate 50 percent of the process cooling demands
    - Secondary loops will be cooled by central chilled water system through heat exchangers
    - Several process demands will require cooling at less than freezing point of water
      - Water-cooled refrigerant chiller units, cooled by secondary chilled water loops
    - System will operate at highest pressure, and secondary loops will operate at a pressure between central system and process fluid
    - Large-geometry secondary loop in hot cell will meet the cooling demands where fissile material leaking through a heat exchanger is not a credible event
    - Other cooling loops will be inherently criticality-safe by geometry, so active controls will not be required to keep fissile material out of chilled water return
    - Conductivity sensors will monitor chilled water return to detect heat exchanger leak

Other Auxiliary Systems – Process Utility System (con't)

- Chilled water subsystem (continued)
  - Facility chilled and heating water
    - System will provide heating and cooling media to HVAC system
    - HVAC system will maintain occupied space at 24°C (75°F) (summer) and 22°C (72°F) (winter), with active ventilation to support workers and equipment
    - Facility chilled water
      - Will be circulated through chilled water coils in the air-handling units → Temperature to HVAC air-handling unit cooling coils will be ~9°C (~48°F)
      - Air will be drawn across coils and cooled to be delivered to RPF production area to maintain temperature
      - Three equal-sized facility chillers located adjacent to RPF → Two in operation and one spare
    - Heating water system
      - Will supply the HVAC system with heating water that is circulated through heating water coils in air handling units → Temperature to HVAC air-handling unit heating coils and reheat coils will be ~ 82°C (180°F)
      - Air will be drawn across coils and cooled to be delivered to RPF production area to maintain temperature
      - Will be generated as a byproduct stream of steam boilers

Other Auxiliary Systems – Process Utility System (con't)

- Demineralized water subsystem → No IROFS
  - Will be produced by removing mineral ions from municipal water through an ion exchange (IX) process and accumulated in a storage tank
  - IX media will be regenerable using a strong acid and a strong base fed from local chemical drums by tote pumps
- Gas supply subsystem → No IROFS
  - Gas supply of helium, hydrogen, and oxygen will be supplied by standard gas bottles
    - Gas bottles will be located near points of use in RPF
  - Nitrogen will be provided from a tube truck
    - Nitrogen will be fed from tube truck to chemical supply room where manifold piping will be used to distribute gas
    - Primary use of nitrogen will be in reducing furnaces during target fabrication

Other Auxiliary Systems – Process Utility System (con't)

- Plant and instrument air subsystem → No IROFS
  - Plant air
    - Will be provided for several activities (e.g., tool operation, pump power, purge gas in tanks, valve actuation, and bubbler tank level measurement)
    - Small, advective flows of plant air will be used throughout RPF to prevent accumulation of combustible gases to hazardous concentrations
    - Combustible gases will be evolved from process liquids due to exposure of these liquids to ionizing radiation
  - Instrument air
    - Will use plant air that is filtered and dried
    - Plant air will be generated by a compressor and cooled to near-ambient temperatures by an aftercooler
    - Lead/lag configuration can supply reduced flow after a single compressor failure
    - Plant air receiver will provide buffer capacity to make up difference between peak demand and compressor capacity
    - Instrument air will be dried in regenerable desiccant beds to a dew point of no greater than 40°C (40°F) and filtered to a maximum 40 micron (μ) particle size
    - Instrument air receiver will provide buffer capacity to make up difference between peak demand and compressor capacity

Other Auxiliary Systems – Process Utility System (con't)

- Purge gas subsystem
  - Plant air and nitrogen supply systems provide purge gases to the required tanks
    - Depending on tank, purge gas will be provided through bubbler tank level measurement device or other means
    - Purge gas flow rates are specified as either high flow for conditions of a large tank or high radioactivity, or low flow where tank is small and radioactivity is low
    - PVV system will collect purge gas from each of vessels and treat it before discharge to Zone I exhaust
      - Systems will work together to prevent explosive gas mixtures from developing in headspace of process vessels
  - Items relied on for safety
    - IROFS CS-10, "Closed Safe Geometry Heating/Cooling Loop with Monitoring and Alarm"
    - IROFS CS-20, "Evaporator/Concentrator Condensate Monitoring"
    - IROFS CS-27, "Closed Heating/Cooling Loop with Monitoring and Alarm"
    - IROFS FS-03, "Process Vessel Emergency Purge System"
    - IROFS CS-18, "Backflow Prevention Device"

Control and Storage of Radioactive Waste

- Radioactive waste control and storage systems are designed to ensure:
  1. That any potential malfunctions do not cause accidents uncontrolled release of radioactivity
  2. In the event radioactive material is released by operations of one of these systems, potential radiation exposures would not exceed the limits of 10 CFR 20 and meet ALARA guidelines
  3. No function or malfunction of auxiliary systems will interfere with or prevent safe RPF shutdowns
- Control and storage of radioactive waste includes following functions:
  - High-dose liquid waste handling (collection, concentration, and solidification)
  - Low-dose liquid waste handling (collection, evaporation, recycle and solidification)
  - Spent resin dewatering
  - Solid waste encapsulation
  - High-dose waste decay
  - High-dose waste handling
  - Waste handling
  - Waste Staging and Shipping Building (Class A waste staging)

Control and Storage of Radioactive Waste (continued)

- Waste handling system is not geometrically safe → IROFS have been identified
  - IROFS RS-01, "Hot Cell Liquid Confinement Boundary"
  - IROFS RS-03, "Hot Cell Secondary Confinement Boundary"
  - IROFS RS-04, "Hot Cell Shielding Boundary"
  - IROFS RS-08, "Sample and Analysis of Low Dose Waste Tank Dose Rate Prior to Transfer Outside the Hot Cell Shielding Boundary"
  - IROFS RS-10, "Active Radiation Monitoring and Isolation of Low Dose Waste Transfer"
  - IROFS CS-14, "Active Discharge Monitoring and Isolation"
  - IROFS CS-15, "Independent Active Discharge Monitoring and Isolation"
  - IROFS CS-16, "Sampling and Analysis of Uranium Mass or Concentration Prior to Discharge or Disposal"
  - IROFS CS-17, "Independent Sampling/Analysis of U Concentration Prior to Discharge/Disposal"
  - IROFS CS-18, "Backflow Prevention Device"
  - IROFS CS-21, "Visual Inspection of Accessible Surfaces for Foreign Debris"
  - IROFS CS-22, "Gram Estimator Survey of Accessible Surfaces for Gamma Activity"
  - IROFS CS-23, "Nondestructive Assay (NDA) of Items with Inaccessible Surfaces"
  - IROFS CS-24, "Independent NDA of Items with Inaccessible Surfaces"
  - IROFS CS-25, "Target Housing Weighing Prior to Disposal"
  - IROFS CS-26, "Active Discharge Monitoring and Isolation"
  - IROFS FS-01, "Enhanced Lift Procedure"
  - IROFS FS-02, "Overhead Cranes"

Analytical Laboratory

- Analytical laboratory design basis is to provide on-site analysis to support RPF operations
- Analysis will determine
  - Mass, concentration and purity of SNM
  - Concentration of ^{99}Mo product and product impurities
  - Process stream chemical and radionuclide concentrations
  - Chemical and radionuclide analysis for waste handling and disposition
  - Ensure compliance with waste acceptance criteria
- Samples from process will be collected, transported to laboratory, and prepared in laboratory gloveboxes and hoods
- No IROFS

Chemical Supply

- Chemical supply system will include tanks supplying aqueous chemicals to process systems, flammable material storage cabinets used to segregate incompatible materials, and storage of chemical solids used during RPF operations
- Design basis is to provide chemical solutions mixed to required concentrations
- Chemicals include nitric acid, NaOH, reductant and NO_x absorber solutions, hydrogen peroxide, fresh uranium IX resin, etc.
- Items relied on for safety
  - CS-18, “Backflow Prevention Device”
  - CS-19, “Safe Geometry Day Tanks”
- Defense-in-depth
  - Comply with Federal and State requirements (e.g., EPA, OSHA) for design and operation of chemical preparation and storage areas
  - Chemical handling procedures will be provided to operators to ensure safe handling of chemicals according to applicable regulatory requirements and consistent with material safety datasheets

Chapter 9 Questions?

U.S. Nuclear Regulatory Commission
ACRS Subcommittee Review

Chapter 11 – Radiation Protection and Waste Management

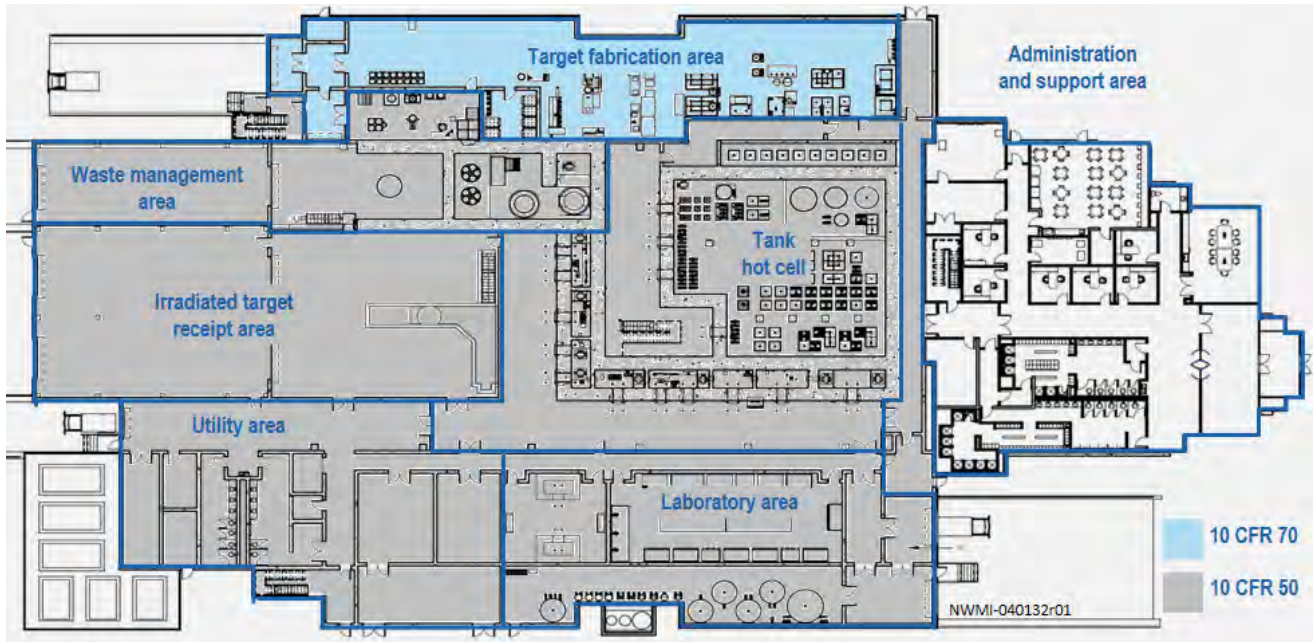
August 22, 2017

Radiation Protection

- Radiation protection program
  - Provides a complete list of all expected radiation and radioactive sources, including airborne, liquid, and solid sources
  - Requires development and implementation of procedures, identifies monitoring instrumentation and techniques, and specifies practices to be employed to verify compliance with radiation dose limits and other applicable requirements
- Basis and plans used to develop procedures for assessing and controlling radioactive wastes and ALARA program are included
- Sources of radiation within Radioisotope Production Facility (RPF) include:
  - Physical and chemical form, type (e.g., neutron, gamma)
  - Curie strength or exposure rates
  - Energy level
  - Encapsulation (sealed or unsealed)
  - Use
  - Storage conditions and locations
  - Planned program for disposal of radioactive material

Airborne Radiation Sources

- Airborne radioactive sources within RPF consist of radioactive gases
  - Target fabrication area
  - Tank hot cell area (e.g., target dissolution, ^{99}Mo recovery, low-enriched uranium [LEU] recovery and recycle)
  - Waste management area
- During normal operating conditions, airborne or gaseous radioactive materials will be contained within closed systems consisting of piping components and tanks
- Airborne releases are based on processing of eight University of Missouri Research Reactor (MURR) targets and consistent with nominal operating conditions
  - Primary dose contributor is Xe
- Offgas system designed to retain releases to below release limits and bound range of target processing



Airborne Radiation Sources (continued)

- Weekly radionuclides (Ci/week) generated for maximum dose case were multiplied by 52 weeks to obtain release rates in Ci/year
- Radionuclide releases were adjusted to conservatively account for one high-efficiency particulate air (HEPA) filter in Zone I heating, ventilation, and air conditioning (HVAC) offgas treatment system
  - Recommends that radionuclide particulate releases be reduced by adjustment factor of 0.01
  - Noble gases and iodine releases were not reduced in analysis
- COMPLY database does not contain the following radionuclides:
  - ^{136m}Ba, ^{137m}Ba, ^{133m}I, ^{97m}Nb, ^{236m}Np, ^{234m}Pa, ^{112}Pd, ^{144m}Pr, ^{106}Rh, ^{128}Sb, ^{128m}Sb, and ^{98m}Y
- Maximum dose to public from normal operational stack releases was calculated to be 0.036 mSv/yr (3.6 mrem/yr) at 9.1 m (30 ft) from RPF
- Modeling results of COMPLY analysis determine that requirement of 10 CFR 20.1101(d), *Radiation Protection Programs*, will be met for RPF
  - Air emissions of radioactive material to environment will not result in a member of public receiving a total effective dose equivalent (TEDE) in excess of 0.1 mSv/yr (10 mrem/yr) from these emissions

Solid Radioactive Sources

- Solid radioactive sources within RPF will consist of fresh LEU, irradiated LEU targets, LEU target material, and solidified waste
- During normal operating conditions, solid radioactive sources will be contained within tanks and shielded hot cells, all within restricted areas.
- Source term based on cumulative total of high- and low-dose waste, encapsulated waste, and one batch of eight MURR targets, 8 hr post-irradiation in a 1-week period
- At discharge from Oregon State TRIGA Reactor (OSTR) (or third) reactor, 30 targets will have essentially same amount of radioactivity as 8 targets being discharged from MURR
  - Since OSTR targets are not going to be received for 48 hr → Total radioactivity is significantly less than eight MURR targets received in 8 hr
  - Other than grams of uranium, radiation source for 30 OSTR targets is lower

ALARA Policy

- NWMI management is committed to implementation of an ALARA program
- Objective of program is to make every reasonable effort to:
  - Maintain facility exposures to radiation as far below dose limits of 10 CFR 20.1201, "Occupational Dose Limits," as practical
  - Maintain radiation exposures to public below dose constraints of 10 CFR 20.1301, "Dose Limits for Individual Members of the Public"
- NWMI management is committed to ALARA philosophy for radiological operations
- NWMI's policy is to conduct radiological operations in a manner that will ensure health and safety of its employees, contractors, and public
- NWMI will ensure that radiation exposure to workers and public, and releases of radioactivity to environment, are maintained below regulatory limits
- Deliberate actions will be taken to further reduce exposures and releases in accordance with a process focused on keeping exposures or releases ALARA
- NWMI is fully committed to implementing an ALARA program that consistently reflects this policy

Approach to ALARA Program

- ALARA program goals are to ensure occupational exposures and environmental releases are as far below regulatory limits as reasonably achievable
- RPF design incorporates ALARA principles
  - As structures, systems, and components (SSC) and process areas are designed, radiation protection staff will evaluate potential dose to workers and public and provide suggested approaches to reducing dose
- Areas where facility personnel are expected to spend significant time are designed so that dose rates are maintained ALARA
  - Areas with higher doses rates will be minimized
  - Radiation areas will be established to minimize spread of contamination and reduce unnecessary exposure of personnel to radiation

Approach to ALARA Program (continued)

- Design and implementation of ALARA program will be consistent with following guidance
  - Regulatory Guide 8.2, *Administrative Practices in Radiation Surveys and Monitoring*
  - Regulatory Guide 8.13, *Instructions Concerning Prenatal Radiation Exposure*
  - Regulatory Guide 8.29, *Instruction Concerning Risks from Occupational Radiation Exposure*
  - Regulatory Guide 8.37, *ALARA Levels for Effluents from Materials Facilities*
- Operation of RPF will be followed to minimize, to extent practicable, contamination of RPF and environment, facilitate eventual decommissioning, and minimize, to extent practicable, generation of radioactive waste
  - Regulatory Guide 8.10, *Operating Philosophy for Maintaining Occupational and Public Radiation Exposures As Low As Is Reasonably Achievable*
  - Guidance of Regulatory Guide 4.21, *Minimization of Contamination and Radioactive Waste Generation: Life-Cycle Planning*
- Radiation protection program will ensure a comprehensive program is implemented and document that policies are established to ensure ALARA goals are met
- Facility procedures will be written to incorporate ALARA principles into routine operations of RPF and ensure that exposures are consistent with 10 CFR 20.1201 limits

Radiation Protection Program

- NWMI is committed to protecting RPF workers, public, and environment from unacceptable exposure to radiation sources
- NWMI's policy → Conduct radiological operations in a manner that ensures health and safety of employees, contractors, and public
  - Will ensure that radiation exposure to workers and public, and releases of radioactivity to environment, are maintained below regulatory limits
  - Deliberate actions will be taken to further reduce exposures and releases in accordance with a process focused on keeping exposures and releases ALARA
- Program will meet requirements of 10 CFR 20 and 10 CFR 19, *Notices, Instructions, and Reports to Workers: Inspection and Investigations*
  - To extent practicable, procedures and engineering controls based on sound radiation protection principles to achieve occupational doses and doses to public that are ALARA
  - Content and implementation will be reviewed at least annually, as required by 10 CFR 20.1101(c)
  - Constraints on atmospheric releases will be established for RPF per 10 CFR 20.1101(d) such that no member of public would be expected to receive a TEDE in excess of 0.1 mSv/yr (10 mrem/yr) from these releases

Radiation Protection Program (continued)

- Administrative exposure limits have been set below limits specified in 10 CFR 20 to ensure that radiation exposure limits are not exceeded and emphasize ALARA principles
  - TEDE for RPF is defined as 0.02 Sv/yr (2 roentgen equivalent in man [rem]/yr)
  - ALARA goal and dose investigation level is set at 5 mSv/yr (500 mrem/yr)
  - Dose investigation level of 5 mSv/yr (500 mrem/yr) is TEDE above which would trigger an investigation by Radiation Protection staff
    - Determine why an individual received such a dose equivalent
- High/very high radiation areas will not be occupied by personnel during normal operations
- Dose rates outside controlled area are in accordance 10 CFR 20.1302, *Compliance with Dose Limits for Individual Members of the Public*
  - Anticipated to be below 0.02 mSv (2 mrem) in any 1 hr and 0.001 Sv/yr (0.1 rem/yr)

Estimated Radioisotope Production Facility Controlled and Restricted Area Dose Rates

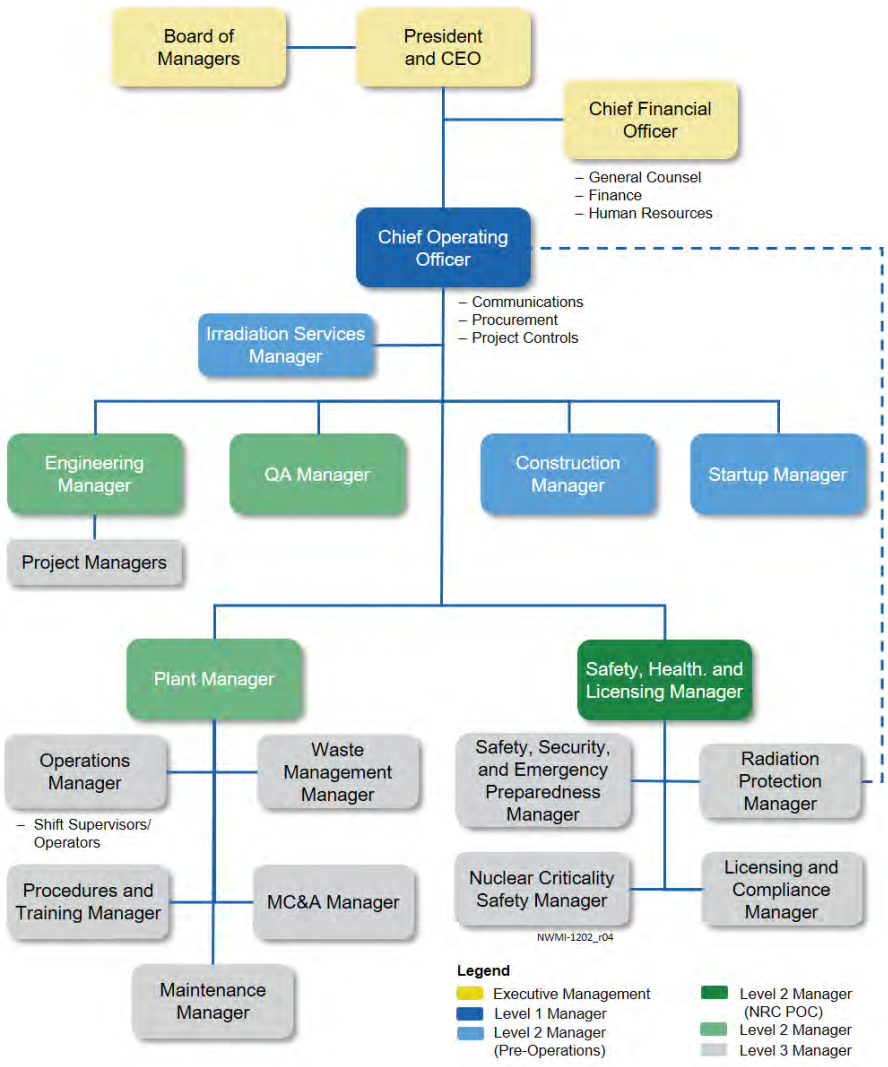
Location	Dose rate	
Target fabrication area	0.0003 mSv/hr	0.03 mrem/hr
Irradiated target receipt area	0.005 mSv/hr	0.5 mrem/hr
Hot cell operating and maintenance galleries	0.005 mSv/hr	0.5 mrem/hr
Waste management loading area	0.005 mSv/hr	0.5 mrem/hr
Utility area	0	0
Laboratory area	0.005 mSv/hr	0.5 mrem/hr
Administration and support area	0	0

Radiation Protection Program (continued)

- Areas identified as controlled access areas, restricted areas, radiation areas, and high radiation areas will be designated, based on definitions provided in 10 CFR 20 and predicted doses rates presented by shielding analysis
- Dosimetry is anticipated to be required in any restricted area
- Area monitoring program will be established in controlled area to demonstrate compliance with public exposure limits
- Radiation protection program will require surveillance of and control over radiation exposure of personnel
- Radiation exposure policy and control measures for personnel will be established based on requirements of 10 CFR 20 and guidance of applicable regulatory guides
  - Recommendations from International Commission on Radiological Protection and National Council on Radiation Protection and Measurements will be used in develop of program
- Area monitoring is anticipated to comprise a combination of monitoring systems located at points in controlled areas that would provide reasonable assurance that radiation areas are not present in controlled areas
  - Passive (e.g., TLD or optically stimulated luminescence)
  - Active (e.g., energy-compensated Geiger-Mueller [G-M] detector systems with local and remote monitoring capability)

Radiation Protection Organization Manager Responsibilities

- Reports to Safety, Health, and Licensing Manager
- Roles and Responsibilities
  - Establish/implement radiation protection program
  - Serve as Radiation Safety Officer
  - Generate/maintain radiation protection procedures
  - Review/audit efficacy of radiation program in complying with NRC and other requirements
  - Adequately staffing Radiation Protection group
  - Establish/maintain ALARA program and ensuring personnel follow ALARA principles
  - Establish/maintain respirator usage program
  - Monitor worker doses, both internal and external
  - Comply with radioactive materials possession limits
  - Perform calibration and quality assurance of all radiological instrumentation
  - Establish/maintain radiation safety training program
  - Perform annual radiation protection audits
  - Establish/maintain radiological environmental monitoring program
  - Post restricted areas and develop associated occupancy guidelines



NWMI RPF Organization Chart

Radiation Protection Training Program

- Design and implementation of radiation protection training program will comply with requirements of 10 CFR 19.12, “Instruction to Workers”
- Records will be maintained in accordance with 10 CFR 20.2110, “Form of Record”
- Development and implementation of radiation protection training program will be consistent with the following guidance:
  - ASTM E1168-95, *Radiological Protection Training for Nuclear Facility Workers*
  - ANSI/ANS 15.11, *Radiation Protection at Research Reactor Facilities*
  - Regulatory Guide 8.10, *Operating Philosophy for Maintaining Occupational Radiation Exposures As Low As Is Reasonably Achievable*
  - Regulatory Guide 8.13, *Instructions Concerning Prenatal Radiation Exposure*
  - Regulatory Guide 8.29, *Instructions Concerning Risks from Occupational Radiation Exposure*

Radiation Protection Training

- Level of radiation protection training based on potential radiological health risks associated with employee's work responsibilities and incorporate provisions of 10 CFR 19.12
- Per 10 CFR 19.12, any individual working at RPF who is likely to receive a dose in excess of 1 mSv (100 mrem) annually requires training to be:
  - Kept informed of storage, transfer, or use of radioactive material
  - Instructed in health protection problems associated with exposure to radiation and radioactive material, procedures to minimize exposure, and purposes and functions of protective devices
  - Required to observe applicable provisions of NRC regulations and licenses for protection of personnel from exposure to radiation and radioactive material
  - Instructed of responsibility to promptly report to facility management any condition that may cause a violation of NRC regulations and licenses, or unnecessary exposures
  - Instructed in appropriate response to warnings made in event of any unusual occurrence or malfunction that may involve exposure to radiation and radioactive material
  - Advised of various notifications and reports to individuals that a worker may request in accordance with 10 CFR 19.13, "Notifications and Reports to Individuals"
- Personnel who have previously been trained for radiological, chemical, industrial, and criticality safety will receive (retraining) refresher training at least annually
- Records of training will be maintained in accordance with NWMI's Quality Assurance Program Plan (QAPP)

Radiation Work Control Procedures

- Work performed in restricted areas will be performed under a radiation work permit (RWP)
- Procedures controlling RWPs will be consistent with guidance provided in Regulatory Guide 8.10
- RWP may also be required whenever Radiation Protection Manager deems that one is necessary or when activities involve licensed materials not covered by operating procedures where radioactivity levels are likely to exceed airborne radioactivity limits
- Routine and nonroutine activities will be performed under an RWP that provides a description of work to be performed (i.e., defines authorized activities)
- RWP will summarize results of recent dose rate surveys, contamination surveys, airborne radioactivity results, and other relevant information
- Precautions to be taken by those performing any task
  - Personal protective equipment to be worn while working (e.g., gloves, respirators, personnel monitoring devices)
  - Stay-times or dose limits for work in area, recordkeeping requirements
  - Attendance of a radiation protection technician during work activities will be defined in RWP
  - Radiation Protection Manager or designee will approve RWP

Radiation Work Control Procedures (continued)

- RWPs will have a predetermined period of validity, with a specified expiration time
- Standing RWPs will be issued for routinely performed activities (e.g., tours)
- Determining need for issuing and closing out an RWP will be responsibility of Radiation Protection Manager (or designee)
- RWP procedures will require:
  - Reviewing planned activities, changes to activities inside restricted areas, or work with licensed materials for potential to cause radiation exposures that exceed action levels or produce radioactive contamination
  - Specifying requirements for any necessary safety controls, personnel monitoring devices, protective clothing, respiratory protective equipment, and air sampling equipment, and attendance of radiation protection technicians at work locations
  - Posting RWPs at access points to restricted areas, with copies of current RWPs posted at work area location
  - Clearly defining and limiting work activities to which RWPs apply
  - Closing out RWP when applicable work activity for which it was written is completed and terminated
  - Retaining RWP as a record at least for life of facility

Radiation Monitoring and Surveying

- Radiation monitoring and surveys will be conducted to:
  - Determine radiation levels, concentrations of radioactive materials, and potential radiological hazards that could be present in RPF
  - Detect releases of radioactive material from facility equipment and operations
- Radiation surveys will focus on those areas where occupational radiation dose limits could potentially be exceeded
- Measurements of airborne radioactive material and/or bioassays will be used to determine that internal occupational exposures to radiation do not exceed dose limits specified in 10 CFR 20, Subpart C, “Occupational Dose Limits”
- NWMI has established written procedures to ensure compliance with requirements of 10 CFR 20, Subpart F, “Surveys and Monitoring”
- Continuous airborne radioactivity monitors will provide indication of airborne activity levels in restricted areas of RPF
- When deemed necessary, portable air samplers may be used to collect a sample on filter paper for subsequent analysis in analytical laboratory
  - Monitor data will be collected for regular analysis and documentation
  - Monitors will be equipped with alarms and will activate when airborne radioactivity levels exceed predetermined limits

Monitoring

- Personnel monitoring
  - Three basic types of personnel monitoring equipment will be used during normal operations:

    Count rate meters (friskers) *Hand and foot monitors* *Portal monitors*
- Air Monitoring
  - Continuous air monitors (CAM) will be provided to provide indication of airborne activity
    - CAMs will be operated to collect continuous samples
    - Portable CAMs may also be deployed when deemed necessary (e.g., non-standard maintenance activities) → CAMs will be equipped with alarms
    - Alarm will be activated when airborne radioactivity levels exceed predetermined limits
    - Limits will be set with consideration given to both toxicity and radioactivity
    - Volume of air sampled may have to be adjusted to ensure adequate sensitivity with sampling time
    - Operating history of facility, along with changes in technology, room functions and design, and regulations, may necessitate adjustment of monitors
  - Exhaust stacks will be provided with CAMs for noble gases, particulate, and iodine
- Radioactive Liquid Monitoring
  - RPF will not discharge radioactive liquids → RPF will not have liquid effluent monitors

Radiation Exposure Control and Dosimeter

- RPF designed to prevent uncontrolled releases to work areas or environment during normal operations
- Goal of maintaining occupational internal and external radiation exposures ALARA encompasses an individual's dose and collective dose of entire working population
  - Because TEDE is sum of internal and external exposures → Radiation protection program addresses both contamination control and external radiation protection
- Process design for ALARA examples
  - Limit constant direct contact of personnel with radiological material
  - Ensure equipment and components are designed to include reliability, availability, maintainability, inspectability, constructability, etc. to reduce or eliminate need for repair or preventive maintenance
  - Provide design redundancy of equipment or components to reduce need for immediate repair when radiation levels may be high or when there is no feasible method available to reduce radiation levels
  - Design equipment and piping to minimize accumulation of radioactive materials
  - Provide for draining, flushing, or remote cleaning of equipment containing radioactive materials
- Facility design for ALARA examples
  - Incorporate ease of maintenance or repair, including ease of disassembly and modularization of components for replacement or removal to a lower radiation area for repair or disposal
  - Provide ability to remotely or mechanically operate, repair, service, monitor, or inspect equipment
  - Lay out facility so that access to a given area does not require passing through higher radiation zone area
  - Provide ability to operate equipment from accessible areas during normal/off-normal operating conditions
  - Provide areas outside of high radiation areas that equipment can be moved to for service

Control of Entry

- Entire RFP is considered a “controlled area”
  - RPF will include areas locked to limit access, and alarms and signals that alert workers to or prevent unauthorized entry into radiation areas, high radiation areas, and very high radiation areas
- RPF has five doors from outside to entrances into “restricted area”
  - Each door will have two credential access controls (e.g., fob/PIN, fob/biometric, or biometric/PIN)
  - RPF radiation protection program will require personnel to access assigned dosimetry and portable survey instrumentation (as needed, based on work authorized) from an as-yet unspecified location within RPF administrative area before entering restricted area
  - Portal survey monitoring will be in place at exit from restricted area into administrative area

Protective Equipment and Materials

- Personnel working within restricted areas will be required to wear appropriate personal protective clothing (PPE) as prescribed by RWP
- PPE selected based on contamination level in work area, anticipated work activity, worker health considerations, and consideration for nonradiological hazards present
- Following types of Protective clothing will be made readily available as necessary:
  - Cloth and disposable coveralls
  - Nonpermeable coveralls (plastic/rubberized)
  - Rubber and disposable shoe covers
  - Rubber and disposable gloves
  - Cotton liners
  - Cloth and disposable hoods
  - Full-face particulate respirators
  - Eye goggles
  - Face shields
  - Supplied-air respirators
  - Self-contained breathing apparatus
- Areas requiring protective clothing will be posted at each of associated entry points
- Based on air sampling results and work evolutions, Radiation Protection Manager will select appropriate respiratory protection required
- 10 CFR 20, Subpart H, “Respiratory Protection and Controls to Restrict Internal Exposure in Restricted Areas,” defines required elements respiratory protection program

Radiological Areas

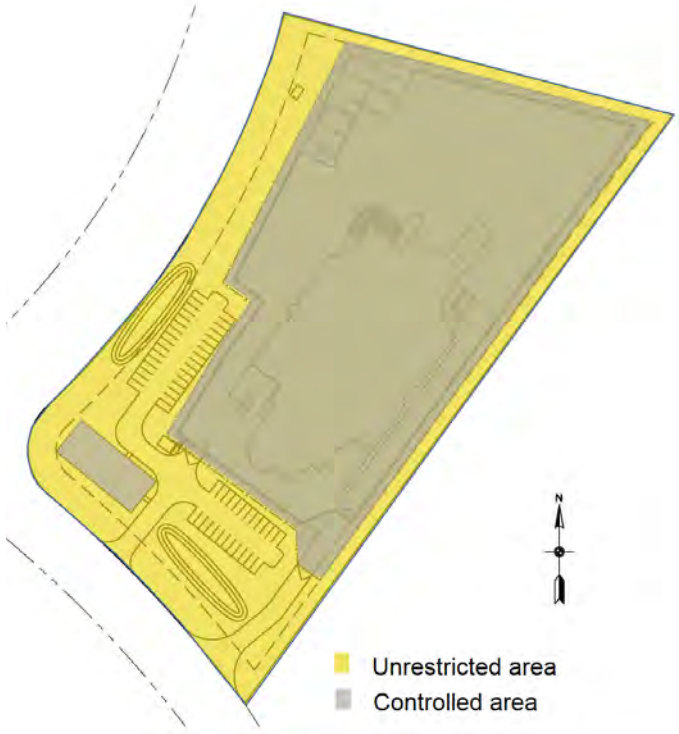
- Restricted Areas
  - Within RPF, access to and egress from a restricted area will be through a radiation protection control point; Monitoring equipment will be located at these points
  - All personnel will be required to self-monitor prior to exiting restricted areas that have potential for contamination and be trained in radiation protection procedures
  - RPF has four restricted areas
    - Radiation Area
      - Where radiation levels could result in an individual receiving a dose equivalent in excess of 0.05 mSv (5 mrem) in 1 hr at 30 centimeters (cm) (11.8 in.) from radiation source or from any surface that radiation penetrates
    - High Radiation Area
      - Area accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 1 mSv (100 mrem) in 1 hr at 30 cm (11.8 in.) from radiation source or from any surface that radiation penetrates
      - Within RPF, these areas will not normally be accessible to individuals during normal operations

Radiological Areas (continued)

- RPF has four restricted areas (continued)
  - Very High Radiation Area
    - Areas accessible to individuals, in which radiation levels exceed 5 sievert (Sv) (500 rem) in 1 hr at 1 m from source or from any surface that radiation penetrates (10 CFR 20.1003)
    - Hot cells within RPF (not normally accessible) are an example of a very high radiation area
    - Hot cells will be radiologically shielded and isolated from access to individuals by use of engineered physical barriers (e.g., shield blocks, locked shield doors)
  - Airborne Radioactivity Area
    - An airborne radioactive area is an area, room, or enclosure where airborne radioactive materials either exist in concentrations that exceed derived air concentrations (DAC) specified in 10 CFR 20, Appendix B, or where an individual present in area without respiratory protection equipment could exceed, during hours individual is present in a week, an intake of 0.6 percent of annual limit on intake or 12 DAC-hr
    - There are no identified permanent airborne radioactive areas with RPF

Radiological Areas (continued)

- Controlled Areas
  - Controlled area as an area outside of a restricted area but inside site boundary, in which licensee can limit access for any reason
    - For RPF → Controlled area is area within perimeter fence but outside restricted area and Administrative Building
  - Area fence will limit public access to controlled area
  - Access training to a controlled area will be provided commensurate with radiological hazard
  - Area monitoring will demonstrate compliance with public exposure limits for such visitors
  - NWMI personnel or contractor employees who work only in controlled area will be subject to exposure limits for public per 10 CFR 20.1301



  - Area monitoring is anticipated to comprise a combination of passive (e.g., TLD or OSL monitors) and active (e.g., energy-compensated G-M detector systems) monitoring systems located at points in controlled area
  - Instrumentation selection, range of detection, and alert/alarm setpoints will be consistent with intent to detect radiation and alert personnel to changing conditions

Radiological Areas (continued)

- Unrestricted area
  - Area that is not controlled or limited by licensee
  - For RPF → Areas not specifically included within definition of restricted and controlled areas will be considered unrestricted areas
  - Areas can be accessed by facility personnel and public
  - Unrestricted area is governed by limits in 10 CFR 20.1301
    - TEDE to individuals from licensed operation not to exceed 1 mSv (100 mrem) in a year (exclusive of background radiation) nor exceed 0.02 mSv (2 mrem) in any one hour

Personnel Monitoring and Assessment of Internal and External Dose

- Internal Dose
  - Internal exposures for selected personnel are evaluated via direct bioassay (e.g. in vivo body counting), indirect bioassay (e.g., urinalysis), or an equivalent technique
  - For soluble (Class D) uranium, 10 CFR 20.1201(e) limits worker intake to no more than 10 milligrams (mg) of soluble uranium in a week
    - RPF annual administrative limit for TEDE will be 0.02 Sv (2 rem)
    - Internal doses will be evaluated at least annually
  - CAM in airborne radioactivity areas may be performed to complement bioassay program
    - Alarm setpoints on CAMs in airborne radioactivity areas may be used to provide an indication that internal exposures may be approaching action limit
  - If facility annual administrative limit is exceeded, an investigation will be performed to determine what types of activities may have contributed to worker's internal exposure → Action limit based on ALARA principles

Personnel Monitoring and Assessment of Internal and External Dose (continued)

- External Dose
  - External dose will primarily be received from fission products produced from irradiated targets and associated processing
  - All personnel whose duties require entry into restricted areas will wear individual external dosimetry devices (e.g., passive dosimeters such as TLDs that are sensitive to beta, gamma, and neutron radiation)
  - External dosimetry devices will be evaluated at least quarterly to ascertain external exposures
  - NWMI's ALARA goal on radiation exposure is set at 5 mSv/yr (500 mrem/yr) based on an administrative limit of 10 percent of NRC limit of 0.05 Sv/yr (5 rem/yr) per 10 CFR 20.1201
  - If 25 percent of ALARA goal (1.25 mSv [125 mrem]) is exceeded in any quarter, an investigation will be performed to determine what types of activities may have contributed to worker's external exposure

Contamination Control

- Contamination will consist of two types:
  - Loose (removable) contamination
    - Can be removed from surfaces by smears and may contribute to airborne radioactivity and/or personnel contamination from routine activities
    - Loose contamination poses both an internal and external radiation hazard
  - Fixed contamination
    - Is not smearable and may only be reduced by using approved decontamination techniques, procedures, and equipment
    - Fixed contamination does not readily contribute to airborne radioactivity and/or personnel contamination from routine activities
    - Fixed contamination poses an external radiation hazard
- Routine Monitoring to Detect Contamination
  - Contamination survey monitoring will be performed for all process areas and areas in which radioactive materials are handled or stored
    - Surveys will include routine checks of non-process areas, including areas normally not contaminated
  - Monitoring will include direct radiation and removable contamination measurements
    - Survey procedures will be based on potential for contamination of an area and operational experience
    - All restricted areas will be surveyed at least weekly; change rooms will be surveyed at least daily
    - Various instruments (e.g., proportional counters, thin window G-M tubes) will be used to evaluate contamination levels

Contamination Control (continued)

- Access Control to Contamination Areas
  - Access control program will be established to ensure that:
    - Signs, labels, and other access controls are properly posted and operative
    - Restricted areas prevent spread of contamination and have appropriate signage
    - Step-off pads, change facilities, protective clothing facilities, and personnel monitoring instruments are provided in sufficient quantities and locations
  - For other areas, access control will be managed by administrative methods
  - Personnel who have not been trained in radiation protection procedures will not be allowed access to a restricted area without escort by other trained personnel
  - Access to and egress from a restricted area will be through one of monitor stations at particular restricted area boundary
  - Access to and egress from each radiation area, contaminated area, or airborne radioactivity area within restricted area will be individually controlled using monitor to prevent contamination spread
  - Skin and personal clothing contamination action levels at point of egress from restricted areas or other designated areas within restricted area will not exceed 2.5 becquerel (Bq)/100 square centimeter (cm^2) (150 disintegrations per minute [dpm]/100 cm^2) alpha or beta/gamma contamination (corrected for background)
  - Clothing contaminated above egress limits will not be released unless laundered to egress limits
  - If skin or other parts of body are contaminated above egress limits, reasonable steps that exclude abrasion or other damage will be undertaken to effect decontamination
  - High and very high radiation areas will not be accessible to individuals during normal operations

Contamination Control (continued)

- Anti-Contamination Techniques
  - RPF is designed to limit contamination, with processes and equipment that contain radioactive material designed to require as little maintenance as possible to ensure personnel radiation exposures are ALARA
  - Additional exposure reductions will be achieved by:
    - Removing as much radioactive material as possible from equipment and area prior to maintenance, thereby reducing intensity of radiation field
    - Providing adequate space for ease of maintenance to reduce length of time required to complete any task, thereby reducing time of exposure
    - Preparing and using procedures that include specifications for tools and equipment needed to complete assigned work activities
    - Conducting proper job planning, including practice on mockups
    - Reviewing previous similar jobs
    - Identifying highest contamination areas and communicating that information to workers prior to start of work

Environmental Monitoring

- Radiological environmental monitoring program will meet 10 CFR 20.1302 and will be used to verify:
  - Effectiveness of plant measures are used to control release of radioactive material
  - Measurable concentrations of radioactive materials and levels of radiation are not higher than expected based on effluent measurements and modeling of environmental exposure pathways
- Methods for establishing and conducting environmental monitoring
  - Regulatory Guide 4.1, *Radiological Environmental Monitoring for Nuclear Power Plants*
  - NUREG-1301, *Offsite Dose Calculation Manual Guidance: Standard Radiological Effluent Controls for Pressurized Water Reactors*
- Environmental Surveillance Program
  - Waterborne exposure pathway
  - Direct radiation exposure pathway monitoring using TLDs
  - Airborne exposure pathway monitored using continuous air samples
  - Ingestion exposure pathway

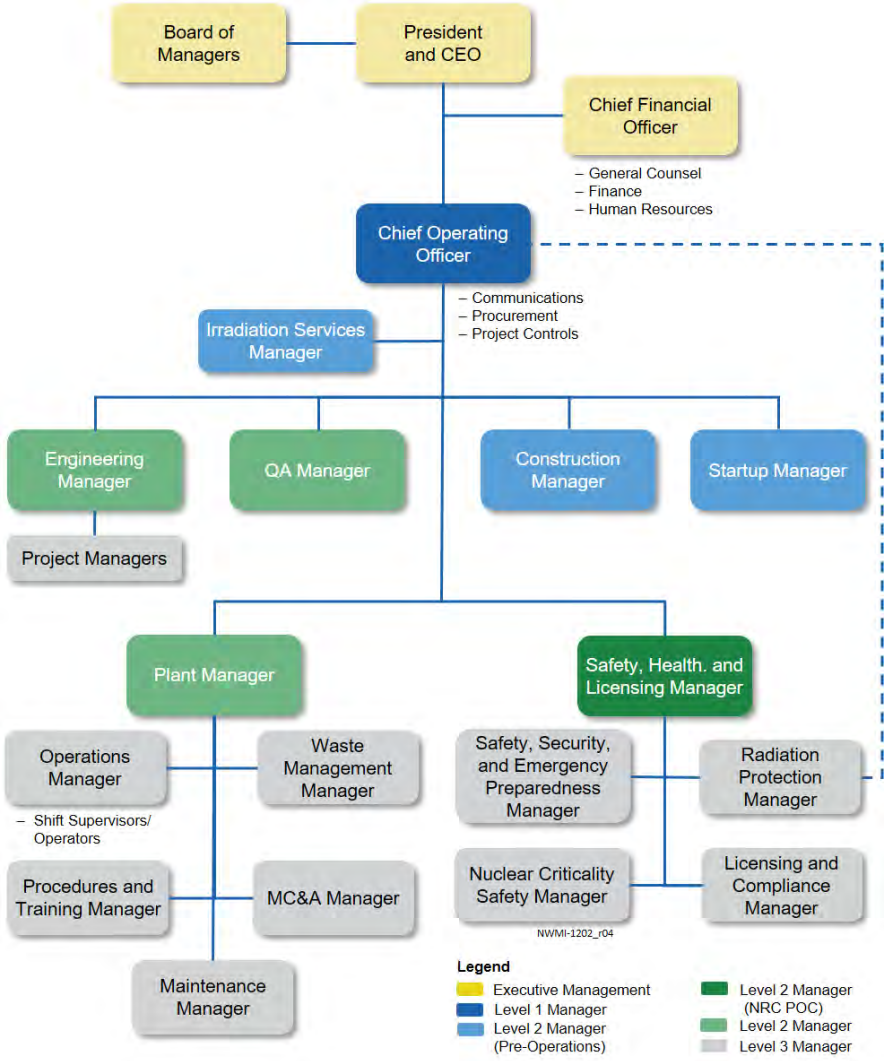
Radioactive Waste Management

- Waste management program will be coordinated with radiation protection program, and program management will report to Plant Manager
- Goal of waste management program is:
  - Minimize waste generation
  - Minimize exposure of personnel
  - Protect human health and environment
- Waste Management Policy
  - NWMI management is committed to ALARA philosophy for radioactive waste management

Conduct waste management operations in a manner that ensures health and safety of employees, contractors, and public, and to comply with all Federal, State, and local laws and regulations for generation, storage, packaging, transportation, and disposal of wastes generated

Waste Management Manager

- Reports to Plant Manager
- Roles and responsibilities include:
  - Implement waste management policy
  - Develop waste management procedures for processing, packaging, and shipment of waste
  - Oversee processing, packaging, and shipping waste
  - Provide technical input to design of equipment and processes
  - Provide technical input to waste management training program
  - Establish/maintain contractual relationships with waste disposal sites/radioactive waste carriers
  - Maintain working knowledge of waste acceptance criteria, standards, codes, etc.
  - Conduct self-assessments of waste management practices
  - Ensure compliance with procedures in accordance with waste management self-assessment program



NWMI RPF Organization Chart

Low-Level Radioactive Waste

- NRC divides low-level radioactive waste into three different classes
- Classes based on waste concentration and half-lives and types of radionuclides in waste
  - **Class A** – Waste consisting of radionuclides with shortest half-lives and lowest concentrations, with radioactivity levels that return to background levels within 100 years
  - **Classes B and C** – Waste containing greater concentrations of radionuclides with longer half-lives, fading to background levels in less than 500 years (must meet stricter disposal requirements than Class A waste)
  - **Greater than Class C** – Waste exceeds requirements for Class C waste and is responsibility of U.S. Department of Energy (DOE) under Federal law
- NWMI will implement pollution prevention and waste minimization activities that review associated processes and procedures to ensure that kinds and amounts of waste generated are minimized
- Waste management control include methods to:
  - Avoid inadvertent exposure of personnel or uncontrolled escape of radioactive materials
  - Maintain continuous control of radioactive materials that require treatment and management as waste

Control of Radioactive Wastes (continued)

- RPF will generate Class A, B, and C low-level radioactive waste
- Greater than Class C waste will not be produced
- Class A waste is low-dose waste, while Class B and C wastes are high-dose waste
- Solidified high-dose liquid waste will be either Class B or Class C waste
  - As a result of reducing waste volume and minimizing disposal costs, liquid waste concentration endpoint may change in final waste classification from Class B to Class C
- High-dose liquids will be designated as waste once liquids are collected in waste concentrate collection tank
- Low-dose condensate from high-dose concentrator held in condensate collection tank will be used as much as practical by uranium recovery process
- Low-dose liquids will be designated as waste once liquids are collected in low-dose evaporation tank
- Solids will be designated as waste once solid materials are loaded into waste drums

Release of Radioactive Waste

- Majority of radioactive waste being shipped from RPF will require special containers to provide for protection of public and environment
- Each of these containers is designed to meet applicable NRC and U.S. Department of Transportation (DOT) standards
- Waste released from RPF will be processed and packaged to meet waste acceptance criteria of an established disposal facility

Waste Produced in Radioisotope Production Facility

Description[a]	Matrix	Class	Annual generation
High-dose[b,c,d]	Solid	B or C	200,000 L (52,834 gal)
Low-dose[b,c]	Solid	A	150,000 L (39,625 gal)
Target cladding materials from disassembly encapsulated in cement	Solid	C	1,100 L (290 gal)
Exchange resins and other solid waste	Solid	C	1,370 L (365 gal)
Solid wastes encapsulated in cement	Solid	A	8,000 L (2,113 gal)
HEPA filters	Solid	A or C	28 m^3 (977 ft^3)
Carbon	Solid	A or C	0.14 m^3 (5.1 ft^3)[ae]
Iodine absorption	Solid	C	0.06 m^3 (2.1 ft^3)[bf]
Facility support waste (non-rad)	Solid	N/A	26,000 L (6,868 gal)
Facility support waste (rad)	Solid	A	40,000 L (10,566 gal)
Silicone oil	Liquid	A	100 L (26 gal)
Lab pack	Liquid	A	10 L (2.6 gal)
Solvent	Liquid	A	200 L (53 gal)

[a] Special nuclear material is not considered a waste. SNM will be returned to the U recovery and recycle system, purified, and reused. In addition, waste volume projections are based on the composite values from the MURR and OSTR mass balance calculations that assume an eight-target/week MURR processing rate plus a 30-target/week OSTR processing rate and will bound the planned operations.

[b] Caustic soda (NaOH) is included in the waste volume estimates.

[c] Waste solidification agents are included in the waste volume estimates.

[d] Nongaseous long-lived radioisotopes are contained in the high-dose liquid waste stream that is solidified and eventually sent offsite for disposal.

[e] Volume represents changeout of carbon beds every two years (1/2).

[f] Volume represent changeout of iodine absorption beds every five years (1/5).

Release of Radioactive Waste (continued)

- Solid radioactive waste
  - Majority of solid waste produced will be high- and low-dose waste
  - RPF will produce intermittent waste that includes HEPA filters, carbon absorption beds, and zeolite absorption beds
  - Waste samples will be analyzed in analytical laboratory to ensure that waste meets the disposal facility waste acceptance criteria
  - Waste will be stored for radioactive decay to meet shipping and disposal requirements, and then packaged in approved transportation casks for transport to disposal facility
- Liquid radioactive waste
  - RPF does not release any radioactive liquid waste
- Gaseous radioactive waste
  - Gases from RPF process and HVAC system will be processed/treated
  - Offgas system is designed to filter and/or retain these isotopes in facility until resulting release is at levels less than those defined in Table 2 of 10 CFR 20, Appendix B
  - Gaseous radioactive emissions will be released through three RPF exhaust stacks
  - Effluent will be continuously monitored

Control and Storage of Radioactive Waste (continued)

- Waste handling system is not geometrically safe → IROFS have been identified
  - IROFS RS-01, "Hot Cell Liquid Confinement Boundary"
  - IROFS RS-03, "Hot Cell Secondary Confinement Boundary"
  - IROFS RS-04, "Hot Cell Shielding Boundary"
  - IROFS RS-08, "Sample and Analysis of Low Dose Waste Tank Dose Rate Prior to Transfer Outside the Hot Cell Shielding Boundary"
  - IROFS RS-10, "Active Radiation Monitoring and Isolation of Low Dose Waste Transfer"
  - IROFS CS-14, "Active Discharge Monitoring and Isolation"
  - IROFS CS-15, "Independent Active Discharge Monitoring and Isolation"
  - IROFS CS-16, "Sampling and Analysis of Uranium Mass or Concentration Prior to Discharge or Disposal"
  - IROFS CS-17, "Independent Sampling/Analysis of U Concentration Prior to Discharge/Disposal"
  - IROFS CS-18, "Backflow Prevention Device"
  - IROFS CS-21, "Visual Inspection of Accessible Surfaces for Foreign Debris"
  - IROFS CS-22, "Gram Estimator Survey of Accessible Surfaces for Gamma Activity"
  - IROFS CS-23, "Non-Destructive Assay (NDA) of Items with Inaccessible Surfaces"
  - IROFS CS-24, "Independent NDA of Items with Inaccessible Surfaces"
  - IROFS CS-25, "Target Housing Weighing Prior to Disposal"
  - IROFS CS-26, "Active Discharge Monitoring and Isolation"
  - IROFS FS-01, "Enhanced Lift Procedure"
  - IROFS FS-02, "Overhead Cranes"

Respiratory Protection Program

- NWMI's radiological respiratory protection program is designed to comply with:
  - ANSI Z-88.2, *American National Standard for Respiratory Protection*
  - 10 CFR 20, Subpart H, *Respiratory Protection and Controls to Restrict Internal Exposure in Restricted Areas*
  - 29 CFR 1910.134, *Respiratory Protection*
- Respirators will only be issued if Radiation Protection Manager determines that engineering controls may be ineffective, total effective dose will be reduced by wearing respirators, and/or physical stress of wearing a respirator will not interfere with workers' health and safety
- Use of engineering controls is preferred over use of respirators to minimize radioactive materials in air
- However, there may be a need to control concentrations of radioactive material in air to maintain TEDE ALARA
  - Control of access
  - Limitation of exposure times
  - Use of respiratory protection equipment
  - Other controls

Respiratory Protection Program (continued)

- Radiological respiratory protection program will includes:
  - Monitoring, including air sampling and bioassays
  - Supervision and training of respirator users
  - Fit testing
  - Respirator selection
  - Breathing air quality
  - Inventory and control
  - Storage, issuance, maintenance, repair, testing, and quality assurance of respiratory protection equipment
  - Recordkeeping

Chapter 11 Questions?

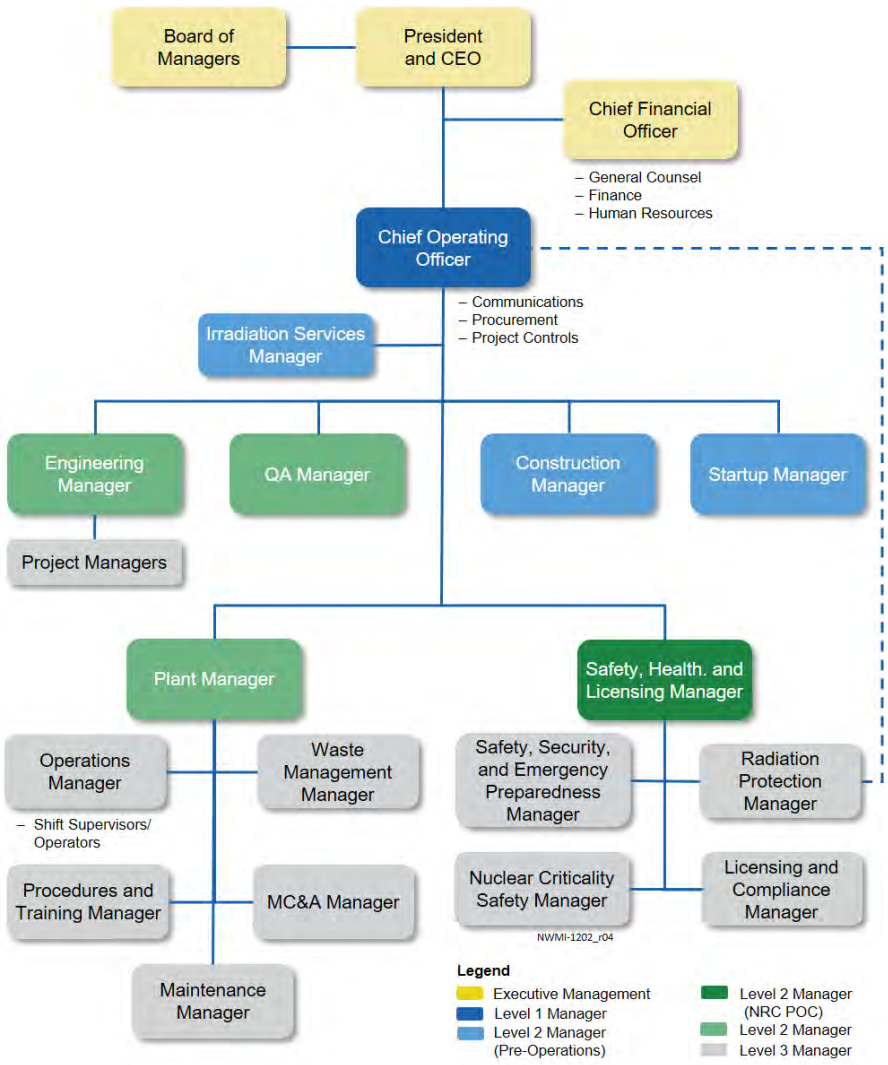
U.S. Nuclear Regulatory Commission
ACRS Subcommittee Review

Chapter 12 – Conduct of Operations

August 22, 2017

Conduct of Operations

- NWMI has the legal responsibility for holding the Radioisotope Production Facility (RPF) operating license.
- NWMI will provide sufficient resources in personnel and materials to safely conduct operations.
- Facility staffing considerations (e.g., minimum staffing levels, allocation of control functions, overtime restrictions, procedures, training) will be defined in the Operating License Application.
- NWMI will establish and maintain formal and informal indoctrination and training programs for facility personnel to ensure that suitable proficiency is achieved and maintained.
- Radiation protection program will meet 10 CFR 19 and 10 CFR 20, and be consistent with Regulatory Guide 8.2, *Guide for Administrative Practice in Radiation Surveys and Monitoring*.
- Safety program will be developed and integrated with radiological safety and other facility safety programs and will use methods described in 10 CFR 50, 10 CFR 70.61, and 10 CFR 70.62.



NWMI RPF Organization Chart

Review and Audit Committee

- Plant Manager will establish committee to ensure that appropriate technical expertise will be available
- Committee activities will be summarized and reported to Chief Operating Officer
- Independent audits will be conducted periodically and specified in the Operating License Application
- Items to be ***reviewed*** by Committee:
  - Determinations that proposed changes in equipment, systems, test, experiments, or procedures are allowed without prior authorization by responsible authority
  - New procedures and major revisions having safety significance, or proposed changes in production facility equipment or systems having safety significance
  - New experiments that could affect reactivity or result in releases of radioactivity
  - Proposed changes in technical specifications or the operating license
  - Violations of technical specifications and internal procedures or instructions having safety significance
  - Facility modification under 10 CFR 50.59, “Changes, Tests and Experiments”
  - Radiation protection program
  - Operating abnormalities having safety significance
  - Reportable occurrences
  - Audit reports

Review and Audit Committee (continued)

- All aspects of facility operations (e.g., radiation protection and laboratory programs, emergency preparedness plan, physical security plan, operator requalification plan) audited at least every two years
- Not all areas have to be audited in parallel, but all will be audited within designated intervals
- Each audit will have a plan prepared and implemented
- Items to be ***audited*** by Committee:
  - Facility operations for conformance to technical specifications and operating license conditions
  - Retraining and requalification program for RPF operating staff
  - Results of action taken to correct those deficiencies that may occur in RPF equipment, systems, structures, or methods of operations that affect nuclear safety
  - Emergency preparedness plan and implementing procedures
  - Deficiencies identified during audits will be entered into the NWMI corrective action program

Other Conduct of Operations Activities

- Procedures → Provide appropriate direction to ensure that the RPF is operated within its design basis and in compliance with technical specifications
- Required Actions → Required actions to be taken in the event of an RPF safety limit violation or the occurrence of a reportable event
- Reports → Required reports will be submitted to the NRC (e.g., environmental reporting, personnel exposures, generic operational parameters)
- Records → Records management program will define process for managing RPF records and will be consistent with requirements of applicable regulations (e.g., identification, generation, authentication, maintenance, and disposition of records) and will be provided in Operating License Application

Other Conduct of Operations Activities (continued)

- Emergency Planning → To be discussed later
- Security Planning → Draft developed using Regulatory Guide 5.59, *Standard Format and Content for a Licensee Physical Security Plan for the Protection of Special Nuclear Material of Moderate or Low Strategic Significance*, and will be updated in the Operating License Application
- Quality Assurance → To be discussed later
- Operator Training and Requalification → Will be provided in the Operating License Application
- Startup Plan → Will be be provided in the Operating License Application
- Material Control and Accountability → Will follow NUREG-1065, *Acceptable Standard Format and Content for the Fundamental Nuclear Material Control (FNMC) Plan Required for Low-Enriched Uranium*, and will be provided in the Operating License Application

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Chapter 12, Appendix A – Emergency Response Plan

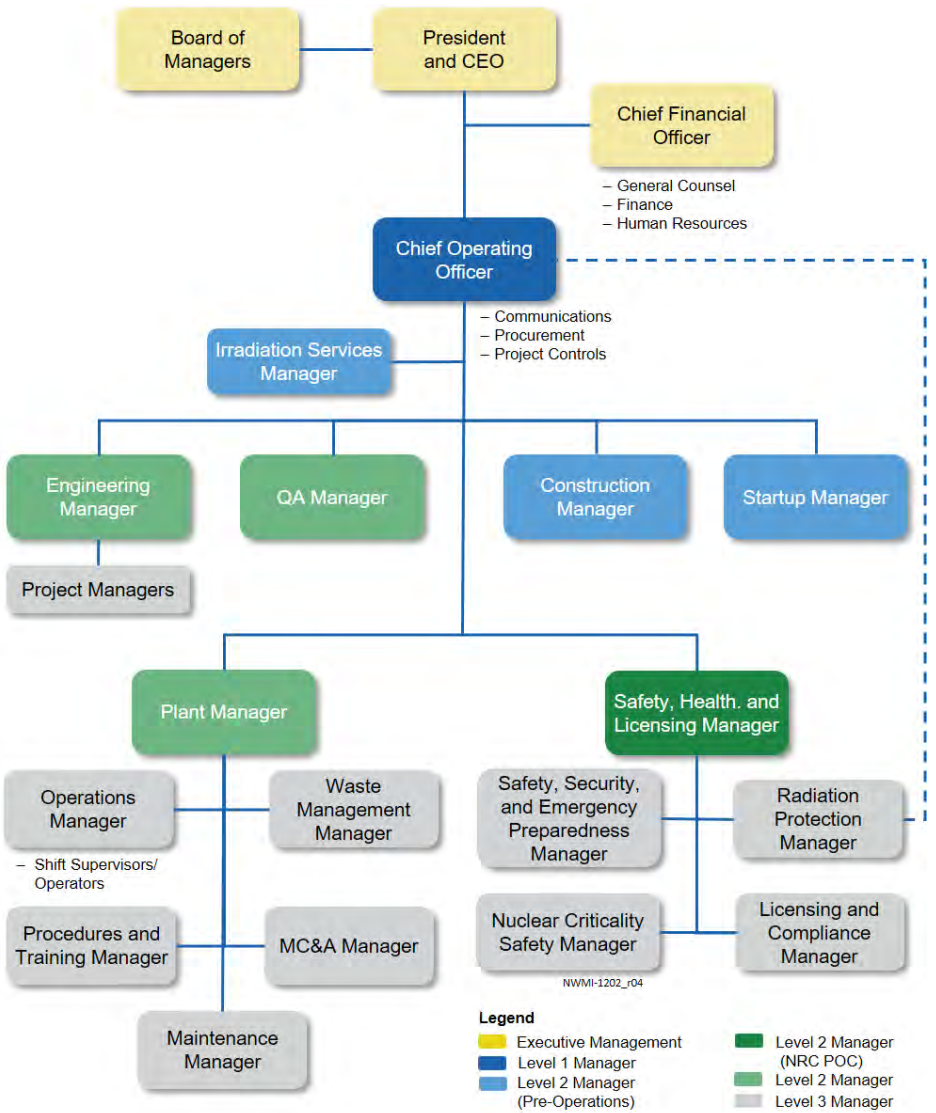
August 22, 2017

Technical Approach

- Format and content will follow ANSI/ANS-15.16, *Emergency Planning for Research Reactors*
- Additional guidance includes:
  - ISG augmented NUREG-1537 (NRC, 2012)
  - Regulatory Guide 2.6, *Emergency Planning for Research and Test Reactors*
  - NUREG-0849, *Standard Review Plan for the Review and Evaluation of Emergency Plans for Research and Test Reactors*
  - USNRC Information Notice 97-34
- Outline
  - Introduction
  - Definitions
  - Organization and Responsibility
  - Emergency Classification System
  - Emergency Action Levels
  - Emergency Planning Zone
  - Emergency Response
  - Emergency Equipment and Facilities
  - Recovery
  - Maintaining Emergency Preparedness

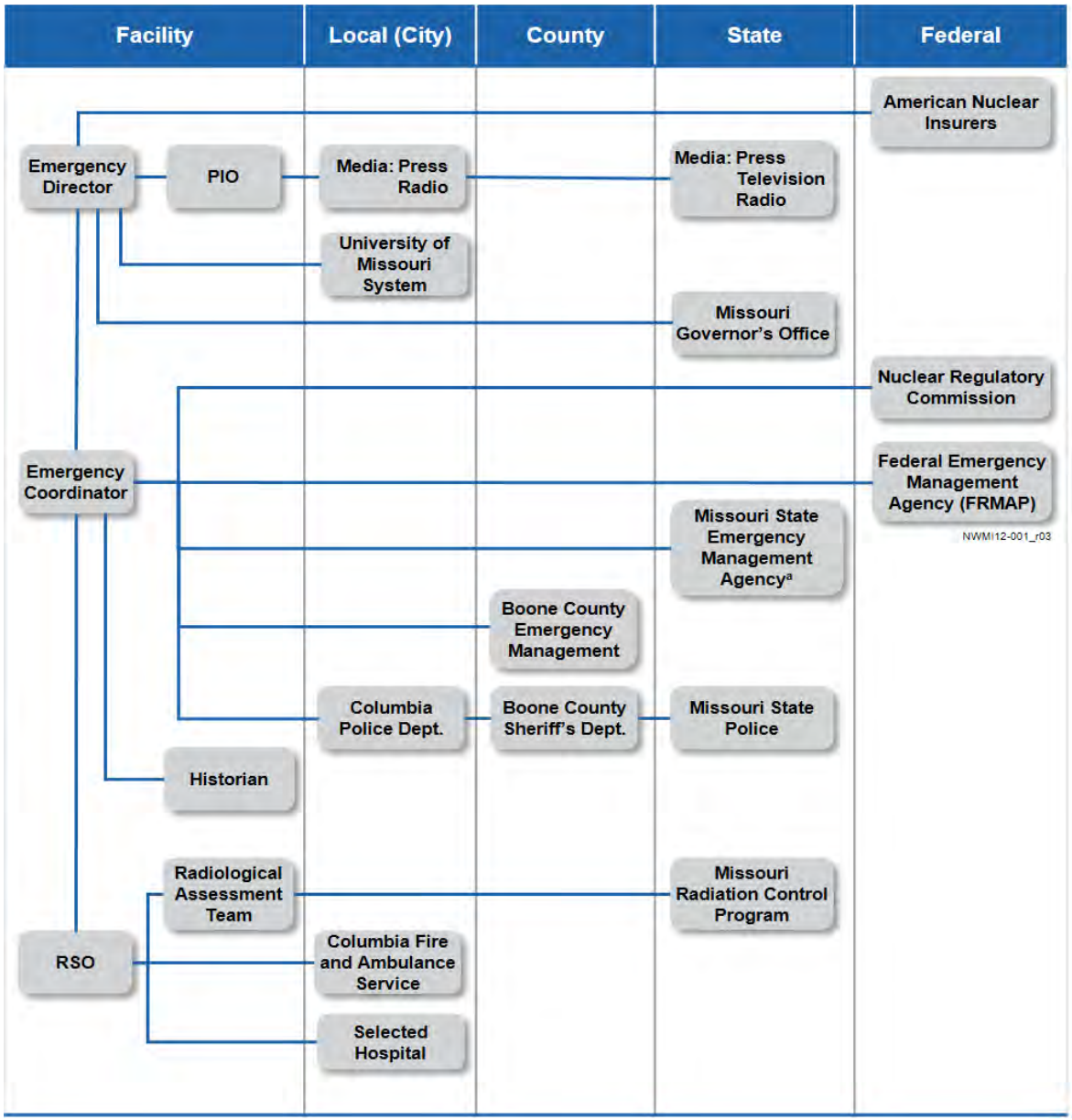
Organization and Responsibilities

- Identifies Federal, State, county, and local potential responding agencies and organizations
- Identifies NWMI organization and responsibilities
  - Primary responsibility for maintenance and implementation will rest with Safety, Security, and Emergency Preparedness Manager
- Emergency positions identified
  - Emergency Director
  - Emergency Coordinator
  - Radiation Safety Officer
  - Radiological Assessment Team
  - Public Information Officer
  - Historian



NWMI RPF Organization Chart

Organization and Responsibilities (continued)



[a] Missouri State Emergency Management Agency has responsibility for the State's formal Radiological Emergency Preparedness Program.

Emergency Classification System

- Personnel and Operational Emergency
- Notice of Unusual Events
  - Receipt of information threatening, or confirming, a breach in physical security
  - Receipt of information that a severe natural is likely to affect Columbia/Boone County area
  - An explosion or a fire in RPF complex lasting more than 15 minutes
  - Actual or projected radiological effluents with concentrations resulting in an unrestricted area total effective dose equivalent (TEDE) of 15 millirem (mrem) accumulated in 24 hours (hr)
- Alert
  - Actual or projected whole body radiation levels at site boundary of 20 mrem/hr for 1 hr, or a 100 mrem thyroid dose (committed dose equivalent [CDE]).
  - Actual or projected radiological effluents with concentrations resulting in an unrestricted area TEDE of 75 mrem accumulated in 24 hr
- Site Area Emergency – Not credible
- General Emergency – Not credible

Emergency Response

- Broken down by class of emergency
- Identifies high-level actions for:
  - Assessment
  - Corrective actions
  - Protective actions
- Emergency dose limits
- Access control
- Dosimetry

Maintaining Emergency Preparedness

- Initial and annual training
  - Facility personnel responsible for decision-making and transmitting emergency information and instruction
  - Facility personnel responsible for accident assessment and assistance (e.g., first responders)
  - Facility radiological monitoring and assessment team members
  - Medical support personnel at Boone and University Hospitals
  - Columbia Police Department personnel
  - University and Boone Hospital ambulance and emergency department personnel
- Annual emergency drills
- Annual review of the plan
- Equipment
  - Communications
  - Radiological detection instrumentation

Conclusions

- Draft plan provides a thorough approach to meeting RPF emergency response needs
- Consistent with applicable guidance
- Some details need to be included (e.g., instrumentation locations)
- Memorandums of Understanding will need to be established with local emergency response organizations
- Emergency plan is very similar to that found at University of Missouri Research Reactor (MURR)
- Initial conversations with local emergency responders have occurred → These responders are familiar with needs of the RPF due to familiarity with MURR emergency preparedness plan

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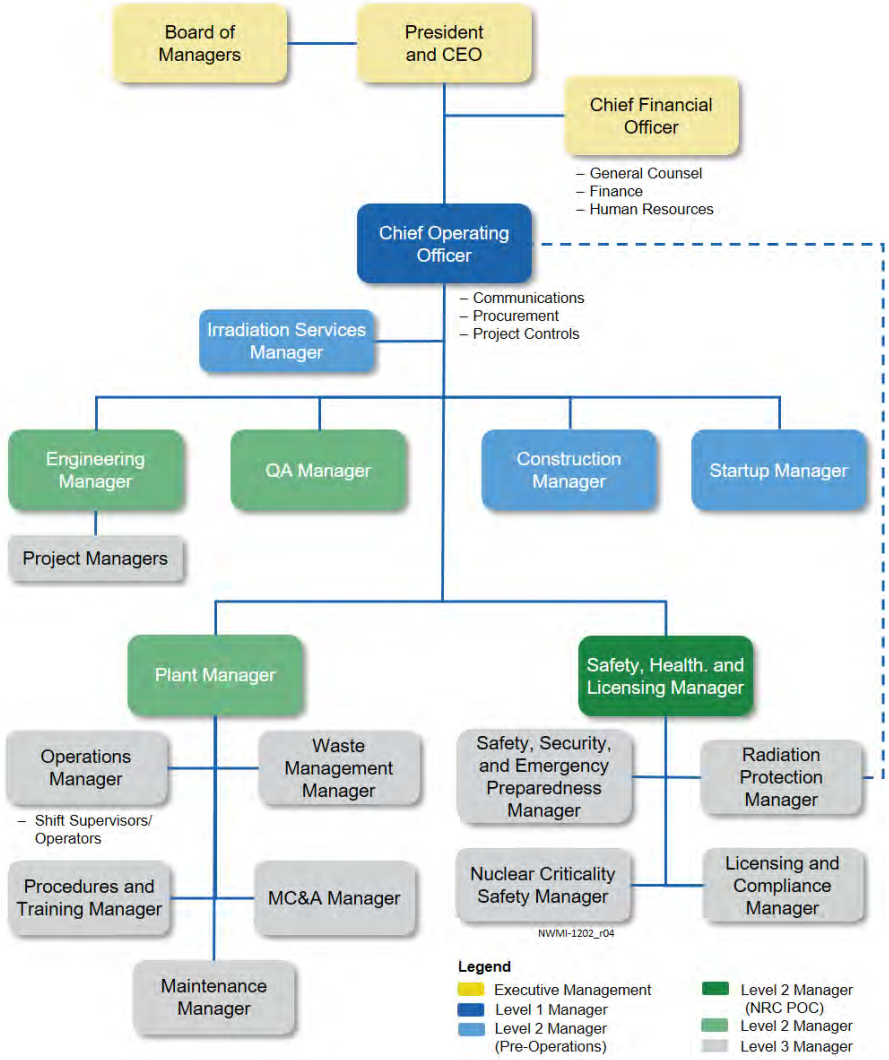
Chapter 12, Appendix C – Quality Assurance

August 22, 2017

Technical Approach

- NWMI Quality Assurance Program Plan (QAPP) describes policies and requirements necessary to meet applicable Federal regulations
  - ANSI/ANS 15.8, *Quality Assurance Program Requirements for Research Reactors*
  - Regulatory Guide 2.5, *Quality Assurance Program Requirements for Research and Test Reactors*
  - 10 CFR 70.64(a)(1), *Quality Standards and Records*
  - ISO-9001, *Quality Assurance Requirements*
- QAPP applies to all nuclear, quality-related projects and activities that require conformance to a nuclear quality assurance (QA) program



NWMI RPF Organization Chart

Quality Assurance Program Plan Compliance

Quality Assurance Program Plan Compliance with 10 CFR 50.34 and associated ANSI/ANS 15.8

	10 CFR 50.34 and associated ANSI/ANS 15.8 requirements[a,b]	QAPP reference	Focus
1	Organization	Section C2.1	• Quality assurance hierarchy • Organization responsibilities
2	Quality assurance program	Section C2.2	• Quality assurance hierarchy • Organization, personnel training and qualification
3	Design control (requirements, process, verification, document/records, commercial grade items change control)	Section C2.3 Section C2.5 Section C2.9	• Design control • Instructions, procedures, and drawings • Control of special processes
4	Procurement document control	Section C2.4	• Procurement document control
5	Procedures, instructions, and drawings	Section C2.5 Section C2.9	• Instructions, procedures, and drawings • Control of special processes
6	Document control	Section C2.6	• Document control
7	Control of purchased items and services (supplier selection, work control, verification, item or service acceptance)	Section C2.7	• Control of purchased items and services
8	Identification and control of items	Section C2.8	• Identification and control of items
9	Control of special processes	Section C2.9	• Control of special processes
10	Inspections	Section C2.10	• Inspections
11	Test control	Section C2.11	• Test control
12	Control of measuring and test equipment	Section C2.12	• Control of measuring and test equipment
13	Handling, storage, and shipping	Section C2.13	• Handling, storage, and shipping
14	Inspection, test, and operating status	Section C2.10 Section C2.11 Section C2.14	• Inspections • Test control • Inspection, test, and operating status
15	Control of nonconforming items and services	Section C2.15	• Identification and control of nonconforming items
16	Corrective actions	Section C2.16	• Corrective action
17	Quality records	Section C2.17	• Quality assurance records
18	Assessments	Section C2.18	• Audits, assessments, and surveillances
19	Experimental equipment		• Not applicable; no experimental equipment

[a] 10 CFR 50.34, "Contents of Applications; Technical Information," Code of Federal Regulations, Office of the Federal Register, as amended.

[b] ANSI/ANS 15.8, Quality Assurance Program Requirements for Research Reactors, American National Standards Institute/American Nuclear Society, LaGrange Park Illinois, 1995, R2005, R2013.

QA Organization Responsibilities

- Maintaining QAPP
- Reviewing and approving implementing procedures
- Reviewing and approving supplier QA programs
- Providing oversight of supplier QA program implementation
- Performing QA technical reviews of procurement documents
- Maintaining approved suppliers list (ASL)
- Administering corrective action and nonconformance process
- Administering auditor and lead auditor certification process
- Monitoring implementation of QAPP and assessing its effectiveness through audit and surveillance
- Investigating any aspect of QAPP to identify problems with execution, and verifying that corrective action is taken in a timely manner
- Stopping unsatisfactory work or controlling further processing when warranted for safety considerations
- Attending status meetings, and staying informed regarding day-to-day activities to ensure adequate oversight
- Providing quality control (QC) activities for purchased and in-house manufactured items

Activities Affected by QAPP

- Design activities
- Quality-affecting procurement activities
- Fabrication activities
- Repairs, modifications, decommissioning, and site remediation
- Waste treatment
- Facility and site operation activities
- Audit, inspection, and surveillance activities
- Testing activities
- Equipment manufacturing
- Technical support/consulting
- Handling, storage, shipping, and receiving activities

Graded Approach

- QAPP employs a graded approach to achieve NWMI's environmental, safety, quality, and compliance goals that results in productive, efficient, and cost-effective work performances
- QAPP shall:
  - Provide for planning and accomplishing activities affecting quality under suitably controlled conditions
    - Controlled conditions include use of appropriate equipment and suitable environmental conditions for accomplishing activity to ensure that prerequisites for given activity have been satisfied
  - Identify special controls, processes, test equipment, tools, and skills to attain the required quality of activities and items and for verification of that quality
    - Responsible organizations will establish and implement the necessary controls and processes to detect and correct quality problems
  - Provide controls over activities affecting quality to an extent consistent with their importance

Grade Approach (continued)

- Structures, systems, and components (SSC) in the RPF are classified as safety-related and non-safety-related:
  - **Safety-related** is a classification applied to items relied on to remain functional during or following a postulated design-basis event (DBE) to ensure:
    - Integrity of facility infrastructure
    - Capability to shut down RPF and maintain in a safe shutdown condition
    - Capability to prevent or mitigate consequences of postulated accidents identified through accident analyses that could result in potential off-site and worker exposures comparable to applicable guideline exposures set forth in 10 CFR 70.61(b), 10 CFR 70.61(c), and 10 CFR 70.61(d)
    - Operation of RPF without undue risk to health and safety of workers, public, and environment to meet 10 CFR 20 normal release or exposure limits for radiation doses and applicable limits for chemical exposures
  - **Safety-related IROFS** – SSCs identified through accident analyses that are required to meet performance requirements of 10 CFR 70.61(b), 10 CFR 70.61(c), and 10 CFR 70.61(d)
  - **Safety-related Non-IROFS** – SSCs that provide reasonable assurance RPF can be operated without undue risk to health and safety of workers, public, and environment, and includes SSCs to meet 10 CFR 20 normal release or exposure limits
  - **Non-safety-related** – SSCs related to the production and delivery of products or services that are not in above defined safety classifications

Graded Approach (continued)

- **Quality Level (QL) 1** will implement the full measure of QAPP and will be applied to safety-related SSC items relied on for safety (IROFS), including items in which failure or malfunction could directly or indirectly result in a condition that adversely affects workers, public, and/or environment, as described in 10 CFR 70.61
  - Items to prevent nuclear criticality accidents (e.g., preventive controls and measures to ensure that under normal and credible abnormal conditions, all nuclear processes are subcritical)
  - Items credited to withstand credible design-bases external events (e.g., seismic, wind)
  - Items to prevent degradation of structural integrity (e.g., failure or malfunction of facility)
- **QL 2** will be applied to non-QL 1 safety SSCs
  - QA program is important to acceptability and suitability of item or service to perform as specified
    - SSCs to meet 10 CFR 20 normal release or exposure limits
    - Fire protection systems
    - Safeguards and security systems
    - Material control and accountability systems
- **QL 3** will include non-safety-related quality activities that are deemed necessary to ensure manufacture and delivery of highly reliable products and services to meet or exceed customer expectations and requirements
  - QL 3 items are controlled in accordance with standard commercial practices

Stop Work Authority

- All NWMI employees will be empowered with authority to stop work when observing unsatisfactory work or unsafe conditions that may threaten quality, health, and safety of workers, the public, or environment
- Such conditions shall be immediately reported to NWMI management for corrective action evaluation
- Any work that has been stopped will be processed for restart relative to and commensurate with complexity and significance of conditions preceding stopped work activities
- All stopped work will be documented as to condition and corrective action taken prior to resumption of work

Design Control

- Processes to be implemented to ensure that SSCs designed by or for RPF are defined, controlled, and verified
  - Design of SSCs is affected by design input, analysis, verification, and interfaces
  - Design changes will be consistently controlled throughout design life-cycle
- Design control measures will ensure that design activities are accomplished on a timely basis and translated into design documents
  - Design inputs will be specified to the level of detail necessary to enable design process to be carried out in a correct manner and to provide a consistent basis for making design decisions, accomplishing design verification, and evaluating design changes
  - Applicable design inputs will be identified and documented, and their selection reviewed and approved
  - Design changes, including field changes, will be controlled in a manner consistent with that applied to original design
- Design activities, interfaces, and documents will be controlled to ensure that applicable inputs (e.g., design basis, regulatory requirements, codes, and standards) are correctly translated into final design

Document Control

- Establishes requirements for preparation, review, issuance, change control, and distribution of project and other quality-related documents that are developed by NWMI or its subcontractors
- Preparation, issue, and change of documents that specify requirements that affect quality will be controlled to ensure that correct documents are used
- Document control system will be documented, and:
  - Identify documents to be controlled and their specified distribution
  - Identify assignment of responsibility for preparing, reviewing, approving, and issuing documents
  - Specify review of documents for adequacy, completeness, and correctness prior to approval and issuance
  - Major changes to controlled documents will be reviewed and approved by the same organizations that performed the original review and approval, unless other organizations are designated

Records Management

- NWMI senior management will establish a records system, consistent with schedules for accomplishing the work activities
- Records will be distributed, handled, and controlled and implemented in accordance with written procedures or instructions
- Records will furnish documentary evidence that items or activities meet specified quality requirements
- Records for QA purposes will furnish documentary evidence that items or activities meet specified quality requirements
- NWMI-QA-PRO-017 (Rev 1), *Quality Records*, identifies the process by which quality records are identified and maintained
  - Items identified in Section 6.1 of the procedure as quality documents are relevant to final design and construction of the RPF

Assessments and Facility Operations

- Assessments
  - Processes and expectations to implement a system of audits, assessments, and surveillance of activities affecting quality
  - Processes are intended to ensure that audits, assessments, and surveillances are planned, scheduled, and conducted to identify strengths and weaknesses that affect organizational and company objectives
- Facility Operations
  - Describes elements of QAPP for RPF conduct of operations
  - Requirements will be applied to any equipment or operation, as appropriate, and be consistent with its potential safety impact or program goals
  - Many program requirements will be satisfied by existing documentation or by procedures and activities required by other requirements, design standards, and Federal or State guidelines
  - Several requirements of the QA program for operations may be found in other documents (e.g., training program, emergency preparedness plan, security plan, technical specifications) and will not be duplicated in QAPP

Conclusions

- NWMI is committed to establishing, implementing, and maintaining a QAPP to ensure that all activities and processes are planned, reviewed, controlled, and verified for compliance with applicable Federal regulations, national standards, and contractual requirements
- NWMI is committed to fostering a culture that provides for a sustained and continuous quality improvement atmosphere such that our internal processes are continually examined, challenged, and improved for our benefit and that of our customers
- QAPP applies to all nuclear, quality-related projects and activities that require conformance to a nuclear quality assurance program
- Will use a graded approach to quality → A process by which the level of analysis, documentation, and actions necessary to comply with a requirement is commensurate with the safety significance
  - A graded approach permits the implementing organization to focus resources on those activities that are deemed, by qualitative analysis, to reduce the associated risks and hazards
  - Activities and tasks are performed in accordance with approved implementing procedures

Chapter 12 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

Chapter 9
Auxiliary Systems

U.S. Nuclear Regulatory Commission

August 22, 2017

Introductions

- **Michael Balazik** - Project Manager, Research and Test Reactors Licensing Branch, Division of Policy and Rulemaking, Office of Nuclear Reactor Regulation
- **Alexander Adams, Jr.** - Chief, Research and Test Reactors Licensing Branch, Division of Policy and Rulemaking, Office of Nuclear Reactor Regulation
- **Stephen Alexander** - Technical Reviewer, Information Systems Laboratories, Inc.
- **Mollie Semmes** - Fire Protection Engineer, Enrichment and Conversion Branch, Division of Fuel Cycle Safety, Safeguards, and Environmental Review, Office of Nuclear Material Safety and Safeguards

Regulatory Basis and Acceptance Criteria

- Regulatory Requirements
  - 10 CFR 50.34, “Contents of applications; technical information,” paragraph (a), “Preliminary safety analysis report.”
  - 10 CFR 50.35, “Issuance of construction permits.”
  - 10 CFR 50.40, “Common standards.”
- Acceptance Criteria
  - NUREG-1537, Part 2, “Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors, Standard Review Plan and Acceptance Criteria.”
  - Interim Staff Guidance Augmenting NUREG-1537, Part 2, “Guidelines for Preparing and Reviewing Applications…for Licensing Radioisotope Production Facilities…”

NWMI RPF Auxiliary Systems

- NWMI radioisotope production facility (RPF) auxiliary systems provide support functions for various RPF main systems described in other preliminary safety analysis report (PSAR) chapters. Some auxiliary systems support safe shutdown of the RPF, maintaining it in a safe shutdown condition, and limiting offsite release of radioactivity in excess of regulatory requirements in postulated design-basis events.
- Auxiliary systems are designed for high reliability and durability through redundancy and diversity, using quality assurance in design, manufacturing, procurement, and installation.

NWMI RPF Auxiliary Systems

- 9.1 - Heating, Ventilation and Air Conditioning (HVAC)
- 9.2 - Material Handling (PSAR Chapter 4.0)
- 9.3 - Fire Protection
- 9.4 - Communications
- 9.5 - Possession and Use of Byproduct, Source, and Special Nuclear Material
- 9.6 - Cover Gas Control in Closed Primary Coolant Systems
- 9.7 - Other Auxiliary Systems

Staff Review Process

- Evaluated technical information contained in:
  - PSAR Chapter 9.0, “Radioisotope Production Facility Auxiliary Systems”
  - Requests for information (RAI) responses
  - PSAR, Revision 1(July 2017)
- Review used
  - Applicable regulatory requirements, guidance and acceptance criteria
  - Codes and standards (regulations, guidance, PSAR)
- Assessed sufficiency of preliminary design for construction permit (CP) issuance
  - Design criteria
  - Design bases
  - Design information (Structures, systems, and components (SSCs), operating characteristics, unusual or novel design features, and principal safety considerations)
- Determines if there is reasonable assurance that
  - Final design will conform to the design basis
  - No undue risk to the health and safety of the public
  - No undue adverse impact on the environment

Summary of Application – HVAC Systems

Design Basis

- Confining hazardous chemical fumes
- Preventing release of airborne radioactivity
- Maintaining ingestion of airborne radioactivity as-low-as-reasonably-achievable (ALARA)
- Providing HVAC for workers/occupants
- Providing makeup air and conditioned environment for equipment

Summary of Application – HVAC Systems (continued)

System Description – Including tables and diagrams

- Facility Ventilation System – cascading pressure zones
  - Zone IV – Clean Zone – Separate, Positive Pressure, admin, utility maintenance, truck bays, spaces
  - Zone III - potentially contaminated, lower pressure, tertiary confinement, structural components of corridors surrounding operating galleries and mechanical mezzanine
  - Zone II – lower pressure than III, potentially more contaminated, secondary confinement, structural enclosures of laboratories with glove boxes and fume hoods, HEPA filter rooms, Zone II ventilation exhaust subsystem
  - Zone I – lowest pressure, potentially most contaminated, primary confinement barrier, glove boxes, vessels, tanks, piping, hot cells, Zone I exhaust subsystem.
  - Boundaries – piping, ducts, dampers, filters, structure, air locks
  - Supply Air Subsystem – outside air, heating and cooling, makeup air
  - Exhaust Air Subsystems (Zone I, Zones II & III, laboratory) – Fan-driven flow, damper-controlled (auto and manual isolation), HEPA filters and carbon adsorbers

Summary of Application – HVAC Systems (continued)

- Process Offgas Treatment System (POTS)
  - Iodine removal unit (IRU) for target dissolution offgas system
  - IRU for uranium (U), molybdenum (Mo), and waste accumulation tanks
  - Process vessel ventilation system
  - Waste handling systems
  - Target fabrication ventilation system

- Cleanroom Subsystem

Summary of Application – HVAC Systems (continued)

Operational Analysis and Safety Functions

- Chapters 11.0 and 13.0 – analyses of normal and off-normal HVAC operation
- Defense in depth – failure of air balance system not in itself an accident, but failure of mitigating system, multiple levels of confinement, U not in form that would contribute to release of airborne radioactivity, U solutions in closed systems
- Items relied of for safety (IROFS) – designated per Chapter 13.0 analysis, Zone I exhaust ventilation subsystem, components of dissolver offgas subsystem and process vessel vent system, exhaust stack height
- Safety Functions – Engineering Safety Features (ESFs), IROFS, and safety functions in PSAR Chapter 6.0
- Confinement – ESFs, Boundary/barriers and shielding surrounding radioactive materials and associated ventilation SSCs (piping, ducting, dampers, filters, penetrations, walls, floors, ceilings, doors, airlocks)
  - Primary Confinement (pressure boundary) – process vessel ventilation system (IROFS)
  - Secondary Confinement - Zone I exhaust ventilation subsystem - IROFS (RS 03, "Hot Cell Secondary Confinement Boundary") – enclosing vessels and process offgas within hot cells, Zone II exhaust subsystem
  - Tertiary Confinement (Zone III, including Zone III exhaust subsystem)

Summary of Application – HVAC Systems (continued)

Instrumentation & Control (I&C)

- HVAC control & monitoring discussed in PSAR Chapter 7.0.
- PSAR Table 9-2 summarizes the HVAC system parameters (in general), indicates monitored or alarmed, not whether initiate automatic functions
- PSAR Section 9.1.4 states that the system sequence of operation will be developed and provided in operating license (OL) application

Technical Specifications – FSAR Chapter 14.0 as part of OL application

Staff Review – HVAC Systems

- RAIs
  - PSAR Section 9.1.1 provided the design basis elements for the HVAC system and PSAR Chapter 3.0 provided design basis functions and values for the HVAC systems. Discrepancies in design basis information between the two chapters and inconsistent terminology, which made it difficult to determine system boundaries.
  - PSAR stated that space temperature control will not be provided for Zone I spaces unless thermal loads are expected to cause temperatures to exceed equipment operating ranges without additional cooling. NWMI didn't explain the circumstances that result in temperature exceeding equipment operating ranges.
- In its November 2016 RAI response to the RAIs, NWMI explained how it intended to address the RAI issues.
- In Revision 1 to the PSAR, NWMI satisfactorily incorporated its proposed resolutions of concerns in RAIs.

Summary of Application – Fire Protection

High-level, functional description of the RPF fire protection system preliminary design

Design Basis

- Fire detection and suppression
- Notification, and transmission of the notification to the central alarm station and control room
- Suppression of small fires
- Prevention of small fires from becoming large fires

Staff Review – Fire Protection

- Reviewed the information presented in NWMI PSAR Section 9.3, “Fire Protection Systems and Programs,” as supplemented by the RAI responses.
- Areas of review included the discussions of potential fires; provisions for early detection; methods for isolating, suppressing, and extinguishing fires; passive fire protection. features; and emergency response capabilities
- A preliminary fire hazards analysis (PFHA) was developed.

Staff Review – Fire Protection (continued)

- PSAR, Section 9.3.2.1 discusses the fire suppression system, which consists of an automatic sprinkler system, a HEPA filter plenum deluge, glovebox fire suppression, fire extinguishers, and fire hydrants.
- The hot cell area will have sprinklers and be enclosed with a two-hour fire barrier. Staff asked an RAI about the type of fire suppression system that will be used in the specific hot cells. NWMI indicated in its response that the hot cell fire suppression system will be described in the FSAR.

Staff Review – Fire Protection (continued)

- PSAR, Section 9.3.2.2 describes the fire detection and alarm system, which consists of smoke and heat detectors, manual pull stations, smoke detection for ventilation systems, and glovebox heat detectors.
- HEPA filters will be equipped with duct heat detectors and fire water spray systems.
- In response to an RAI, NWMI indicated that a combustible loading administrative control program will be provided with the FSAR.

Staff Review – Fire Protection (continued)

- PSAR Section 9.3.2.2, describes the emergency response capabilities for the facility.
- The Columbia Fire Department (that also services the University of Missouri - Columbia research reactor) will respond in the event of a fire.
- The fire department to be notified automatically through detectors or manually via a fire alarm pull station.

Conclusions – Fire Protection

- NWMI should adhere to National Fire Protection Association (NFPA) 801, “Standard for Fire Protection for Facilities Handling Radioactive Materials” in the FSAR.
- The level of detail is sufficient for the purposes of issuing a CP, and detail needed (e.g. information on selection of systems, FHA) to complete the safety analysis can be seasonably left for, and will be provided, in the FSAR.

Summary of Application – Communications Systems

Design Basis

- Communications during normal and emergency conditions between vital areas of the RPF and the Administration Building
- Capability for operators/designated staff to announce emergency in all areas of the RPF
- Provide two-way communications between all operational areas and the control room
- Function consistent with safety and protection of the environment
- Compliance with Electronic Industries Alliance and Telecommunications Industry Association

System Description

- High-level functional description
- Assertion that system functions and features satisfy design basis – not inconsistent
- No drawings or detailed specifications for communication system at this stage of preliminary design, but fiber-optic and copper conductors mentioned

Summary of Application – Communications Systems (continued)

Operational Analysis – Chapter 13.0 accident analysis does not credit the communications system

I&C – NWMI refers to PSAR Chapter 7.0

TS – NWMI will identify in FSAR Chapter 14.0

Summary of Application – Cover Gas System

- A process function rather a single system.
- Sweep/purge gas system with plant and instrument air system, cooling water collection tanks, and process vessel vent system.
- Prevent hydrogen explosions - damage/injury to facility SSCs/personnel - possible uncontrolled release of radioactivity
- Dilutes hydrogen and oxygen mixtures (from radiolysis of process vessel cooling water) in chilled water system by sweep/purge gas
- Hydrogen kept below 25 percent of the lower flammability limit of 5 percent
- Accident analysis is in PSAR Chapter 13.0
- No preliminary IROFS identified for this process function
- Certain functions of the process vessel vent system are IROFS

Summary of Application – Other Auxiliary Systems (continued)

Utility System Design Bases

- Malfunctions do not cause accidents or uncontrolled release of radioactivity.
- If radioactive material is released by operation of utility systems, exposures remain within 10 CFR Part 20 limits and ALARA.
- No function or malfunction of the utility systems will interfere with or prevent safe shutdown of the RPF
- Provide saturated steam to various process equipment
- Provide chilled water to various process equipment during normal operations
- Provide demineralized water to the process steam and cooling water systems
- Provide plant air for instrument air, air-diaphragm pump power, mechanical tools, and grouting material conveyor
- Provide instrument air for bubblers and valve actuation
- Provide nitrogen, helium, and hydrogen to the reduction furnace, and nitrogen and oxygen to the dissolvers
- Provide purge/sweep gases for cover gas control in closed cooling systems

Summary of Application – Other Auxiliary Systems (continued)

Utility System Descriptions

- Functional description of each utility system
- Tables and diagrams

Operational Analysis

- PSAR Chapter 13.0 evaluates accident sequences that involve fissile solution or solid materials being introduced (leaks, backflows) into systems not normally designed to process these solutions or solid materials
- IROFS identified

I&C – NWMI refers to PSAR Chapter 7.0

TS – NWMI will identify in FSAR Chapter 14.0

Summary of Application – Analytical Laboratory

Design Basis

- On-site analysis to support the production of Mo-99 product and fabrication of targets for irradiation
- On-site analysis to support recycle of uranium
- Samples analyzed in glove boxes or hoods as required for
  - Mass, concentration and purity of SNM
  - Concentration of Mo-99 product and product impurities
  - Process stream chemical and radionuclide concentrations
  - Chemical and radionuclide analysis for waste handling and disposition
- Analyses required to:
  - Verify acceptable Mo-99 product to ship
  - Confirm uranium content
  - Determine adjustments for feed tanks and other associated adjustments
  - Verify that recycled uranium complies with product specification
  - Ensure compliance with waste acceptance criteria

Summary of Application – Analytical Laboratory (continued)

System Description

- Hoods to complete sample preparation, waste handling, and standards preparation
- Hoods for specialty instruments, including an ICP-MS and kinetic phosphorescence analyzer
- Glovebox for ICP-MS
- Gloveboxes for sample delivery and preparation prior to sample transfer to hoods
- Countertops for the gamma spectroscopy system, low-energy photon spectroscopy, alpha spectroscopy system, liquid scintillation system, and beta-counting system
- Storage for chemical and laboratory supplies
- Benchtop systems, such as balances, pH meters, and ion-chromatography
- Diagram of lab layout and list of instruments

Summary of Application – Analytical Laboratory (continued)

Operational Analysis

- Chapter 13.0 analysis
  - Evaluates lab accident sequence S.R31, “Chemical Burns from Contaminated Solutions During Sample Analysis
  - Chemical safety process upsets in areas without significant fissile or high-dose licensed material present (chemical storage, laboratory)
  - No laboratory IROFS identified
- Defense-in-depth
  - Set protocols on sampling and analysis (sampling locations & techniques, containers, transport routes, analysis procedures, reagents, equipment, residue disposal)
  - Procedures evaluated for standard safety protocols for chemicals and equipment

I&C – NWMI referes to PSAR Chapter 7.0

TS – NWMI will identify in FSAR Chapter 14.0

Technical Safety Review and Evaluation

- RAIs addressed
  - Inconsistencies between PSAR Chapters 9.0 and 3.0 related to the design bases
  - Inconsistencies in terminology
- RAI responses
  - Consolidated design basis information in Chapter 3.0
  - Clarified and standardized terminology
- NWMI submitted Revision 1 to the PSAR in which the acceptable resolutions to the RAIs were satisfactorily incorporated
- Staff concluded that PSAR Chapter 9.0
  - Describes adequate design basis for auxiliary systems
  - Sufficient for satisfying standards for issuance of CP

Evaluation Findings and Conclusions

The staff evaluated descriptions and discussions of the NWMI RPF auxiliary systems, including probable subjects of technical specifications, as described in PSAR Chapter 9.0 and supplemented by the RAI responses and PSAR, Revision 1, and finds that the preliminary design of the auxiliary systems, including the principal design criteria; design bases; and information relating to general arrangement, major structures, systems, and components, and a high-level functional description:

1) Provides reasonable assurance that the final design will conform to the design basis.
2) Meets applicable regulatory requirements and acceptance criteria in or referenced in NUREG-1537.

Evaluation Findings and Conclusions (continued)

3) The design of RPF auxiliary systems as documented in the PSAR is sufficient to satisfy the standards for issuance of a construction permit.

4) Parts of certain auxiliary systems are or support IROFS and the preliminary design provides reasonable assurance that those IROFS should remain functional for the protection of the health and safety of facility personnel and the public and protection of the environment.

5) Based on engineering judgment, the staff concludes that the level of detail on the auxiliary systems in the PSAR is adequate for the issuance of a construction permit and technical or design info needed to complete safety analysis can be reasonably left for later consideration and for submission in the FSAR.

Evaluation Findings and Conclusions (continued)

- Accordingly, NWMI has met the following requirements of 10 CFR 50.35 for issuance of a construction permit:

1) NWMI has described the RPF auxiliary systems, including, but not limited to, the principal architectural and engineering criteria for the design, and has identified the major features or components incorporated therein for the protection of the health and safety of the public.

2) Further technical or design information may be reasonably left for later consideration in the FSAR.

3) The proposed facility can be constructed and operated at the proposed location without undue risk to the health and safety of the public.

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

Chapter 11
Radiation Protection

U.S. Nuclear Regulatory Commission

August 22, 2017

Introductions

- **Ty Naquin** - Project Manager, Fuel Manufacturing Branch (FMB), Division of Fuel Cycle Safety, Safeguards, and Environmental Review, Office of Nuclear Material Safety and Safeguards (NMSS)
- **Stewart Bland**, Technical Reviewer, Chesapeake Nuclear Services
- **Michael Balazik** - Project Manager, Research and Test Reactors Licensing Branch, Division of Policy and Rulemaking, Office of Nuclear Reactor Regulation
- **David Tiktinsky -** Senior Project Manager, FMB, Division of Fuel Cycle Safety, Safeguards, and Environmental Review, NMSS

Regulatory Basis and Acceptance Criteria

- Regulatory Requirements:
  - 10 CFR 50.34, “Contents of applications; technical information,” paragraph (a), “Preliminary safety analysis report.”
  - 10 CFR 50.35, “Issuance of construction permits.”
  - 10 CFR 50.40, “Common standards.”
  - 10 CFR 20, “Standards for Protection Against Radiation”
- Acceptance Criteria
  - NUREG-1537, Part 2, “Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors, Standard Review Plan and Acceptance Criteria.”
  - Interim Staff Guidance (ISG) Augmenting NUREG-1537, Part 2, “Guidelines for Preparing and Reviewing Applications…for Licensing Radioisotope Production Facilities…,”

Review Procedures and Technical Evaluation

- Evaluated the technical information presented in Chapter 11 of the PSAR using NUREG-1537 and the ISG Augmenting NUREG-1537

- Assessed sufficiency of radiological protection and waste management programs in support of construction permit issuance

Radiation Protection Program

- Nature and magnitude of radiation sources
- Radiation Protection Program
- Technically Qualified Staff
- As Low as Reasonably Achievable (ALARA) Program
- Access Control
- Monitoring and Surveillance
- Records and Reports
- Environmental Surveillance
- Radioactive Waste Management
- Respiratory Protection

PSAR 11.1.1 Radiation Sources

- PSAR provided a description of materials and process to produce molybdenum-99 (Mo-99) and resulting fission and activation products resulting from radioisotopes production facility (RPF) operations.
- PSAR identified where materials are handled and resulting fission products from recovery and purification
- Source management strategy – Radiation protection perspective
  - **Gaseous sources** – Target dissolution, LEU recovery/recycle – Hold and decay prior to release
  - **Liquid sources** – Mo-99 recovery/purification, LEU recycle, offgas processing – none released as liquid
  - **Solid sources** – Material to be processed (LEU, targets, waste – storage and disposal

PSAR 11.1.2 NWMI Radiation Protection Program

- Programmatic management commitments
  - Establishes independence of the Radiation Protection Program (RPP) from operations
  - Establishes the role and make-up of the Radiation Safety Committee
  - Establishes access of the Radiation Protection Manager (RPM) to the Chief Operating Officer
- Commitment to implementation of the program
  - Commensurate with the scope of activities – 10 CFR 20.1101(a)
  - Use of procedures/engineering controls to achieve doses that are ALARA 10 CFR 20.1101(b)
  - Annual program review – 10 CFR 20.1101(c)
  - Air emissions constraint – 10 CFR 20.1101(d)

PSAR 11.1.2 Responsibilities and Training

- Technically Qualified Staff
  - Qualification and training of all staff, from Plant Manager to individual employees
    - ANSI, ASTM, NRC Regulatory Guides PSAR 11.1.2.5
    - Organizational Structure and Reporting Chain – PSAR 11.1.2.1
    - RPM Qualifications and Radiological Protection (RP) Staffing – PSAR 11.1.2.1.3
  - Training program – PSAR 11.1.2.5
    - Staff training
    - Visitors, contractors
    - Records, testing, refresher training, audits

PSAR 11.1.3 ALARA Program

- Procedures and Engineering Controls
  - Radiation Work Control Procedures – PSAR 11.1.2.8
    - All Work – Routine and Non-routine
    - Posted, personal protective equipment, Stay times, Limited Life
- Exposure Controls
  - Occupational Exposure Limits – PSAR 11.1.2
    - External – National Voluntary Lab Accreditation Program (NVLAP) Accredited Dosimetry
    - Administrative Control Limits
    - Contamination Controls
    - Internal – Bioassay
      - Continuous Air Monitoring
  - Public Limits – PSAR 11.1.2
    - Compliance through Environmental Monitoring Program

Radiation Protection Program Features

- Access Control – PSAR 11.1.5.3
  - Controlled Area
  - Restricted Areas – Radiation Areas, High Radiation Areas, Very High Radiation Areas, Airborne Radioactivity Area
  - Radiological work permits for Entry (via Control Point) – Identify access requirements, PPE requirements, Exit requirements, posting
- Monitoring and Survey Requirements – PSAR 11.1.4 and 11.1.6
  - Dosimetry Requirements (NVLAP)
  - Instrumentation stationed at Restricted Area exits - friskers, partial body monitors, portal monitors, continuous air monitoring systems (CAMS)
  - Instrument sensitivities and calibrations
  - Loose and fixed contamination surveys

Radiation Protection Program Features (continued)

- Records and Reporting – PSAR 11.1.2.9
  - Recordkeeping commitments made
  - Reporting commitments specified

- Environmental Surveillance – PSAR 11.1.6.12
  - Waterborne (no liquid discharge)
  - Airborne – stack monitoring of noble gases and iodine
  - Direct – Environmental thermoluminescent dosimeters (TLDs)
  - Ingestion – Evaluation of dairy products for iodine uptake

Radiation Protection Program Features (continued)

- Respiratory Protection – PSAR 11.3
  - Engineering controls emphasized over respirator use
    - Confinement, Zonal System Structure, & Filtration
  - National Institute of Occupational Safety and Health (NIOSH) approved only
  - Elements consistent with 10 CFR Part 20
    - Performance testing
    - Physician involvement
    - Fit testing and annual retest
  - Policy, Training, Records, Audits

10 CFR PART 20, Radiation Protection

- 20.1101 – Subpart B – Radiation Protection Program – Chapter 11.1.2
- 20.1201 – Occupational Dose Limits – Chapter 11.1.2
- 20.1301 – Radiation Dose Limits for Individual Members of the Public – Chapter 11.1.2
- 20.1401 – Radiological Criteria for License Termination – Chapter 11.1.6.12
- 20.1502 – Surveys and Monitoring – Chapter 11.1.4
- 20.1601 – Control of Exposure from External sources in Restricted Areas – Chapter 11.1.5.6.2
- 20.1701 – Respiratory Protection – Chapter 11.3
- 20.1801 – Storage and Control of Licensed Material – Chapter 11.1.5.5
- 20.1901 – Precautionary Procedures – Chapter 11.1.2.8
- 20.2001 – Waste Disposal – Chapter 11.2
- 20.2101 – Records - Chapter 11.1.2.9
- 20.2201 – Reports – Chapter 11.1.2.9

Evaluation Findings and Conclusions

- Regulatory References and Technical Standard Level of Commitments in PSAR provide assurance that regulatory requirements can be met
- Irradiated Targets to be received and processed – Dose Implications
  - Use of COMPLY computer code by NWMI for normal operational releases
  - Staff RASCAL confirmatory computations are consistent with dose levels shown in PSAR.

Radioactive Waste Management

- The NWMI facility will generate radioactive wastes spanning NRC's waste disposal classes A to C and DOT transportation types from LSA to Type A and B quantities.
- The NWMI facility proposes extensive use of decay in storage, leading to on-site retention of wastes.
- The design of the Waste Staging and Storage Building will be provided in the FSAR.

Summary of Application

- PSAR Section 11.2 describes:
  - Radioactive waste management program
  - Radioactive waste controls
  - Identified requirements for releases of radioactive (solid) waste.
- Waste processing systems are described in PSAR Section 9.7.2.

Radioactive Waste Management Program

- The Staff concludes that the program objectives, management and supervisors responsibilities, program elements such as self-assessments, audits, and record-keeping and documents control presents a sufficient administrative structure to assure releases of gaseous and solid radioactive wastes are in accordance with the regulations.
- Elements of the program that will be reviewed at the FSAR include the waste management procedures development, and how program elements and procedures are integrated into the conduct of operations.

Solid Radioactive Waste Controls

- The radioactive waste management program will include audits that evaluate waste minimization efforts.
- Waste streams are contained in tanks and piping systems within shielded enclosures, system design allows sampling; system operation is controlled in batches.
- PSAR Section 11.2.2.2 states that procedures will ensure proper identification, characterization, and treatment of the waste streams.
- Staff review concluded that NWMI identified and sufficiently described the controls proposed for each identified stream of solid radioactive waste for CP issuance. Preliminary information indicates the controls should assure appropriate processing and packaging for storage, transportation, and eventual disposal.

Radioactive Waste Controls (continued)

- Liquid waste chemical characteristics and radioactive material content at the proposed NWMI facility are significantly different than those found at nuclear power plants.
- Response to RAI 9.7-3b states that inputs to high dose waste collection tank are sampled prior to transfer providing control of waste tank contents.
- Staff will review NWMI's program of developing radioactive waste management operating procedures in the FSAR.
- Staff will review waste package storage and handling within the waste staging and storage building in the FSAR.

Releases of Radioactive Waste

- NWMI does not anticipate liquid radioactive effluent releases during normal operations.
- Gaseous radioactive releases describe in PSAR Section 11.1.1.1.2.
- Staff review concludes that NWMI has identified the requirements for adequate packaging of solid wastes for transport and disposal and has committed to comply with 10 CFR Part 20, Subpart K and the waste acceptance criteria for the potential waste disposal sites.

Evaluation Findings and Conclusions

- The staff finds that the level of detail provided on the waste management program is suitable to determine that:
  - The proposed radioactive waste management program should provide sufficient administrative structure to assure compliance with the regulations.
  - The proposed radioactive waste controls for each identified stream of solid radioactive waste should assure appropriate processing and packaging for storage, transportation, and eventual disposal. Further technical or design information required to complete the safety analysis of the radiation protection program and waste management provisions may reasonably be left for later consideration the FSAR.
  - NWMI has identified the requirements for adequate packaging of solid wastes for transport and disposal and has committed to comply with 10 CFR Part 20, Subpart K and the waste acceptance criteria for the potential waste disposal sites.

Evaluation Findings and Conclusions

- Based on these findings, the staff has made the following conclusions regarding issuance of a construction permit in accordance with 10 CFR 50.34, 10 CFR 50.35, 10 CFR 50.40, and 10 CFR Part 20:

  1) NWMI has described the proposed facility design criteria for radiation protection and waste management, including, but not limited to, the principal architectural and engineering criteria for the design, and has identified the major features or components incorporated therein for the protection of the health and safety of the public.

  2) Further technical or design information required to complete the safety analysis of the radiation protection program and waste management provisions may reasonably be left for later consideration the FSAR.

  3) Reasonable assurance that the proposed facility can be constructed and operated at the proposed location without undue risk to the health and safety of the public

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Chapter 12
Conduct of Operations

U.S. Nuclear Regulatory Commission

August 22, 2017

Introductions

- **Annie Ramirez** - Quality Assurance Engineer, Programmatic Oversight and Regional Support Branch, Division of Fuel Cycle Safety, Safeguards, and Environmental Review, Office of Nuclear Material Safety and Safeguards (NMSS)
- **Michael Balazik** - Project Manager, Research and Test Reactors Licensing Branch (PRLB), Division of Policy and Rulemaking (DPR), Office of Nuclear Reactor Regulation (NRR)
- **David Tiktinsky** - Senior Project Manager, Fuel Manufacturing Branch, Division of Fuel Cycle Safety, Safeguards, and Environmental Review, NMSS
- **Alexander Adams, Jr.** - Chief, Research and Test Reactors Licensing Branch, Division of Policy and Rulemaking, Office of Nuclear Reactor Regulation

Conduct of Operations

- Addresses organization, review and audit activities, procedures, required actions, reports, records, emergency planning, security planning, quality assurance, operator training and requalification, startup plan, and material control and accountability program.

- Some of the sections in Chapter 12 “Conduct of Operations” will be addressed in the Final Safety Analysis Report (FSAR) of the Operating License (OL) application.

Regulatory Requirements

- 10 CFR 50.34, “Contents of applications; technical information,” paragraph (a)(7), requires a description of the quality assurance (QA) program.
- 10 CFR 50.35, “Issuance of Construction Permits.”
- 10 CFR 50.40, “Common standards.”
- 10 CFR 70.64, “Requirements for new facilities or new processes at existing facilities,” paragraph (a)(1) “Quality standards and records.”

Acceptance Criteria

- NUREG-1537, “Guidelines for Preparing and Reviewing Applications for the Licensing of Non-Power Reactors”, Part 1, “Format and Content,” and Part 2, “Standard Review Plan and Acceptance Criteria”
- Interim Staff Guidance (ISG) Augmenting NUREG-1537, Part 2, “Guidelines for Preparing and Reviewing Applications…for Licensing Radioisotope Production Facilities…,”
- NUREG-1520, “Standard Review Plan for Fuel Cycle Facilities License Applications”
- Regulatory Guide 2.5, “Quality Assurance Program Requirements for Research and Test Reactors”
  - The general requirements for establishing and executing a quality assurance program for the design, construction, testing, modification, and maintenance of research and test reactors in [American National Standards Institute/American Nuclear Society] **ANSI/ANS-15.8-1995** provide an acceptable method for complying with the program requirements of 10 CFR 50.34, “Contents of applications; technical information.”

Conduct of Operations Section 12.1- Organization

- The staff performed and evaluation of the information presented in Chapter 12, “Conduct of Operations” Section 12.1 Organization and Appendix C “Quality Assurance Program Plan,” in the NWMI Preliminary Safety Analysis Report (PSAR).

- Staff applied the guidance outlined in NUREG-1537, Part 1 and 2 and ISG Augmenting NUREG-1537. In addition, the staff used guidance in NUREG-1520 Chapter 2 “Organization and Administration.”

Conduct of Operations Section 12.1- Organization

- Areas of review:
  - Organization and its structure,
  - Responsibilities of individuals and groups,
  - Organizational aspects of the radiation protection program.
- NWMI committed to detail in its OL application:
  - Staffing considerations for facility operations
  - The production facility safety program.

Conduct of Operations Section 12.1 - Organization

- **Staff Review**
  - The staff evaluated the preliminary structure of the NWMI organization, as described in NWMI PSAR Section 12.1 and Appendix C, in part by reviewing the organizational structure, the responsibilities of individuals and groups, the staffing for operations, the selection and training of personnel, the organizational aspects of radiation protection, and the production facility safety program.
- **Evaluation and Conclusions**
  - The staff has determined that the level of detail provided on the NWMI organizational structure in conjunction with the Appendix C is adequate for a construction permit. The staff found that deferral of details in this section to the OL application is acceptable. Since the remaining deferred details cover strictly organizational structure for the operation of the facility.

Conduct of Operations Section 12.2 - Review and Audit Activities

- Areas of Review:
  - Review and audit committees are established by the NWMI Project Manager.
  - Review and audit activities are summarized and reported to NWMI Executive Management.
  - Independent audits of the NWMI facility are conducted periodically.
- NWMI committed to detail in its OL Application:
  - Specific considerations for audits regarding facility operations audits and scope of these audits.

Conduct of Operations Section 12.2 – Review and Audit Activities

- **Staff Review**
  - The staff evaluated the preliminary program for NWMI review and audit activities, as described in PSAR Section 12.2 and Appendix C, in part, by reviewing the composition and qualification of the committee members, charter and rules of the committee, conduct of the review function, and conduct of the audit function.

- **Evaluation and Conclusions**
  - The staff has determined that the level of detail provided on the NWMI review and audit activities section is adequate for a construction permit. The staff found that the deferral of the details of this section to the OL application is acceptable. Since the details deferred cover a number of administrative controls in the area of operation that would not affect the design and construction phase of the facility.

Conduct of Operations Section 12.3 - Procedures

- Areas of Review:
  - Operating procedures will be written, reviewed, approved, controlled and monitored.
  - Procedures will be prepared, approved, revised, canceled, and implemented in accordance with the procedure program. Document Control (DC) controls the procedures in accordance with this program.
  - NWMI policy on use of procedures is documented and clearly understood by all applicable NWMI personnel. Activities and tasks are performed in accordance with approved implementing procedures.
  - NWMI have committed to detail in its OL application
    - Details on specific operating procedures. Controls established for design and construction procedures will be captured under QAPP. Therefore, the staff found the deferral of details on specific operating procedures to be acceptable for the purpose of this review.

Conduct of Operations – Deferred to FSAR

- NWMI committed to detail these sections its OL application:
  - Section 12.4 - Required Actions
  - Section 12.5 - Reports
  - Section 12.6 – Records

- The staff found that the deferral of these sections to the OL application is acceptable. The sections deferred cover a number of administrative controls that would not affect the design and construction phase. The details of these sections regarding the construction are covered in Appendix C via the NWMI Quality Assurance Program Plan.

Conduct of Operations Section 12.9- Quality Assurance

- The staff performed an evaluation of the information presented in Appendix C of Chapter 12.0 in the PSAR, as supplemented by responses to requests for additional information (RAI), to assess the adequacy of NWMI's Quality Assurance Program Plan (QAPP), in support of the issuance of a construction permit.

- Staff applied the guidance outlined in ANSI/ANS-15.8-1995, "Quality Assurance Program Requirements for Research Reactors." This standard provides criteria for QA in the areas of design, construction, operation, and decommissioning of research reactors.

- Areas of review included all of the applicable QA program requirements outlined in the standard.

Conduct of Operations Section 12.9- Quality Assurance (Cont.)

- NWMI committed to ANSI/ANS15.8-1995 standard fro the QA activities. This QAP will be applicable for the design and construction phase of the facility.
- “Facility Operations,” of NWMI’s QAPP, specific details were not provided. The staff determined details were not necessary to support the issuance of a construction permit. A more detailed evaluation will be deferred until receipt of the FSAR supporting an operating license application.
- “Decommissioning,” of NWMI’s QAPP, the applicant stated that this section would be updated at a later date. Therefore, the staff deferred the review of this section until the receipt of an FSAR supporting an operation license application.

Staff Review of the QAPP

- In evaluating NWMI's QAPP, the staff need additional information to determined if the applicant addressed the full scope of requirements outlined in ANSI/ANS-15.8-1995. The following summary of RAIs were issued:
- **RAI 12C2.2-1** asked NWMI to clarify the scope of items relied on for safety (IROFS) addressed by its quality assurance program and describe the applicability of different QA Levels to IROFS.
  - NWMI responded that its QA Plan will be revised to clarify the difference between QL-1, QL-2, and QL-3 and the areas where they will be applied as follows:
    - QL-1 will be applied to IROFS, systems, structures, or components (SSC), and activities in order to prevent or mitigate consequences that will exceed performance requirements established in 10 CFR 70.61. These items will be controlled in a more rigorous manner in accordance with ANSI/ANS-15.8-1995.
    - QL-2 will be applied to activities that include administrative controls for IROFS and SSCs that are nor QL-1 SSCs. These items will require a less rigorous approach than QL-1.
    - QL-3 applies to all those non QL-1 or QL-2 the items. These items will be controlled in accordance with standard commercial practices.
  - The staff finds this response acceptable since the response defines NWMI intention for IROFS and QL.

Staff Review of the QAPP (continued)

- **RAI C2.3-1** asked NWMI to clarify its intent to perform qualification testing or the need to demonstrate the adequacy of performance of SSCs under conditions that simulate the most adverse design conditions. For example, if and IROFS requires a type of qualification testing for during the construction period and how will this be capture in the QA Program.

  - NWMI stated that qualification testing will be performed to demonstrate the adequacy of SSCs under conditions that simulate the most adverse design conditions. Formal testing or analysis will be required to verify conformance of designated SSCs to specified requirements and demonstrate satisfactory performance for service or to collect data in support of design fabrication. Results will be documented and evaluated by a responsible authority to ensure that test requirements have been satisfied.
  - The staff finds this response acceptable and consistent with the standard ANSI/ANS 15.8-1995.

Staff Review of the QAPP (continued)

- **RAI C2.3-2** asked NWMI to clarify whether the QAPP controls to capture significant design change that are necessary because of an incorrect design, the design process and verification procedure should be reviewed and modified as necessary.

  - NWMI stated that engineering change control procedures have been developed for the RPF design and construction to ensure that modifications to safety-related SSC's or computer codes, will be based on a defined "as exists" design. Changes to verified designs will be documented, justified, and subject to design control measures commensurate with those applied to the original design.

  - The staff finds this response acceptable and consistent with the standard ANSI/ANS 15.8-1995.

Staff Review of the QAPP (continued)

- **RAI 12C.2.11-2** asked NWMI to clarify if the computer software testing is to be done by another entity other than NWMI and whether there are any software testing controls applicable to NWMI.
  - NWMI stated that computer software testing will be required by all suppliers to verify and provide evidence of the quality of their software. In addition, NWMI will include methods to control and approve supplier-generated documents based on the complexity of the product and the importance to safety.
- The staff finds the answer acceptable, it establishes that controls will be in place depending on the safety importance of the item and will be also applicable to suppliers and NWMI.

Staff Review of the QAPP (continued)

- **RAI C2.17.1** On the application NWMI PSAR, Appendix C, Section C2.17 "Quality Records" states that a quality record will be defined in implementing procedures. The NRC asked NWMI to clarify if the implementing procedures, at a minimum, address the ANSI/ANS 15.8-1995 listed quality records.
  - NWMI stated the types of record identified under their quality records procedure. NWMI also listed quality documents that are relevant to the final design and construction phase and stated that they are consistent with those mentioned in ANSI/ANS 15.8-1995.
  - The staff finds this response acceptable and consistent with the standard ANSI/ANS 15.8-1995.

Conduct of Operations 12.9 Quality Assurance Evaluation Findings and Conclusions

- The Conduct of Operation Section 12.9 “Quality Assurance Program” and Appendix C “Quality Assurance Program Plan” is adequate for the purpose of the issuance of a Construction Permit. The staff determined that the information to be included in NWMI PSAR Section 12.9, “Quality Assurance,” is sufficient and adhere to ANSI/ANS 15.8-1995 standard to support the issuance of a construction permit with the acknowledgment of these two conditions:
  - A complete description in “Facility Operations,” and “Decommissioning,” is not necessary to support the issuance of a construction permit.
  - In addition, any required changes to the QAPP due to the OL application are subject t to review and acceptance prior to issuance of the FSAR.

Chapter 12 Conduct of Operation Evaluation Findings and Conclusions (continued)

- The staff finds that the information in Chapter 12 Conduct of Operations and Appendix C included in the NWMI PSAR is sufficient and meets the applicable regulatory requirements and guidance to support the issuance of a construction permit in accordance with 10 CFR 50.34, 10 CFR 50.35, 10 CFR 50.40, and 10 CFR 70.64.

- The information provided is adequate for the issuance of a construction permit, with the acknowledgement that additional requirements will need to be considered:
  - The staff will perform a more detail evaluation of Sections 12.4-12.6 of the Conduct of Operations after the receipt of the FSAR supporting an OL Application.
  - A complete description of “Facility Operations,” and “Decommissioning,” have been defer to the FSAR supporting an OL application.