U.S. Department of Health and Human Services

Centers for Disease Control

National Institute for Occupational Safety and Health

Advisory Board on Radiation and Worker Health

Metals and Controls Corporation Work Group

Thursday, May 3, 2018

The Work Group convened in the Montreal Room of the Cincinnati Airport Marriott, 2395 Progress Drive, Hebron, Kentucky, at 8:30 a.m., Josie Beach, Chair, presiding.

Present:

Josie Beach, Chair
Henry Anderson, Member*
David Kotelchuck, Member
Loretta R. Valerio, Member

Also Present:

Ted Katz, Designated Federal Official
Nancy Adams, NIOSH Contractor*
Bob Anigstein, SC&A*
Pete Darnell, DCAS
Mike Elliott
Rose Gogliotti, SC&A*
Kevin Kane
Jenny Lin, HHS*
William Lorenzen
John Mauro, SC&A
Pat Mccloskey, ORAU Team
Jim Neton, DCAS
Mutty Sharfi, ORAU Team
John Stiver, SC&A*
* via telephone

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Proceedings

(8:30 a.m.)

Welcome and Roll Call

Mr. Katz: This is the Advisory Board on Radiation and Worker Health. It is the Metals and Controls Work Group. It will be the first meeting of this Work Group.

There are some materials for the Work Group today that are posted on the NIOSH internet page under schedule and meetings, today's date. So you can go there.

Most importantly, John Mauro of SC&A has a presentation there. So anyone of you who want access to that presentation can see those slides there on the internet.

There is also an SC&A review. It's posted on the NIOSH site. But I'm not sure they've moved it yet to the meetings page. So you could check on that. If it's not there yet, it will get there. I don't know exactly when.

And there is a NIOSH White Paper which hadn't cleared DOE review in time to be posted there. But when it does clear, it will be posted there as well. So you'll be able to see -- which is the NIOSH responses to the SC&A review, in effect.

So all those will be posted on that, on today's date meeting date, that portion of the website so you can find it easily in connection with this meeting.

Let me get to roll call. One other thing just for people who are not familiar with these Work Group meetings that may be on the phone, please everyone keep your phones muted. And if you don't have a mute button on your phone, press *6 to mute your phone. And you press *6 again to take your phone off of mute. But please keep your phones muted except when you're addressing the group.

For members of the public, there is on the agenda an opportunity for you to comment on what you've heard or questions later in the day. But otherwise you should keep your phones muted during the proceedings.

And also, please no one put the call on hold at any point. That sabotages the audio for everyone else. So, please, if you need to leave the meeting for a piece, just hang up and dial back in, but don't put the call on hold at any point.

Henry Anderson, are you on the line?

Member Anderson: Yes, I'm here.

Mr. Katz: Okay. So roll call.

(Roll call.)

Mr. Katz: Okay. That takes care of roll call. The agenda for the meeting is also posted, by the way, on the NIOSH website, same place, schedule and meetings, today's date, so you know what's happening when, although not what time, just order.

And with that, I think that takes care of things. Josie, it's your meeting.

Chair Beach: Okay. Thank you. And welcome everybody to our first Metals and Controls meeting.

We are going to start with SC&A. We had a presentation several months ago on this, on metals and controls. SC&A's report is posted on the NIOSH website. Hopefully, Andy, you found that by now and the slides.

Member Anderson: Nope, I'm not there yet.

Chair Beach: Okay. It's fairly simple to find it. If you have trouble, let us know. You just Google it. It'll come up.

And we're going to go through your report. SC&A's report is posted along with the slides. And we're

going to start with SC&A with going through your slides, the presentation.

And I understand we're going to stop as we get to each finding and have a discussion. This is the first SEC discussion. So there are some SEC questions I'm sure that are going to come out and want to be discussed through this process.

So, and I also noticed, Pete, the memo is posted that you put out, the three-pager. Did you have any plans to discuss that, or is that just on there for background?

Mr. Darnell: It was one of the documents --

Mr. Katz: That was --

Mr. Darnell: -- for background.

Mr. Katz: So that was posted as background because --

Chair Beach: Just background, okay.

Mr. Katz: -- at the time we didn't have the White Paper.

Mr. Darnell: Right.

Chair Beach: Okay.

Mr. Katz: But now we have the White Paper, which is --

Chair Beach: And I'm not sure how much we're going to get into that subsurface White Paper. I don't know that SC&A has had time or the Work Group has had time to really look at it. But we'll see how we're doing.

Mr. Darnell: SC&A's pretty much aware of what --

Chair Beach: I understand, yes, yes. They just haven't gotten anything out to the Work Group, their reply to it or -- so, anyway, we'll just go step by step and see where it takes us. I don't expect this to last

too late into the afternoon. But, again, we'll see where it takes us.

So, John, if you want to get started -- let me ask Andy. Have you got there yet?

Member Anderson: No, I'm still playing around.

Chair Beach: Okay. So did you go into Google, NIOSH Radiation Advisory Board? That's the simplest way to find it on your own computer.

Ms. Gogliotti: If you can't find it, it should be in your email.

Chair Beach: Oh, there you go. Someone you know got it to you.

Mr. Darnell: Josie, before we move on, Pat reminded me if we can't get the White Paper mostly addressed or fully addressed in this meeting, we may not meet the August date for the Board meeting.

Chair Beach: Okay.

Mr. Darnell: So just wanted to let you know.

Chair Beach: Okay. Thank you.

Dr. Mauro: Also what might be helpful, since we've seen the White Paper just a few days ago, my crew and myself had a chance to read it. And I think, though, what could get very useful is we are addressing the same issues, subsurface is, you know, the primary thrust, although we address a few other pathways.

What would be good is -- where I'm really headed here is there are these unusual pathways that were not addressed before but are being addressed now.

SC&A came at the problem as best we could. And you did too. And to get an understanding of where we are different on how we see it and how we come at the problem and the data we use, so from that perspective when we hit each issue we're going to be

talking about the issues you talk about.

And so, if we can engage at that point, when I'm talking about some of the subsurface things we did and the data we used, it would be good to hear a little bit more, because when I read your report it looked like you may have had additional data that we may not have had because you -- you know, things like that, but as a preface, so we could interact. Okay --

(Simultaneous speaking.)

Chair Beach: Okay. And then before we get started, sorry, John, I'm going to take it back again, we do have a issues matrix that was handed out this morning. Who's going to be keeping notes, anybody? I know I always do. But it would be helpful if each group -- and, John, I don't know if you've got somebody online that will keep notes for SC&A's --

Mr. Katz: Well, it's, we don't, I mean, we don't have -- in this case, we don't, I mean it's a Work Group meeting so --

Chair Beach: Right.

Mr. Katz: -- we have a transcript and --

Chair Beach: No, I get that --

(Simultaneous speaking.)

Mr. Katz: The only question is who will update the matrix after the meeting --

Chair Beach: Yes, that's what my point was.

Mr. Katz: It's just SC&A or NIOSH.

Chair Beach: Yes.

Dr. Mauro: Just action items, that's one of the important things. As we move through it, anyone say you've got an action item --

Chair Beach: Right.

Dr. Mauro: -- and I'll write that down.

Mr. Katz: So did you put together the matrix, Pat?

Mr. McCloskey: Yes.

Mr. Katz: So, Pat, since he put together the matrix, he can update it after the meeting.

Mr. McCloskey: Sure.

(Simultaneous speaking.)

Mr. Katz: Yes, always, right.

Chair Beach: All right.

Mr. Katz: Thanks. John, take it away.

SC&A Review NIOSH SEC Petition Evaluation Report

Dr. Mauro: Okay. We're going to talk about Metals and Control Corporation and its SEC. This is a metal, uranium fuel handling facility, a classic AWE facility just outside of Boston, south of Boston.

And they were in business, started it as an AWE, starting in 1952. And they continued as an AWE right up to about the end of 1967.

And it turns out -- in fact, I'm going to be talking more than going to my slides. I'll try to stay with my slides. But I find it easier just to talk, you know --

(Laughter.)

Dr. Mauro: So we're going to flip through the slides. And so we're going to be talking about there is an SEC petition that was filed, number 236. And it specifically addresses the residual period.

A previous SEC petition was filed and granted that covered 1952 to the end of 1967. And the reason it was granted was the inability to reconstruct internal exposures from thorium. So that's behind us.

Now we're moving on to the AWE period. And in fact,

if you want to flip to page 3, and we're going to be talking about it's important to understand that there are two levels we're going to operate on.

One is the SEC question, which is can you --- and it's a judgement the Board makes, can doses be reconstructed with sufficient accuracy.

SC&A doesn't come to that conclusion. We don't make those conclusions. I'm saying this as my understanding of the policy. And certainly, Ted, correct me if I'm wrong.

What we say is whether we think doses could be reconstructed with scientifically sound and claimant-favorable and why and the data we use and the assumption we use and why we believe we can do it.

The judgment whether it meets the criteria of sufficient accuracy, certainly that's a Board decision.

And it differs from a standard Site Profile, because what we're really asking is, listen, do we have the data and the information regarding activities that we think is a trackable problem. It's one of the words I've been using for quite some time.

That differs than saying what we will call a Site Profile issue. That means, well, we think we can track it, but we don't, we may not necessarily agree on all the assumptions regarding resuspension factors and occupancy times.

These are things we have to discuss. And so they're different. And I think it's more important today, in my opinion, that we get a grasp on do we have the data and do we understand what took place at this facility to the extent that we could reconstruct the doses from this facility.

What those particular doses are, we have some estimates that we made. But they're more as examples that, yes, I think we could do it.

And in fact, right on page 3, and that's a good place

to start the discussion, I give you the end of the story. And then we'll take it from there. The end of the story is that we believe that the doses could be reconstructed. So --

Chair Beach: John, could I back --

Dr. Mauro: Yes.

Chair Beach: So, on your slide, you're on page 2.

Dr. Mauro: Well, the bottom of the page says 3.

Chair Beach: Okay. But if you look online, it -- oh, it does say 3. Mine says 2. That's --

Member Anderson: I got it. I'm here.

Chair Beach: Okay.

(Simultaneous speaking.)

Dr. Mauro: Okay. Yes, I'm on page 3. Well, my hard copy trying --

(Simultaneous speaking.)

Chair Beach: That's weird. My pages are just off. I'll just go by this. Thank you.

Dr. Mauro: So --

Chair Beach: I just wanted to make sure we were tracking.

Dr. Mauro: We're going to get into the bowels of this. But in the end, our takeaway, and it wasn't easy to get to this position by the way when we're talking about it, that we think you can reconstruct the doses for the workers during the residual period in a scientifically sound and claimant-favorable manner.

However, now the second part is, but we reviewed your original Evaluation Report. I understand you're supplementing it. But we reviewed it. And we did have lots of concerns. And they were all delineated.

And in fact, they're all itemized as observations and findings, which we could discuss.

But the most important issue really is our takeaway is that we think you can do it. Now, I want to sensitize everyone to this is, this was a tough judgment for us to make. And I'm going to tell you why in a second, because we're going to go to slide number 4. Okay.

I more or less already introduced this slide, but just to get a picture, nice to look at a picture. When you think about metals and control, you should think about that really there are these two time periods from 1952 to 1967, which was the AWE operations period where there was a very good health physics program in our opinion. We reviewed it. We reviewed what they did and all their metal workings activities and fuel handling activities.

And, but they did have a problem with thorium, as I mentioned earlier, that they couldn't reconstruct that. So, therefore, if you look on the left-hand side of my little picture, an SEC was granted, it's SEC-00149, because of the inability to reconstruct internal doses of thorium.

And now we're going to leave that. And starting in 1968 all the way till 1997 is the residual period. Now, NIOSH wrote an Evaluation Report regarding that time period. And the outcome of that was, yes, we can do it. And you describe all of your assumptions and how you do it.

And this is the really important point. Well, how come you came to that conclusion? How can you do that? Because there was very little data.

In other words, when you look at it, you say when 1968 began and the residual period, there were all these workers -- and they're all doing now non-radiological work. It's commercial work except for one very special type of activity called HFIR. Not even going to talk about that.

That was a fuel activity, took place in Building 10. But those workers had nothing to do with the AWE. They just happened to be there working in their own little box.

And so, though there was fuel onsite being handled, it was in that separated area. We're not concerned about reconstructing those, their doses. They're not covered.

We are concerned about the workers that worked primarily in Building 10, but other buildings also, where they were doing their classic commercial metals and control work. And they were working at a time beginning in 1968 when they were under the impression there was no radioactivity there. It was all the fuel, that AWE-related activity was long since gone. They took that, got rid of it. Okay.

And you could see that, while there was AWE activity going on, there was a pretty good health physics program where took care of business and they kept the place as clean as they could, that sort of thing.

Mr. McCloskey: Hey, John --

Dr. Mauro: Yes.

Mr. McCloskey: -- you're right. All the AWE fuel left at that point. But there's still a lot of fuel onsite for HFIR.

Dr. Mauro: Yes.

Mr. McCloskey: And the workers really didn't have a clear distinction between it. So --

Dr. Mauro: Yes, but they're -- see, in my mind, I see what you're saying. Any doses an M&C worker might have experienced from HFIR work don't count --

Mr. McCloskey: That's correct.

Dr. Mauro: -- during the residual period.

Mr. McCloskey: That's true.

Dr. Mauro: It's a residual period.

Mr. McCloskey: Yes --

Dr. Mauro: That's a good point by the way, you know --

Member Kotelchuck: And why doesn't it count?

Dr. Mauro: Well, you know, since the HFIR work was fuel-related work not AWE-related and when you're -- during the actual AWE period, there's very often lots of different types of radiological work going on.

Member Kotelchuck: Sure.

Dr. Mauro: Some of which is AWE work and some of which is not. When that's going on, there's an obligation. And this is the policy that NIOSH has adopted is, well, you have to include all the doses. For example, they may be working with radium beads. They may be working with fuel not for the weapons complex.

And if that's onsite and you're in the AWE period where people are doing AWE work, you do have to include those doses.

But once you leave that time period, the AWE period, now you're in the residual period. Any exposures associated with non-AWE work don't carry through. In other words, you don't have to add them in. Once you leave the AWE period, then you're in the residual period. So that's how we came at the problem.

We are only concerned with what are the exposures experienced by M&C workers due to residual radioactivity associated with AWE activities that ended in the end of 1967. So that's why it's good to strategically sort of understand how the game is played.

So what was NIOSH's job, well, our job? It was NIOSH's job to say, okay, starting in 1968, we've got all these workers doing commercial work under the

impression there's no radioactivity anywhere. And they're doing their job and -- which was commercial work.

Now, it turns out along the way later on they wanted to terminate their NRC license. They had a license, originally had a license.

So a team of ORAU people, I believe, came in with contractors to say, well, we're going to terminate your license. So we're going to -- and we're going to D&D any residual activity. This was called the classic FUSRAP characterization of clean-up activity.

Well, lo and behold, what happened was they says, holy mackerel, there's some radioactivity still, the residual at this site and -- which was a classic AWE residual period situation. We've run into this time and time again. And so you have to be able to reconstruct those doses.

Now, it turns out interestingly enough -- and this is also the opening of our report, our February 3rd report. I asked one of our crew to look into it and say, listen, how often do we run into a circumstance --

Mr. Katz: Excuse me. Let me interrupt. Someone has an open line on this.

Dr. Mauro: Okay. Yes, well, I'm trying to set the table. So what we have is these workers that were working. And the --

Member Anderson: What slide are we on now?

Dr. Mauro: We're still on 4. And I will flip through the slides as we go. But I'm trying more to set the table --

Member Anderson: Okay.

Dr. Mauro: -- so conceptually you can understand.

And when you look at this page 4, the important point I want to make here is that you have this long time

period from '68, from the end of '67 to '68 to 1997, which is the residual period, lots of workers involved in work doing all sorts of non-AWE activities, commercial work, very busy.

And a petition was filed. Listen, we found out -- this is the workers talking now. Geez, we found out that there was residual radioactivity at the site. So all these workers that were working actually received some exposure.

And they decided, their judgment was they needed an, they think they should get an SEC. So they filed their SEC petition. Okay.

NIOSH said, okay, we'll review it. And they prepared their SEC, more SEC Petition Evaluation Report, which is the report that currently is active, even though we all recognize that, in light of things that we've learned, you'll be doing some amendments. Is that correct?

Dr. Neton: That is correct.

Dr. Mauro: Good. Okay.

Dr. Neton: Or revisions.

Dr. Mauro: Or revisions? Whatever you see fit. All right.

Now, the thing that's interesting about this problem is that when you're in a residual period you have a problem. We know that usually the amount of radioactivity is kind of low compared to the AWE period because they removed all the radioactivity except what was residual. And so you expect that to happen.

But so one of the first things we did is say, listen, how prevalent is it where AWE facilities are granted SECs for the residual period. We have a lot of history.

Turns out there are 50 of them where there was a petition for an SEC covering the AWE period. And it

turns out we found 3, so 3 out of 50. So it is kind of rare.

And we did that just to say, listen, under what circumstances do we find that SECs are granted, were granted. And it usually occurs when something unusual takes place during the SEC period. Okay. So, and where for some reason there's an unusual amount of radioactivity left over, a residual, or workers are doing things during the SEC period that are unusual that put them in contact with that material. And it's very difficult to reconstruct their doses. So we know that from historical precedent.

So the question we posed to ourselves is, okay, do we have that here. Is there anything unusual? All right. Let's flip the page.

Member Kotelchuck: Although --

Dr. Mauro: Yes.

Member Kotelchuck: Although -- Dave Kotelchuck. But we look at each case individually. And therefore, we're not talking about precedent, are we? We're talking about, okay, we're looking at this case individually.

Dr. Mauro: Yes.

Member Kotelchuck: But this is what has happened in the past. And it may inform our perspective.

Dr. Mauro: Exactly.

Member Kotelchuck: Okay.

Dr. Mauro: Exactly. That's the only reason why we did that.

Member Kotelchuck: Yes.

Dr. Mauro: And to get a -- it sort of sensitizes us to when you do run into the circumstance. That doesn't mean something different could happen here.

Member Kotelchuck: Right.

Dr. Mauro: But it sort of helped us lay the groundwork.

Member Kotelchuck: Okay.

Dr. Mauro: We're going to go to slide number 5.

Participant: Excuse me. When are questions allowed, at the end or during the slide?

Mr. Katz: Yes, we have a session. It's on the agenda. But it's after all this discussion there's a -- I will ask for the petitioner, if the petitioner wants to comment or make questions. I'll ask for that later. Thanks.

Dr. Mauro: In fact, let's stick with slide 4 just for one more minute. Okay?

When you look at slide 4, you'll see the top line. And I mentioned earlier one of your problems in trying to reconstruct doses during the residual period is the lack or deficiency of data, because usually they stop their health physics measurements. They stop taking film badge readings. They stop taking bioassay samples. They stop taking air samples because they just moved out all the radioactivity.

The contract's over. And so you're really not routinely making measurements. So, if you want to reconstruct doses during the AWE period, you got to become creative and say how are we going to do this thing.

Well, it turns out -- and that's why this top line is important. It says the sources of the data that are fundamental to being able to do a dose reconstruction during the residual period turns out taking advantage in some way the data that you do have, and we're going to get into this, during the AWE period.

There's certain information during the AWE period that was collected that you will see when we get into

it can be useful to you in predicting what took place during the residual period.

In addition, once they got into the process of license termination, in other words before you could actually terminate your AEC license, you have to go in and ORAU goes in and contractors come in to make sure the place is clean and meets the current standards for termination of license. Everything is fine.

And there were certain measurements made. One set of measurements were made around the 1984 period. I actually think it was 1982. But it's in the '80s.

So someone came in. It was '82. So a team came in and made some measurements. And they said, ah, we got some residual radioactivity we're finding here. Oh, okay.

And then later on they brought in a contractor to do the formal FUSRAP clean-up, license termination type work where a team comes in. They characterize the nature and extent of the radioactivity in the environment. Is there any? And if there is, we got to clean it up.

So where does the data come from so that you could reconstruct the doses? The data comes from whatever you could use that might be useful that was gathered during the AWE period, whatever was collected in that 1982 -- that '84 is the wrong number. I think it's 1982 on the slide.

And then in the 1990s is when a really aggressive clean-up program, characterization and clean-up program took place, which is a really good program, it was performed by, I think under the direction of some of the Texas Instruments people at the time. And the contractors came in. [identifying information redacted] came in.

[identifying information redacted]was there. Everybody knows -- I don't know if everybody knows

[identifying information redacted]. He's the head of, one of the leaders of the CDC Radiation Studies Branch. He was part of the team. Interestingly, Mark Griffon, who we all know and love, was part of that team, and a company called CPS.

And we looked very carefully at that program. It was a good one. They had good health physics controls. They took lots of really good measurements.

So, at that real back end way in 1992, there's data that they collected. Okay. So that sort of sets the stage of, all right, this is a body of information we have available to us to somehow use to reconstruct doses during the residual period.

Now we can move on to, a little bit more quickly. But I think it so important to set the table and understand where, you know, how this whole thing plays out. Slide 5. Okay.

There's only really one reason I brought up, I put slide 5 together. The SEC Petition Evaluation Report was issued in April 2017. This is the report that NIOSH prepared.

And that's the report that SC&A was asked to review. And we got to work. And we're reviewing it, looking at the internal, the data that they had, internal exposures and external exposures.

Along the way, the petitioners, I think there was some feedback, because they looked at the SEC Petition Evaluation Report also.

Chair Beach: There was two letters that were sent.

Dr. Mauro: There you go. And they brought up a very important point. They said, folks, I think you guys missed the boat. There was an awful lot of things that took place during the residual period that you did not take into consideration. Okay.

And because of that, we held a special three-day

meeting. What was the town just outside of Boston? Started with an M.

Dr. Neton: Attleboro?

Dr. Mauro: No, Attleboro was I think --

Mr. McCloskey: Madison --

Dr. Mauro: Manfield. Manfield?

Mr. McCloskey: Yes, Mansfield.

Dr. Mauro: Manfield, we met in Manfield. And, you know, Pat and Pete, myself and Rose Gogliotti were there. And we met with 12 of the workers that worked there during the residual period. And they were great. They just poured out information. And the transcripts I think are now available for everybody to read.

And these are the people that actually were there. They worked there during the residual period. And they all told their personal experience and what they did.

So we have -- in October, actually on the 24th through the 26th of October 2017, they come in and they tell their story. And son of a gun, they were right. There were some really unusual things going on that created circumstances that were not captured explicitly in the SEC Petition Evaluation Report.

So the takeaway, and I think we would all agree, the takeaway is, you know what, we got to go back to the drawing board and do the best we can to see if we could reconstruct those unusual exposure scenarios that they described to us using the information they gave us.

And so that became the key. So now, and here we are today talking about it.

You know, so we went ahead and wrote our report, this February report that includes all of this. And our,

I guess, outcome is that I think we have enough data that we could reconstruct these unusual scenarios that we're going to talk about in a minute.

But it's a stretch. Okay. I'll be the first to admit we struggled with it. You know, do we really have enough information here that we could model these doses? And we caucused a lot on that. And we talked about it.

And our takeaway is, yes, I think you could do it. All right. And we explained why. We explained the data we have and why we think we could do it.

And in my opinion, it's, you know, we -- that's our takeaway. But really it's the Board that has to judge, well, do you really have enough data to do that. Do you really understand the scenarios, these kinds of unusual things that took place in the residual period that you could marry those activities to the data and somehow come out with a way to calculate worker doses, right?

And that's a judgment. Our takeaway was, yes, you could do it. And we actually give examples in our report of how we would do it. Okay.

Now, we're not saying -- in fact, not only that, we give examples. But we also talk about a number of strategies you could come, you could use. There's a lot of ways you could, you know, come at this kind of problem.

We picked one particular, a couple of approaches to do it. And we give our results and the doses.

And the outcome was, well, there are a lot of different scenarios, a lot of different activities. And we're going to talk about those activities.

But one in particular turned out to be the one that had the greatest potential, in our opinion, to cause additional exposures that were not originally addressed in the Evaluation Report. And that's referred to as subsurface activities. And we're going

to get a little bit into that.

These are things that the workers did a lot of when they dug holes and worked underground. And, lo and behold, under the ground there was residual radioactivity.

There were pipelines that they cut. There was a lot of hands-on work in the hole, in the ground, under Building 10, and outdoors where there was residual radioactivity where the workers up close and personal close to this residual activity. All right.

So, but -- and we're going to get into other scenarios, other ways also that we looked at. But it turns out they did not really, they were not the big drivers.

Although, as we discuss this, I know Josie has her thoughts. There may be some others that you guys didn't look at. We talked about this last night. And I think it's important we talk about that. And we'll get to that. Okay. Let's move on.

Chair Beach: I just don't want to get too far into Site Profile stuff --

Dr. Mauro: Right.

Chair Beach: -- because I know some of your slides appear to be more like Site Profile in --

Dr. Mauro: Yes.

Chair Beach: So I want you to be careful with that.

Dr. Mauro: And we're going to -- I'm going to emphasize the data, what it is and why we think you could use it, and not whether we use the 50th percentile --

Chair Beach: Okay.

Dr. Mauro: -- the 95th percentile, no. We're going to talk about, listen, here's the data we have. Can you use that data to model that pathway? Or that just doesn't work. And therein lies the SEC question. Do

you have the data? And are you stretching it too far? That's it. You know, and that's a judgment call.

So we're going to move on. And we're going to first talk about reconstructing the internal exposures. Okay. All right.

Now, we could think about this and there's --

Chair Beach: What page are you on --

Dr. Mauro: I'm on page 7 now.

Chair Beach: Okay.

Dr. Mauro: Okay. All right. Now, the way I'm going to tell my story is NIOSH wrote their SEC Petition Evaluation Report. And they have described in detail the method they used to reconstruct internal exposures during the AWE period. Okay.

And so we reviewed this report from the point of view of the classic approach. Okay. This is how you plan to reconstruct internal exposures. And do we have anything to say about it? Okay. That's on one level.

The other level, which is the more important level, is we now know that there were sources of internal exposure that are uniquely associated with the residual period that are not explicitly addressed in the current version of the Evaluation Report. And we're going to get to that part.

So I actually broke it up into two parts. Okay. What are our comments on your SEC Petition Evaluation Report and how you came at doing the internal exposure? And we have some comments on that. We'll talk about that.

But more importantly, and we got to get to this, is, well, what about these new pathways that the workers described to us. How are you going to deal with that? And we're going to get to that.

But let's first do the, what I call the classic Evaluation

Report, internal exposures. Okay. Now, it turns out that the pathway that NIOSH evaluated is called the classic resuspension pathway for internal exposure.

You could visualize -- for those of you who have done AWEs, you've heard this before. But for those of you who haven't done AWEs, this is the classic problem. During the AWE period, they're machining and working and handling uranium. The deposits happen on the floor, on the ground. Okay.

When the AWE period ends, they get rid of all the uranium and some thorium. And what do you have left? You have a little residue or a little whatever on surfaces. Okay. It's there.

And now you're in the AWE period. And there's workers working around not knowing that there's residual uranium on the ground. And they kick it up. It becomes airborne. They breathe it. They ingest it. So you have to model that pathway. Okay. So NIOSH said, okay, we have to model that pathway.

And here's where we were in a fortunate position. It turns out that in 1966 and '67, the last two years of AWE operations, they took 7,776 swipe samples from the surface to characterize the end of, toward the end of the AWE operations. As part of their regular health physics survey program, they collected that data.

NIOSH says, okay, we're going to assume that that's the level of contamination that's on the floor at the beginning of the residual period. Good, good, classic, what's called OTIB-70 approach to the problem.

Then they said, okay -- and this is removable contamination. They take a paper. They wipe the surface. They count it. Okay. So they have the results presented as dpm per 100 centimeters squared of surface contamination. And they have 7,765 of those values.

NIOSH went ahead and said, okay, that's the stuff that could become resuspended and people breathe

it. That's the stuff that people will be standing on and could get external gamma and beta exposure from.

NIOSH elected to say, okay, they're gathering the data, and they put it into a distribution. And they say we're going to pick off the upper 95 percentile of those 7,000 numbers.

Chair Beach: Okay. Can we -- can I stop you before --

Dr. Mauro: Sure.

Chair Beach: -- you get to that, because I had a question on the swipes before you get into the 90th percentile?

And my question when I originally read this was where did you get the swipes. So I actually went in and looked. And I have a list of where they were all located.

And I want to say that probably about 75 percent of them are illegible. You can't read them. And I see where they had '66 to '69. And you're only electing to do '66 and '67, those years.

But I have a question, because it's hard to distinguish where those were even taken. A lot of them you could kind of make out floor. You have the front page that says locker room, machine shop, x-ray inspection area, the applied physics lab.

I guess I'm going to have a hard time with how you're going to take those smears and use them in this environment. And most of it you can see are floor. I don't see a lot of walls. I don't see rafters. I don't see anything in subsurface areas where these guys were actually working. So I do have questions on those.

Mr. McCloskey: Of course, we concede that the subsurface isn't modeled well with this model. And that's why we're going to talk about a whole different scenario. And the rafters, there might be some overhead contamination surveys available there. But

--

Chair Beach: It's not clear by those, by --

Mr. McCloskey: And you're right. The legibility is a concern. It was a struggle.

But we understood which, you know, to the extent that those surveys were labeled, we understood which areas were within the HFIR or excluded areas. And we tried to only use the areas that were outside of the HFIR within the final periods of the AWE operations. And so, I mean, we blow up this --

Chair Beach: So some of the areas that have the really high readings were like the enriched vault. Is that something you were going to use? Or the smelting room, the nuclear -- I mean, there's some that are clearly higher.

Mr. McCloskey: Yes, I think the rooms you just mentioned are HFIR rooms. I have maps. And like --

Chair Beach: Yes --

Dr. Mauro: -- we've done before --

Chair Beach: Yes, okay. So I'm just saying I'm concerned about that smear data as being usable for what we're talking about, some of the areas where you guys of concern is. So --

Mr. McCloskey: Okay. I know Rose looked at that pretty closely.

Dr. Mauro: Yes, Rose, are you online?

Ms. Gogliotti: I did actually go through that data with a fine tooth what NIOSH had actually used in their modeling versus what was actually used. And they were very, very claimant-favorable.

And in terms of the illegible readings, if it was, could have been a 4 or a 9, it was always the higher number. I went through maps and everything that could clearly be this area versus the HFIR was

included.

Chair Beach: Okay.

Ms. Gogliotti: And I actually only used the later data, because that would be more representative of the residual period rather than the earlier, which had more activity going on from operations.

Chair Beach: So what dates are you saying were considered the later?

Ms. Gogliotti: The '66 and '67.

Chair Beach: Right, okay. Yes, and that's -- I saw. And I'm not questioning that they used the most claimant-favorable.

My question is more in line with where the swipes were taken and what areas workers were actually working. And that can just sit on the table for now. And I know we're going to get into that discussion --

Mr. McCloskey: One of the things you've seen me do in the past, Josie, I would take these maps, floor plans --

Chair Beach: Yes.

Mr. McCloskey: -- in the facility and put them in front of four former workers and have them point to the areas so that I could sort of marry what --

Chair Beach: Yes.

Mr. McCloskey: -- the description is on the survey to an area.

Chair Beach: Yes, and I caught that when I was reading all the worker transcripts. I did catch that --

Mr. McCloskey: Oh, okay.

Chair Beach: -- they were looking at maps.

Mr. McCloskey: Good.

Chair Beach: So I know --

Mr. McCloskey: Okay.

Chair Beach: -- that that's what you did. And I'm sorry I was not able to attend that meeting. But, so, yes, I understand that.

I just -- my concern is out on the table with those swipes and with where the folks were actually working. So we'll get into some more of that.

Member Anderson: So this is Andy. My concern was the representativeness and the sampling strategy, if there was one, when they did it.

Chair Beach: Right.

Dr. Mauro: Rose, as I recall, we talked about it and they set up a grid system?

Member Anderson: Okay.

Dr. Mauro: Yes.

Chair Beach: I think that was outside --

(Simultaneous speaking.)

Member Anderson: -- anything in writing, here's our strategy or --

Ms. Gogliotti: Well, these samples were actually taken as part of the regular operations at the site just to make sure that everything was acceptable for the workers that were actually working areas.

Chair Beach: Right.

Member Anderson: Okay.

Ms. Gogliotti: This wasn't part of the D&D.

Member Anderson: Okay.

Chair Beach: Not at all, which is the point I'm trying to make, too. And it has, there's nothing for outside

in the grid sampling you're talking about. And the workers did work outside. And there's nothing for that at this point in the swipes, which is some of the data you're planning on using.

Mr. McCloskey: Right, the workers outside, we would be concerned about the subsurface exposures out there.

Chair Beach: Right.

Mr. McCloskey: And we concede that the model that's in place using this surface resuspension doesn't accommodate those folks well enough. And we're going to address that with a separate method.

Dr. Mauro: So, as I understand it, our takeaway was they had lots of good data and the AWE, and as an all classic AWE, I'm sorry, residual period for AWE sites, that's the OTIB-70 strategy. And it's been used time and time again. And it's been found to be acceptable. And we feel that this falls within that domain. And that's what was done. And once you get -- please.

Chair Beach: I was just going to say it does fall within the domain if you know what they're dealing with. But we're talking about subsurface work, inside and outside. There's roof work. There's rafters. There's ventilation.

And for a normal site, I agree with that. But for this site, I think it's unusual. And I'm not in --

Dr. Mauro: And I completely agree. And we're going to get to that.

Chair Beach: I know we are.

Dr. Mauro: You see, what I'm trying to do is, this is what was in the SEC Petition Evaluation Report --

Chair Beach: Yes.

Dr. Mauro: -- which is the classic OTIB-70 approach.

Did they follow --

Chair Beach: Right.

Dr. Mauro: -- the classic OTIB-70 approach that has been approved? And did they have the data necessary to follow that approach? We will get to the point where that approach is inadequate --

Chair Beach: Yes.

Dr. Mauro: -- and what scenarios might have existed that that approach doesn't capture it. And that we will get to. So I felt it good to separate the two.

Chair Beach: Yes, and I just felt I needed to bring up the swipes since that's what we were talking about there. So --

Dr. Mauro: So now we have an estimate of dpm per 100 centimeters squared. It turns out the upper end value that they picked was 54.8 dpm gross alpha per 100 centimeters squared. Okay. The average turns out to be 12.5 if you average all of the readings.

So, and once you have the activity, whether you go with 12.5, you go with 58, or you go with some bigger, a higher number, because in theory you can go wherever you want to go on the distribution, then you apply a resuspension factor, which basically tells you, if you know the activity on the surface and we know people are working there, you get dust coming up that people will breathe and people could inadvertently ingest some. All right. Enough.

But there's this other pathway, which we will get to, which is what about the rafters and stuff that might be coming down. But, of course, the stuff that comes down will land on the ground and be part of, you know, but that, you know, but during the AWE operations.

But you bring up -- we're going to get to that point. And we did not address that. NIOSH did not address that. And that's going to be a subject that we've got

to talk about. But I think I want to get as much --

Chair Beach: Go ahead.

Dr. Mauro: -- behind us that we could say we understand. And whether we agree or disagree is another matter.

Now, my takeaway -- and now you've got this resuspension factor. When you take a resuspension factor, you have to take into consideration how loose is the contamination.

And there's a lot of discussion about it. And Jim and I talked about it. There's guidelines. There's OTIBs.

There are times when you should use a fairly low resuspension factor, 10 to the minus 6 per meter. That means only a very, very small amount was coming up.

And you use that when the site is relatively clean. They've sort of cleaned it up. And there really isn't that much activity going on where people could be scuffling around kicking dust up. So, but NIOSH elected to use what I call the lower one, the 10 to the minus 6 one.

But our takeaway -- and I am going to get to actually the end of the story. Our takeaway is that if we were doing it I would have gone with the average concentration of 12 point something dpm per 100 centimeters squared and not the upper end. And let me tell you why.

Picture that you've got a large floor area that's contaminated and it's patchy. Okay. And now all of a sudden work is going on. People are walking around kicking dust up. And the dust comes up and falls down, comes up and falls down. And it sort of redistributes itself.

So, in the end, if you're working there for a few years, you're not going to continuously experience the upper 95th percentile. How could that happen?

You're going to experience more a general central tendency number that represents sort of the average conditions.

So I would have gone with a lower number. So I think you were very conservative.

Mr. McCloskey: And we agree at the moment that that's more appropriate --

Dr. Mauro: Yes. Although in light of what we just heard Josie mention, you know, that the, maybe it was fortuitous that you used the 54.8, because it sort of it takes care of some of the concerns you raised, heavily contaminated and where workers primarily worked. And maybe that could be, that could happen.

But the way I look at it, over a long period of time, workers would be exposed more to what I would call a central tendency measure of the activity on surfaces.

But I would have gone with 10 to the minus 5 per meter resuspension factor because, remember, this was a swipe sample.

Chair Beach: From '82, correct?

Dr. Mauro: No, no, not '82. We're still in the data that comes out of the AWE time period, which is 1966/'67 data.

So we have these swipe samples. But they're swipe samples. Now, a swipe sample means that stuff is readily removable, right? So, if it's readily removable, that means it's readily removable. You want a higher resuspension factor. You don't go with the 10 to the minus 5.

And in fact, if you go into the history of where those numbers come from, the NRC, and I have a footnote in my report, recommends a lower number when the site has been cleaned up. It's gone through D&D, maybe not the greatest D&D, but they've cleaned it up. And there's not too much activity going on.

Well, in my mind, they may have cleaned it up, but obviously there was still a substantial amount of removable contamination swipe sample. And we also know there's an awful lot of commercial activity, people moving around doing all sorts of stuff.

So I would have gone, I would have done the problem a little differently. I would have gone with a lower concentration, 12.5 instead of 54.8 dpm per 100 centimeters squared. But I would have gone with a ten times higher resuspension factor.

What's the difference? A factor of two. So we would have come out with a factor of two. You know, that's how we would -- and that's the end of my story.

Dr. Neton: And I might have read this in the report somewhere. I'm not sure if this is true. But there were multiple AWE and non-AWE operations going on before 1968. Is that correct?

Mr. McCloskey: Yes.

Dr. Mauro: Yes.

Dr. Neton: And so it's true that both of those operations were covered in the AWE period. When you get to the residual period, the only residual contamination that's covered is the AWE-derived contamination.

Dr. Mauro: Right.

Dr. Neton: And what we have represented in these smears are commingled contaminations.

Dr. Mauro: Yes.

Dr. Neton: So, in that sense, it's conservative as well, because I don't know if a portion was AWE versus non-AWE. But again, you're only supposed to cover the AWE-derived. And I think the way it works is if you can't distinguish between the two, you just assume it's all --

Dr. Mauro: It's --

Dr. Neton: But there is a conservatism built into that calculation as well that we're assuming everything that was smeared in that building was AWE-derived.

Dr. Mauro: Good point.

Dr. Neton: Just wanted to point that out.

Dr. Mauro: Agree with you.

Dr. Neton: And what I think would be interesting is to look and try to quantify what those ratios are, because if it's -- I don't know what it is.

Dr. Mauro: Yes, so --

Dr. Neton: It could be ten, you know, and --

Dr. Mauro: Yes, and that's why I say this factor of two difference that we came up with, it's sort of noise when you think about the things you're doing and the kinds of consideration you just don't know.

So I'm not that troubled by the fact that we came in with a different, maybe it was higher. The way I -- my takeaway on this is that we were both in the same ballpark. And this would be what we would call a Site Profile issue.

Dr. Neton: Right.

Dr. Mauro: Okay.

Dr. Neton: And by the way, that ratio also applies to all these subsurface contamination value we'll be talking about --

Dr. Mauro: Yes, we'll get to that.

Dr. Neton: -- distribution --

Mr. McCloskey: Yes, the two biggest projects are on the AWE period. And the biggest one was the Naval Nuclear Propulsion project core assembly, so that

was the lion's share of the work. It's not covered obviously. And then --

Dr. Neton: So you're saying the contamination in Building 10 specifically was a combination of work activity, I believe.

Mr. McCloskey: Yes.

Dr. Neton: And the extent that it was driven by non-AWE operations would be interesting to quantify.

Dr. Mauro: And that's mentioned in our report, our big report.

Dr. Neton: Okay.

Member Kotelchuck: This is Dave. I was not here back on the Board when those kinds of decisions were made. What drove it? Was it a legal opinion, or was this a technical matter that we determined?

Dr. Neton: I think it was more legally driven in the sense that I think the Act says something about it should cover activity at that facility. It didn't delineate AWE activity versus any other activity. So the position was taken that activity at that facility is all radioactivity at that facility during the AWE period.

That same logic does not apply in the residual contamination period because there's no AWE activity at that point.

Mr. Sharfi: So it's written into the Act.

Dr. Neton: It is.

(Simultaneous speaking.)

Mr. Katz: -- get to the bottom of the --

Member Kotelchuck: Okay.

Mr. Katz: -- it's a legal matter.

Member Kotelchuck: To me, technically --

Mr. Katz: Yes.

Member Kotelchuck: -- that doesn't make sense in terms of the exposure of people.

Dr. Neton: I agree.

Member Kotelchuck: But the law is the law. And we --

Dr. Neton: It's really an interpretation, though.

Member Kotelchuck: Okay.

Dr. Neton: I mean, it's not specific that you cover all activity. It doesn't say so. So the conservative interpretation was made that --

Mr. Sharfi: In the Act, the residual it specifically says that only --

Dr. Neton: Yes, right, yes.

Mr. Sharfi: -- residual. So it specifically excludes all the other stuff in the residual period --

Dr. Neton: Except where you can't differentiate, and then you should include both.

Chair Beach: And then in this case, it's pretty muddled in --

Dr. Neton: Yes.

Chair Beach: -- my mind -- this time period --

(Simultaneous speaking.)

Dr. Neton: Yes, and we've had this situation before where, you know, a plant or a site does a little bit of AWE business, I mean, more than a little, but you get a little bit of contamination in the AWE period. In this residual period, related to AWE operations. Then you have this massive amount of commercial activity. And how do you really --

Member Kotelchuck: I've seen it elsewhere.

Dr. Neton: And to the extent we can tweeze those out, we do. But in some cases and in this case --

Member Kotelchuck: Right.

Dr. Neton: -- we can't. So --

Member Kotelchuck: But it's a legal opinion, and it's in the law. It's the legal interpretation of the law.

Dr. Neton: Yes.

Member Kotelchuck: Then we don't have any choice or say.

Dr. Neton: Yes, there's no way to, or we have to follow it.

Member Kotelchuck: Okay.

Mr. McCloskey: John, since this is your Observation 1, and we said we would delineate action items from this onto issues matrix, I think it might be worth noting here that we agree that we've averaged for the better idea, and the minus 5 resuspension we can agree with that. And we can just let it be no action.

Dr. Neton: I think that's included in our report, is it not?

Mr. Sharfi: In our matrix, we've already agreed that when you revise the AR that that was the other revision that would be in. Okay.

Member Kotelchuck: What observation was that?

Mr. Sharfi: Observation 1, page 4 of 9 on the matrix.

Dr. Mauro: Now, we're at a point now where we -- okay, we've got the airborne activity. There are people that are going to be breathing that airborne activity.

But what are we going to assume it is? We know it could be uranium or it could be thorium, because we know there's a little bit of thorium work going on, too.

NIOSH's position is, well, since you've, you know, it's most likely going to be uranium, but it could be thorium, too. So their position is that they will assume the radionuclide that's the most limiting.

So let's say you're reconstructing a dose, a particular type of cancer, where the thorium assumption is limiting from a PLC perspective, they're going to use that or uranium.

So we like that. I think that's claimant-favorable to default to the isotope that would be the limiting one --

Chair Beach: Have you moved to page 8?

Dr. Mauro: I'm on page 8.

Chair Beach: Okay. I just want to make sure where --

Dr. Mauro: Yes, please remind me. I'm trying to stick with the pages --

Chair Beach: That's okay.

Dr. Mauro: -- while I, you know --

Chair Beach: You started talking thorium. And that is definitely on --

Dr. Mauro: And that's on that page, exactly.

So now we've got that. Now, there's one more last item. When we talk about the concentration that's in the air from resuspension and from the swipe samples, remember those swipe samples were taken at the end of the AWE period. And we're assuming that the, that that's the activity at the beginning of the residual period.

The reality is we all know that, as time goes on, whatever's residual is going to go down just due to natural attenuation factor rates. It just goes down.

Now, it turns out that NIOSH did a very thorough

review of this subject in support of OTIB-70. And the takeaway was, well, a good rate of decline is .00067 per day. That's the fraction of the activity that's present is exponentially going down at that rate per day.

And in theory, they could have used that as a default value. But they were fortunate that they had -- remember I said earlier measurements were made in 1982? And those measurements were -- they were not swipe samples. They went there with an alpha survey meter. And they did classic, I guess, zinc sulfide survey getting a gross alpha count. That's how they did that survey in '82.

All right. They said, okay, now we know the dpm per 100 centimeters squared, not on swipes now in this '82, but based on a gross. They said but -- so what do we do with that?

Well, we know that not all of that activity is resuspendable, because now we have the total activity. It's not just the swipe, which is resuspendable. We have the total activity, all right, only a portion of which would be resuspendable.

Well, it turns out this subject has been studied by the Nuclear Regulatory Commission. And there's actually some regulatory guides, and I cite them in my report, that says, you know, the reality is it's only about ten percent of what you might measure that is resuspendable.

So what they did, NIOSH did, they said we'll take the survey readings and dpm per centimeters squared and divide by ten and say that's the stuff that's removable. Okay.

Now we have an estimate of the airborne activity using the resuspension factor, whichever you choose, in 1968. And we have a concentration in the air based on this survey with the adjustment for what's removable in 1982.

You draw a line and you get a slope. And the slope turns out to be .00025. This is bullet number 6 on page 8. The slope is .00025 per day, the fraction of the activity that becomes airborne per day when you calculate the slope.

What is so nice about this, all that stuff, it's a little bit higher, the rate of -- no, sorry. The rate of decline is slower as measured when using real data. And they use that data. Bingo. You can't do better. Okay.

Not only that, it reinforces the default value that's in OTIB-70. It's another case where you say, you know, that's a pretty good number, because look at that, we've got real data, more real data. They had some real data when they originally did it. And now we've got more data.

So our takeaway is that's great. That's the way to do it. So our only difference from this particular scenario, we're spending a lot of time, but it's good to understand this stuff, is that we would have used a little different approach that may have come in a factor of two higher. And it sounds like you guys would agree with that.

Okay. All right. Now, the end of the story now is what about ingestion.

Chair Beach: Now we've moved to page 9.

Dr. Mauro: We're now on page 9. We're on the pathway, ingestion. And this is where I could use a little help from NIOSH.

The approach that they take is there is some guidance out there and some data out there that says, if you know what's on the surface, contaminated on the surface and you know people are working and you know that inadvertently they're going to use hand-to-mouth activity and then ingest some stuff, well, what NIOSH used was 10 to the minus 4 per meter squared per hour.

So whatever the activity is meters squared and dpm

per meter squared, 10 to the minus 4 of that is going to be ingested every hour. Okay. That's the ingestion rate. And that was the approach that was used.

Now, I'm just going to bring this up as a question. That's a widely used number. It's, I believe, very similar to the number used in NUREG/CR-5512, which is sort of like a bedrock report that the NRC uses. And but it -- and in the past in reviews like this we accepted that as being -- we're okay with that.

But more recently, and Bob Anigstein could speak to this, more recently on the Carborundum project and on the --

Chair Beach: GSI.

Dr. Mauro: -- GSI, a different strategy was used. And all we -- and one of our findings or observations is that did you consider that as being another approach.

Bob, would you, if you're on the line, would you mind giving us a quick description of the difference between these two approaches?

Dr. Anigstein: Sure. Whenever there are measurements or the model of surface activity at the end of the AWE period in several cases, like Carborundum was the most recent one I was involved with, we use that. We don't take the airborne --

Mr. Katz: Excuse me, Bob. Bob, as often with your phones, this phone that you're using right now is not very audible. So --

Dr. Anigstein: Okay. Just a moment.

Mr. Katz: Yes, thank you.

Dr. Anigstein: All right. Is this good?

Mr. Katz: Much better. Thank you, thank you.

Dr. Anigstein: Okay. So what we've done then is, if you know what was going on during the AWE period,

you simply say the surface activity will still be there. The air activity won't be there except as through the resuspension. So you can model resuspension during that period.

And also, since the ingestion pathway depends on not only the airborne activity but on the surface activity, you simply use, I believe it's TIB-9, which Jim Neton offered, and you use that to give you your ingestion pathway.

So the ingestion pathway actually does not decrease. It stays -- whatever the ingestion pathway was at the very end of the AWE period, it just continues into the residual period with this OTIB-70 decline of the table in OTIB-70 in terms of how much -- first year you assume there's no decline. After that for the next 30 years, there is a exponential decline every year.

So that seems like a very straightforward way. Actually, it's a little on the conservative side, because as was pointed out by one of our colleagues, Bill Thurber, when he reviewed the Hooker Electrochemical site, he said actually there are two almost equal components to the ingestion pathway.

One of them is the worker gets, his hand is contaminated, and he inadvertently licks his fingers, puts his hand on his face, and some of that gets ingested.

And then there's a second equal pathway where he has a cup of coffee, and fallout from the activity, the airborne activity, goes into his cup. Now, that fallout would not exist during the residual period because that airborne activity is gone except for resuspension, which is all right.

However, we haven't really made an issue of that, is the factor of two difference. So either of these, either taking the TIB-9 or what's after TIB-9 would be acceptable.

I have personally been involved in this one. So, in the

first history year, when I was working under a contract with NRC or even EPA before that years back, we reviewed 5512.

And as pointed out, it's a NUREG/CR. So it's a contractor NUREG. It's something that NRC paid for. But it's not necessarily accepted as NRC policy. You have your, when you have a NUREG without the CR after it, that's an official NRC document. This is just something that was an NRC-sponsored work.

And the 10 to the minus 4 is just an arbitrary number from that. Not to be deprecating, but, I mean, it does say, well, let's just assume that it's one squared, 10 minus 4 is simply one squared method. You know, it could be a square meter, though, 10,000 square centimeters is a square meter. It just says, you know, if we're working in inches, you could write it just as easy and call it a square inch.

So that does not have a scientific backing. The TIB-9 has a plausible argument attached to it. And more important, it has been accepted, as SC&A reviewed it, has been accepted work in progress.

So basically, here's what we're saying. Use the known activities at the end, the known conditions at the end of the AWE period, and then use the TIB-9 approach.

I will say parenthetically that the ingestion pathway, at least for uranium, assuming there's all different airborne activity, makes a tiny contribution to the dose, because first of all, there's less intake than inhalation, and second of all, the dose conversion factor is for all of the order -- don't quote me on this because I'm not looking at the numbers. But my recollection is they're about an order of magnitude less than the inhalation pathway.

So it's added because you have to consider all pathways by law, by regulation. So we always do the ingestion pathway. And it always comes out that we -- and I'm just quoting it for recent dose construction.

It's typically one percent of the, give or take, of the inhalation pathway. So it's not something probably you should spend a great deal of time on.

Dr. Neton: Thanks, Bob. Okay. I'm probably in the best position to address this issue.

First, Bob, thanks for giving me credit for writing TIB-9, but Dave Allen actually wrote TIB-9. I did review and approve it. So I'll take that much credit, but to set that record straight.

Secondly, TIB-9 -- and we've had this discussion before. TIB-9 requires you to have an airborne concentration value, an actual work process airborne concentration value. I don't think we have that anywhere at this site.

And this came up, I forget which site, but we had this long discussion about this. And you cannot resuspend material on the ground and say that's the air concentration that you're using to generate the ingestion value of TIB-9, which is 20 percent of the ambient air concentration, it just doesn't work physically or logically, because TIB-9 assumes that you have deposition coming from an active process, airborne process generation.

And we modified, I believe, TIB-70 to include this square meter ingestion rate to accommodate that lack of data onsite. So this has been discussed before and --

Dr. Mauro: I can help out a little bit more here, too. I agree with you, this whole issue of deploying two times the air concentration. But that's not what Bob's saying.

Dr. Neton: Okay.

Dr. Mauro: Bob's saying when you go through that process during the AWE period, which is the appropriate way to go, you take the air concentration times .2 --

Dr. Neton: Right.

Dr. Mauro: -- and you get the ingestion. But you get an ingestion. You got an ingestion now.

Dr. Neton: Right.

Dr. Mauro: Okay. That's what the ingestion is during the AWE period. And all Bob is saying, well, if that was the ingestion during the AWE period, the -- so forget about the air now. We're not in the air anymore, right. Now, we're saying this is what is being ingested.

And that's going to go be the same, because it's the same process you're going through, you know, inadvertent -- you see, you made a good case of when you're in the AWE period, you use the .2 approach and you get an ingestion. And that works.

Dr. Neton: Right.

Dr. Mauro: But now you have an ingestion number. All right. And all Bob was saying is, well, if you got an ingestion number, that ingestion number is going to continue into the residual period.

Dr. Neton: But it won't, because the airborne concentration drops to zero from the mechanical process.

Dr. Mauro: But at the end of the -- think of it like this. You're saying that at the end of the AWE period this is the ingestion, how many picocuries per day. That's what it is at the end of the AWE period.

Well, whatever you eat, that's what's ingested and it's because of this hand/mouth relationship primarily. Well, it's going to stop, it's going to continue right into the -- so it's another way to think about it. Do you see --

Dr. Neton: Yes, I'd have to go back and look at what we did for the ingestion --

Dr. Mauro: Yes.

Dr. Neton: -- in the AWE period. I don't remember what we did.

Dr. Mauro: Your approach has always been after we fixed the .2 problem --

Dr. Neton: Yes.

Dr. Mauro: -- which we all agreed, we went to the 10 to the minus 4 approach. And we accepted that.

Dr. Neton: Yes.

Dr. Mauro: As Bob pointed out, what was recently accepted was this other idea that I just mentioned that we applied to Carborundum and General Steel, where you say, well, you've got an ingestion number. Forget about the .2 now. You've got an ingestion number, how you came to it you came to it.

Dr. Neton: I don't remember how we came to it. But if it -- we'd have to go back and look at that. I don't --

Mr. Sharfi: At Carborundum we had an --

Dr. Neton: Airborne --

Mr. Sharfi: -- airborne during the operation --

Dr. Neton: At the very end of it probably.

Mr. Sharfi: Well, yes, because we did an entire -- I mean, we don't have an SEC during the operational period. So we had ingestion intakes during the operational period.

Dr. Neton: Right.

Mr. Sharfi: And so we now then calculated it separately per dose year because it has multiple residual periods --

(Simultaneous speaking.)

Mr. Sharfi: So this -- I think what we did was we just, like John said, we just copied over. And we really didn't recalculate during the residual period.

Dr. Neton: But I assume we did that because we didn't have any idea of surface contamination on the ground. See, if you have no surface contamination values, you have to use your airborne concentration.

Mr. Sharfi: Yes --

Dr. Neton: Because you've got a detailed map that tells you what the surface contamination levels are, then you would default to what's on the ground, not some extremely highly conservative value, which is assume that the ingestions people took at the end of, compared to the value that would be experienced at the very last day of operations.

If you have a surface contamination value and you have no air concentration value in the residual period, then to me it makes sense. And that's what we did.

I do agree that it's a small component in the overall dose. I mean, it might not -- I think if you look at the ingestion rates that we're using, it's probably higher than what we did for the ingestion, well, probably not the ending operational period.

It's a pretty -- this value that Bob sort of said was not very scientifically valid, I think is a little more credible than Bob portrayed it. I mean, it is a contract report. We do agree it's not an NRC policy decision.

But it was pretty, it's a pretty well reviewed document I think. And there is some science behind it. It's not a made up number. And I don't think it's 1 times 10 to the minus 4, but something else in that --

Dr. Mauro: It's close.

Dr. Neton: Close, yes. And there is a write-up in there. It's pretty credible to us. And I think we all

agreed several years ago that this value was appropriate to use when there was a paucity of information at the end of the operational period.

Mr. Katz: Well, I think you can iron this out.

Dr. Neton: Yes, this is --

Mr. Katz: You can iron this out in reports --

Dr. Neton: This is --

(Simultaneous speaking.)

Dr. Mauro: One point that I'd like to mention, though, once you move into the residual period, all of a sudden what happens is, as Bob pointed out, the inhalation contribution during AWE grossly dominates the intake and the inadvertent ingestion is always a very small fraction.

But once you move into the residual period, your airborne pathway drops like a rock.

Chair Beach: In most circumstances.

Dr. Mauro: In most circumstances --

Chair Beach: No, this one is a little --

Dr. Neton: -- there is no airborne concentration or residual contamination --

Dr. Mauro: Except for resuspension.

Chair Beach: Right.

Dr. Neton: There's zero process generated air --

Dr. Mauro: Exactly. So all of a sudden the ingestion pathway becomes relatively a little bit more important. So --

(Simultaneous speaking.)

Dr. Mauro: We should move along. Yes, because we're not really -- I'm spending all this time on --

Dr. Neton: Yes.

Dr. Mauro: -- not the important things. Let's close this thing down. Okay.

Dr. Neton: Could we take a little break for a second?

Chair Beach: Yes, I was going to say 10:30. But let's break now. Ten, fifteen minutes, what do you think?

Mr. Katz: Ten minutes is good, comfort break.

(Simultaneous speaking.)

Chair Beach: Yes.

Mr. Katz: So it's 9:50. We'll get started again at 10:00.

(Whereupon, the above-entitled matter went off the record at 9:50 a.m. and resumed at 10:03 a.m.)

Mr. Katz: Okay, we're back, pretty much on time, and John, let's carry on -- oh, let me just check and see. Andy, are you back on the line? Henry?

Member Kotelchuck: Well, we've got a quorum. He'll be back in a moment, I'm sure.

Mr. Katz: Andy, are you there?

Member Anderson: Yes, I'm here.

Mr. Katz: Okay, great. Thanks. Okay, John, go on.

Dr. Mauro: Okay, we're on page 10 of my slides, and really in the home stretch of this piece. And on page 10 it says, Okay, what are the issues that SC&A has raised regarding the Evaluation Report with respect to internal dose?

And next, page 11, is a summary of those, and we already talked about it. So we're done with pages 10 and 11. We don't have to talk about that; we already did, okay? It simply summarizes what all our issues are -- simple.

Okay. Now, we're going to get to the meat of this meeting; why are we here? All right? I mean, the more important reason, in my mind; the Petitioners met with us, and they were great. And they told a story about -- listen, as I mentioned earlier, you really missed a lot of important pathways.

A lot going on there, and during that meeting, we met with 12 people. Notes were taken; I believe they're all in the record now. The transcript is out there. When I wrote this, I did not have a transcript, but I took 50 pages of notes. I think I got it right, but you may have more to add, and that's great.

But the important point is this: Remember when I opened up, I said, When an SEC is granted for the residual period at AWE facilities, it's because something unusual was going on, either in regard to what was left over, in terms of contamination, or people were doing things that were unusual, which put them up close and personal to contamination, and there are cases when that happened. In fact, as it turns out, there were three, where historically, we found SECs were granted for AWE residual period.

Well, we have one of those here. We a place where there was residual radioactivity, and you're going to see it wasn't that high, but there were some pockets of it that were what they are. And there are certainly unusual things going on that are not explicitly taken into consideration in the current version of the Evaluation Report.

Now, here's where the creative process comes in a little bit. In listening to the workers, I have a takeaway. I said, Well, what are the pathways that I just heard this guy describe to me that we need to explicitly address and try our best to quantify? And if we can't quantify those, we got an SEC. It doesn't need talking about.

If we could quantify that reasonably and say, Well, I think we could place a plausible upper bound, then we don't, in my opinion -- you guys make that

judgment, but I think the doses can be reconstructed. It's just a matter of what assumptions you want me to use.

So my takeaway was that there were four pathways that were described to us. There was a lot of material that was described to us. I mean, these folks -- we were there for three days, six hours a day, listening and taking notes. These were the workers; they actually did this stuff. And the first one -- you see these four bullets on page 12 -- first one was what they called Subsurface Maintenance and Repurposing Activities, especially in Building 10. Building 10 was where most of the activity was, where most of the AWE activity was, and where a lot of the residual radioactivity was.

And the Petitioners point out, Listen, we were digging into that, cracking through the concrete, and digging down -- not all the time, but often -- because we were repurposing and maintaining.

What they were doing is, they get a new contract; they'd have to put new equipment in to do whatever they've got to do. And usually doing that required them to dig down, build a new foundation, put in a new piece of equipment, dig out the old dirt, and put the new piece of equipment in.

But even more importantly, it turns out that a lot of their conduits and lines and drainage lines were all subsurface, and those clogged up all the time. And the way they explained it to us was that apparently, there was a lot of dust generated during the activities that were performed, AWE and non-AWE. And water would go down drainage lines and clog up the lines with all sorts of debris, some of which was cuttings and dust, chunks of uranium that were jamming up the lines.

Now we're in the commercial section, right? And they've got work to do, and they have to have their drainage work. So they said, Well, we've got to go down there; we've got to go down there for a lot of

reasons. We've got to go down and clear those drainage lines. Sometimes they snaked it and just pulled out the junk. And sometimes, nope, you've got to dig a hole, climb down there. They said they go down as far as eight feet.

They go down there, they go, and they'll cut out the segment of pipe or conduit, whatever -- cut it out, replace it, and that was caulked. They're only doing this so that they can do their commercial work, and when they were doing the stuff, they had no idea there was residual radioactivity down there.

So here we go; those guys were in an unusual circumstance. They're in a hole in the ground where they didn't know there was residual contamination in the soil, and that there was residual contamination plugging up the drainage lines, and they were doing their job. That was in theory, they had the possibility of external exposure to uranium, but not that strong, but as beta and some gamma, and of course, inhalation. They said, How do we get out of the problem? We don't have an ongoing monitoring program of the subsurface environment. But what we do have is lots of data that was collected in the 1990s that characterized the subsurface environment, because they had to understand what was there to go through D&D, so there's data. There's data describing activity in the soils; there's data describing activities in the pipelines. And there's distribution of measurements there, big spreads, especially the pipelines. They go from very, very low concentrations for some of the sludge, to relatively high concentrations, very high, orders of magnitude difference between the low end and the high end.

Member Kotelchuck: Question: for those workers, for external radiation, were they wearing badges?

Dr. Mauro: No.

Member Kotelchuck: Okay. Because they didn't think it was --

Dr. Mauro: During the residual period, no badges, no bottle acid, no anything.

Member Kotelchuck: I just wanted to confirm --

Dr. Mauro: Because as far as they were concerned, they were just -- this was a factor in their work.

Member Kotelchuck: Okay. But they were doing commercial radio --

Dr. Mauro: Yes. That continued until -- that was a HFIR work, and that was continued, but that's -- those workers, they were covered, they were badged, they were under a very formal health physics program. But they're not in the SEC; they're out of the picture.

Member Kotelchuck: Okay.

Dr. Mauro: So whatever data you have for them, whatever you're doing --

Member Kotelchuck: It's physically in another spot.

Dr. Mauro: It's -- well, it's in Building 10, but I think it was blocked off. It had controls.

Mr. Darnell: We actually worked with the dosimetry of the person on the HFIR to see if there was any relationship we could come up with, and it just never worked. So it's completely excluded.

Member Kotelchuck: Good.

Dr. Mauro: Okay. All right, so there's one pathway. Let's talk a little bit about how do you get out of that? Well, we looked at the data, and I think you may have more data than we have, because we looked at the data that we had available up through the date that we finished this report, and we had a certain amount of data.

And the important data that we found was, the activity that was in the pipelines. And we said, Well, listen, there's activity in the pipelines, but we also

know those pipelines leaked. We also know that the floor in Building 10 -- very often, because of a high water table, sometimes there were puddles that had been drained, so the subsurface environment got itself contaminated, the soil, through seepage and through leakage of the underground pipes.

Now we say, All right. We have a guy who goes underneath. He goes in there -- what's his job? He's going to go in there and go either excavate out the dirt, so they can put in a new foundation for a new piece of equipment, or he's going down there to maintain pipelines.

Chair Beach: So can I add something? The drain lines themselves at the surface level, those were also contaminated; the tops of the drain lines when they went back in, I believe in the early '90s, they were finding counts right at the floor level, weren't they? Of those drain lines? That was a high point.

Mr. McCloskey: I think a few inaccessible surfaces around those, yes.

Chair Beach: There were some pretty significant doses from what I remember from reading some of the notes.

Mr. Sharfi: I mean, I don't know about significant doses.

Chair Beach: Okay.

Mr. McCloskey: They're weren't doses; they were --

Chair Beach: Or, not doses, contamination. Sorry. Okay. So the drain lines themselves were contaminated. I just wanted to make sure.

Dr. Mauro: And I'm going to call on Rose in a minute, I want to conceptually explain what we've decided to do.

Mr. Darnell: One other thing that's important to note is, most of the work that was done on the subsoil

stuff was done with dampened soil; we're not talking about completely dry soil.

Chair Beach: So now -- and I get where you're getting that from. There were certain evolutions from the workers' notes that I read, that they wanted to keep it dry in the later period.

In the early period, they said that sometimes it was wet, sometimes it wasn't wet. It was dusty; they would hose themselves off with air. So yes, it's a drain line, it's flooded. It's going to be moist; but not always.

Mr. Darnell: Then it's true then; I wasn't trying to take away from that part, but just so that everybody knew, the conditions down there were not always the worst case condition when they did the digging.

Dr. Mauro: Okay. So what we ended up doing was saying, Okay. We have all this information from the 1990 characterization work. We talked to the workers; they said they believed that contamination setting, as represented by the work done that they did to characterize the subsurface and surface environment in the 1990s in support of the cleanup operation, probably was the activity that was present throughout the residual period. They said that they would believe that that was probably a fairly --

Chair Beach: Okay. Can I stop you again?

Dr. Mauro: Please.

Chair Beach: Forgive me; this wasn't in -- you guys did the interviews. Now, one of the points that I was thinking of is, they were snaking and cleaning out those drain lines during the whole residual period, correct?

Mr. McCloskey: Right.

Chair Beach: So did the workers ever tell you when they reamed out a line, or when they dug it up and they took the pipe out, what did they do with the

material that was inside? Did they leave it down there and cover it back up?

Mr. McCloskey: So when you snake a drain, you literally pull the material out --

Chair Beach: Yes.

Mr. McCloskey: -- and dispose of it. So it's disposed of in whatever industrial waste --

Chair Beach: So in that case, I get when they snake it out. But when they went down, they cut through the concrete. They cut out a chunk of pipe, and then they cleaned it out, replaced the pipe. That particular material -- did it get left down below?

Because they're under the assumption that there's no contamination there; they're just working with a clogged-up drain. Did that come up in the interviews at all, what happened to that material? Because it's contaminated material in some cases, or potentially.

Mr. McCloskey: So you'd pull out the broken pieces of pipe and dispose of it, and whatever is inside of it. You wouldn't necessarily try to clean it up during --

Chair Beach: You'd just snake it out and --

Mr. McCloskey: But I think what you're saying is a good point. They wouldn't have tried to remediate all of the soils around there. They would do the normal practice of cleaning up after themselves, not leave material other than soils on the ground, and put it in a condition where you can operate.

Member Kotelchuck: Presumably, they put that in with their regular industrial waste, and the general waste pickup people would get that radiation. I mean, that limited amount of radiation.

Chair Beach: But it's not really radiation if it's put to the contamination. Because there were materials that they found -- metal -- they found a very long piece, a five-inch piece of metal --

Mr. McCloskey: Sure.

Chair Beach: But they also found shavings and stuff as well, in different interview notes I read. So anyway, okay, I was just curious if somebody ever said --

Mr. Sharfi: That would have to be covered under their commercial license to deal with radioactive waste anyway, so --

Chair Beach: But they weren't dealing with radioactive waste when they were in that subsoil.

Mr. Sharfi: They're still doing commercial radioactive work, so anything coming in would still be covered under their license to --

Dr. Mauro: The M&C workers that are seeking a petition are workers who are not associated with HFIR, and are only doing commercial work that was not radioactive.

Mr. Sharfi: No, I'm saying to dispose of the piping, they would still be under the commercial license to be required, on how they dispose --

Chair Beach: Had they known --

Mr. McCloskey: They had access to that building, because of their license, but they would not have identified this as a piece of radioactive material, right? And they would have just done whatever they needed to --

Member Kotelchuck: But presumably, they're not going to leave a pipe down there, that --

Chair Beach: Probably not.

Member Kotelchuck: They're going to remove a pipe to keep the site clean.

Chair Beach: I just wanted to know if it came out during -- if it was me, and I was a pipefitter, and I was cleaning out a pipe or whatever, I'd just leave it

down in the dirt and then just cover it back up. But I was curious if that was a question that was asked, or if it was talked about.

Member Kotelchuck: We didn't.

Chair Beach: Okay. Thank you.

Dr. Mauro: But I think it may be the way we came at the problem might solve that uncertainty. What we did -- I'm going to call on Rose in a minute --

Chair Beach: Oh, yes.

Dr. Mauro: -- is, All right. We've got lots of really nice data, characterizing the uranium concentration in the pipes. It comes in very wide distribution. The numbers are in the report. Rose and I --

Ms. Gogliotti: Ten to 53,000 picocuries.

Dr. Mauro: Say again, please?

Ms. Gogliotti: Ten to 53,000 picocuries.

Dr. Mauro: Ten to 53,000; big spread.

Chair Beach: I saw that.

Dr. Mauro: Now, one of the things Rose and I talked about is, Okay, you've got this guy now; he's working down there. He doesn't know if there's any radioactivity, and if you'd asked me, well, we know the range of activity in the pipe, and we know it leaked. So we know that the soil in the vicinity of the pipe is probably contaminated too, perhaps not to the same level as the pipe, because it's leaked. So what's in the pipe is something like the source, and what gets into the dirt is dispersed in the dirt.

But we don't know to what extent that occurred, and we don't have any detail or data on what was actually in the dirt in the vicinity of the pipe. You folks may have some information on that. When I read your report, it looks like you may have some subsurface soil measurements, am I correct? When I read your

report, I got the sense that you got hold of some data that we didn't have at the time we did our work.

Mr. Darnell: We shared it with Rose.

Dr. Mauro: Say again?

Mr. Darnell: We shared it with Rose.

Dr. Mauro: Oh, good. Okay, then the recent edit. But now, what we ended up doing is saying, Let's go to the upper 95th percentile of the uranium gross alpha, the uranium concentration in the pipe and say, That's the concentration in the soil where the workers are working.

Chair Beach: So the 53 picocuries; where did that number come from?

Mr. McCloskey: It's 53,000 is the max value that they found during the characterization --

Chair Beach: In 1994?

Dr. Mauro: Yes.

Chair Beach: Okay. So in '94, you have calculations, and you have some contamination, 53 curies comes from that. So between '67 and '94, some of that stuff got cleaned up, potentially, and you may have had different numbers that you don't know anymore, because that was already -- I mean, they were cleaning out these pipes for 10 years, right? Prior to any -- this dose that you're using?

Mr. McCloskey: Yes. It was episodic in nature. It wasn't large scale remediation of the subsurface environment. There was some snaking of material that came out, some isolated sections were removed. We have a map that shows which ones were now PVC if you replaced over that time period.

So yes, did they remove some activity? Would it have been greater prior to this survey? I would agree, but I don't know how significant the increase --

Chair Beach: But you don't know. Really, we don't know, right?

Dr. Mauro: You're raising an important SEC question.

Chair Beach: I know. That's why I'm raising it, because we don't know.

Dr. Mauro: And I think there's a point where we make the issue crystal clear: We are operating on the premise that the characterization in the pipeline, as acquired in the 1990s, in support of D&D, represented a bounding set of circumstances that also were the circumstances that existed in the subsurface environment during the residual period, the '70s and the '80s.

You're saying that, Well, maybe it was higher in that time period, and that number is not representative. Fair question; the only argument I would make is that it wasn't until they went in later, when they found this chunk of uranium that was sitting there. So whatever they may have done during the operations, they missed that one.

Chair Beach: That was in the '94 time frame. They found that when they remediated it.

Dr. Mauro: It was still there.

Chair Beach: But the workers' interview notes said they found metal shavings, they found other things earlier during their active remediation period.

Mr. Darnell: We should not discuss what they said they found.

Chair Beach: Okay. Sorry.

Mr. Darnell: It's okay.

Chair Beach: Okay. I just wanted to make that clear, that --

Dr. Mauro: I think you've raised the first SEC question that needs to be dealt with. That's how I see

it. We operated on the premise that the concentration distribution that was found in the pipelines is the concentration distribution that was there all along, during the residual period.

And on that basis, we said, What are we going to do with that? Well, we were going to do some very conservative, bounding assumptions. We're going to assume that the concentration that the workers were exposed to, who were in the dirt and working down there, is the same concentration distribution that was in the pipeline.

But -- and here's where Rose talked me into this one -- I said, Rose, I would have went with the average, because the workers down there, they're working down there, and sometimes they're in a hot spot, the high end, and sometimes they're not.

But Rose said, No, no, no. If they went down there to fix the pipe, it's the part of the pipe that's clogged; that's why they're cutting it out. It's clogged, and they have to replace it. So they're probably tending to be in the areas where the higher activity is.

So Rose convinced me to go with the upper 95th percentile as being the concentration of the uranium in the soil to which the subsurface workers were exposed to, for the purpose of reconstructing internal exposures to the workers from that scenario.

So here's the issue: We took information collected later, in the '90s, and applied it to scenarios that took place in the '70s and '80s. We have two embedded, conservative assumptions: one, that the exposures that the workers might have experienced were the high-end exposures contained in the pipes.

The reality is, they were probably exposed to the dirt, more so than the -- it was the dirt that they were exposed to, which was diluted in other words. It might have leaked from the pipe only a little bit lower than was in the pipe, and they weren't necessarily always right there in close proximity to the high end.

Nevertheless, we can't rule that out, so we ended up going with the 95th percentile. But the important point is, this is our tract. This is a scenario where we think we have a tractable situation where we're saying, Well, it's just a matter of degree. What do you want to use as the concentration? So we ended up going with the upper-end uranium concentration that was observed in the pipes. So that's assumption number 1.

Chair Beach: So when you say, we, you're talking NIOSH's --

Dr. Mauro: No, SC&A.

Chair Beach: SC&A, okay.

Dr. Mauro: SC&A. Not speaking for them. We're going to get to --- I guess we're going --

Mr. McCloskey: I'd like to draw a distinction --

Dr. Mauro: Absolutely, because you may have come at the problem differently. I'm not quite sure exactly what you folks did, and it might be a good time to talk about that, because this is the big deal. I mean, when all is said and done --

Chair Beach: This is part of the big deal. There's more of the big deal.

Member Kotelchuck: Can I ask a prior question? Weren't they replacing pipes? I assume pipes clogged up during the active period, and people went down and replaced pipes. They would have external batches of that core. Were there any measurements of the subsurface before the residual period, and that will give us a clue as to what's going on? Your assumption that it's constant is good, but there must be some -- these external measurements.

Mr. Darnell: The problem is the way the plant was actually set up to do the work. It's not a union shop, so anybody in plant maintenance, operations, facilities -- if they weren't doing work, they could get

sent to go do the drain job. They could get sent to go do the dust collector job. So there's really no demarcation of the group of workers that did that type of work; it was everybody.

So now you take the exposures of everybody and see where it goes to the specific soil type work, and you can't do it.

Member Kotelchuck: I see. But there's no possibility -- but one could have -- or, can talk to the workers from the active period and find out -- identify some who did a lot of the replacement work --

Mr. Darnell: We actually talked to some of the workers that did; this is how we found out there was no real way, even during operational period, to correlate back to specific workers in their dosimetry records.

Member Kotelchuck: Okay. It's hard to think that -- forget about union or not union. Some people typically did some work, and some people typically didn't. Admittedly, people moved around. It's hard for me to think that one could not identify a core group of workers who did that, and then look at their badges.

Chair Beach: This was also a 24-hour operation, so you might get called at two o'clock in the morning to come and unclog a drain. It wasn't just an eight-hour day or a 10-hour day; it was -- this went on around the clock.

Member Kotelchuck: Okay.

Chair Beach: So if you have a group of workers in there at midnight, and their floor is filling up with water, you might get a call at home, and they're going to catch who they can in that big, large group.

Member Kotelchuck: I see.

Dr. Mauro: You're making a good point that I like. What you're saying is, We looked at the data that

came out of the D&D program; they're saying, Wait a minute. This is going on all the time, even during the AWE time, because pipes get clogged.

Now, I have to say that I don't recall talking about that with them, to what extent were you doing coring and snaking and things that make this work during the AWE operations?

Dr. Neton: Well, we never really investigated, because this was an SEC for the entire operations period.

Dr. Mauro: Right, and we didn't have the presence of mind to ask him, because I know we didn't ask him. But it's a good question, because what that does is say, Well, that's more data.

I said, Listen, this is what we had then, and this is what we have here. Well, right now I can say that we did our work; we just operated from the data that came in later.

Now, was there any data earlier? All I can say is, well, let me just say one thing. It seemed to me that the repurposing, especially the repurposing, was something that really became aggressive once they finished the AWE work. In other words, the AWE work was done, except for the HFIR work. And then I know their discussion was -- I don't know if those folks are on the line, listening, but --

Mr. Katz: There are people on the line, but --

Dr. Mauro: But you see where I'm going. We got the sense that an awful lot of repurposing took place, beginning in the residual period, when they started new operations, got new contracts, had to dig, had to do this. And they sought to maintain the subsurface pipelines.

The degree to which that type of activity took place during the AWE operations, we didn't explore that. We didn't even talk about that. And I think the reason you bring up, Why wouldn't we, because we weren't

concerned with that.

But now that you bring up the question, that would have been data, if it's out there, it would be useful, right?

Mr. McCloskey: Well, they didn't believe they were digging up radioactive material during the residual period. I don't know that they would have believed now that it's the AWE operations period, that they're going down to these drains and digging up radioactive material. And I don't know that we'd be able to paint a person with a TLD or a film badge and say, Okay, since you're the person digging --

Dr. Neton: But there are bioassay data for those workers for uranium.

Dr. Mauro: I would be the first to agree, any film badge data collected during the AWE period, any bioassay data collected, we can't use. But what you can use is if someone pulled out samples of dirt, corings, out of a pipeline. That is important, because that's the material that was in the pipeline --

Chair Beach: But it only shows what's in certain areas. And it was pointed out, it's different in different areas.

Dr. Mauro: Yes. But the reason our takeaway was -- and this is a fundamental assumption -- the distribution of activity that was observed in the pipeline later on is where you get your hook. Okay, we've got that, and we go with the upper 95th percentile. We assume all the dirt that people down there were doing -- M&C guys, not doing any bad work, just doing their jobs -- that's what they were exposed to.

Member Kotelchuck: Right, and I accept that, given the data that you had, that seems like a fair, conservative worker-friendly approach.

Chair Beach: But we're not at that approach yet. I mean, that's more Site Profile, correct? Isn't that how

you approach --

Dr. Mauro: No, I think it's an SEC issue, because what we're really saying is, We could use that data to apply to M&C workers. See, this is data that was collected; it had relevance to the cleanup in the 1990s and the jobs they had to do.

We said, Well, that's useful information that we can apply to the residual period, to M&C workers, because they were down there doing similar things. The cleanup people in the 1990s, they were doing the same thing. They were going underground, excavating; but they were doing it under health physics program, and they were dealing with this stuff.

Now, we're saying that characterization also could be used as a hook to what might have been the circumstances during the residual period. There is the core of the SEC question.

Chair Beach: Okay. Can I add -- Henry, are you still on the line?

Member Anderson: Yes, I am.

Chair Beach: I don't want to ignore you. Do you have any questions or comments --

Member Anderson: Well no, since you're covering all the things I would have raised my hand for.

Chair Beach: Okay. I just wanted to make sure we weren't ignoring you there.

Member Anderson: No, no, I'm good. I'm on mute, though, but --

Chair Beach: Okay, thank you.

Dr. Mauro: So we're right where we should be right now. This is where the action is. Can you reconstruct the doses to the guys who were involved in maintenance and repurposing activities during the

residual period? That's the question: Can we do it, and can we place a plausible upper bound?

And we're saying, Well, we're going to go with this upper end concentration in the pipeline as being the contamination level that these workers were exposed to as being a plausible upper bound.

Now, bear in mind, now, the next question is, Well, the people that did that, we're saying, whoever did it, when they did it, were up close and personal to the worst sections of the pipes, where the concentrations were at their worst. And we're also assuming that it's always the same person. We know that's not true. So we're really -- we're going to start to push it to the high end.

Reality is, we know from talking to the workers that this was a job not too many people had to do, going down there, doing all this stuff. And that, all of the maintenance, they actually had groups and names; I forget their names -- the groups of people that belonged to certain maintenance activities -- they would be the ones who were sent down to do this dirty work. And very often it was the new hires; the supervisors didn't go down there. But there was a pool of people that they drew upon.

So assuming that the same guy is always doing it is again another conservative assumption over years. But one of our dilemmas was, Well, when they were doing that, how long were they down there?

Chair Beach: Can we hold back that part of the discussion? Do you mind?

Dr. Mauro: No.

Chair Beach: Because there's more to this. There's the outside work we haven't even touched on. They were outside in the burial grounds; that was a known burial ground, but it was relatively unknown to these workers, because they were running pipes and water lines. And I believe there was a fire in Building 10,

and so they were taking -- and I might get the building back and forth.

They were building a new building and taking lines through it. So these workers were in, digging in dirt outside, that they ran into pockets later of high contamination levels of thorium uranium. So those folks are part of this as well.

Mr. McCloskey: The same group of workers that could be called upon to remediate, unclog drains or do subsurface work inside the building would be called upon to go outside. The same group that would do the repurposing could go outside and dig up a pneumatic line or --

Chair Beach: And I think it was in '83, installing an air line underground, they ran into buried debris, and I know they ran into thorium later, when they did their samples. It doesn't take a fairly large dose of thorium to have a large internal dose; we know that.

Dr. Mauro: As I mentioned, every time you run into a circumstance where you're trying to model the internal dose, you always assume the isotope is the limiting isotope.

Chair Beach: Do we know how many lines were run in those burial grounds, or how often they were --

Mr. McCloskey: We queried the former workers and asked them for an upper bound on the amount of subsurface work they would do. We landed on a number that said if it took more than one month a year, if you combined all of this work, that would be a lot.

Chair Beach: That's including the subsurface work inside and outside?

Mr. McCloskey: Yes; the same pool of people would be called upon to run new utilities both inside and outside the building. The same pool of people would be drawn upon to clean clogged drains.

Chair Beach: Okay. Can we say that during the course of that work -- I know that we've already talked about it inside, potentially not knowing what they ran into in different drains -- outside when they were running and digging those trenches and digging those lines, do we know how often they ran into pockets that they didn't even realize they were into -- I know they had called an HP at one point who didn't -- nobody has the dose for the records from calling him.

So do we know how often they may have run into different things in the course of their digging?

Mr. McCloskey: That's what you do, is bound it. We had them point to places where they might have done some utility runs and digs outside, and we had the subsurface data from where the contamination was, so we can bound it.

Dr. Mauro: The issue you're basically raising is that we, SC&A, paid a lot of attention to the subsurface work in Building 10. Rose can talk a little bit, because she also looked at the outdoor work, and tried to model those doses.

I believe I'm correct in saying the limiting dose was the assumption I just made about the guys underground in the worst place in the subsurface environment in Building 10.

Ms. Gogliotti: Yes.

Dr. Mauro: Yes, thank you. And that was your limiting pathway, compared to the outdoor work that you just described, which was also subsurface work. A big question was, how much time?

Chair Beach: Well, and how much contamination they may have run into? I know they found quite a bit, and it doesn't take very large doses to create a huge problem.

Mr. McCloskey: Let me just speak to one thing there, Rose. Your scenario for inside the building, because

it does dwarf the outside one, but we have some differences with the way we did it. The one thing that the subsurface samples from inside Building 10 don't do for you is provide a thorium exposure.

What they did was isotopic ID inside the building, and it was all uranium; it didn't have any form -- any gross alpha there. So unless you've come up with some ratio from a document that would give you a thorium component for that dose, you're going to struggle to -- to be able to assign a thorium dose from inside.

Outside, however, we had gross alpha, a tremendous amount of gross alpha data, and we have ISO ID, which occurs in thorium. So it does that for us. We also incorporated a lot more of the areas outside, besides the formal waste burial area. We went into a metals recovery area; we went into the stockade; we went into some of the other areas. You'll see that.

Dr. Mauro: What I'm hearing is, we zeroed in on this subsurface work in Building 10, the way I just described it --

Mr. McCloskey: Right.

Dr. Mauro: -- as being a plausible upper bound exposure scenario for internal exposure.

Mr. McCloskey: But you had no thorium in the building.

Dr. Mauro: From an intake perspective, and we are assuming that wherever that intake is, you don't know whether that intake was thorium or uranium. Now, here's where we may differ: We're under the assumption that you would use that -- once you get a becquerels-per-hour intake rate -- inhalation rate, let's say -- you would use thorium or uranium, depending on the cancer.

Mr. McCloskey: Only at gross alpha can you do that.

Dr. Mauro: Oh, when the starting point is gross

alpha?

Mr. McCloskey: You can make the assumption that it's either one. It can be either one.

Dr. Mauro: You got the isotopic breakdown on Building 10?

Mr. Sharfi: Building 10 was all uranium, isotopically identified.

Dr. Mauro: So when there was ambiguity, when you weren't quite sure where the radionuclide was, then you go to the limiting --

Mr. Sharfi: Limiting --

Dr. Mauro: But when you know what it is, you know what it is.

Mr. McCloskey: You're handcuffed; you can't make, you know?

Dr. Mauro: So there's a --

Mr. McCloskey: And that's one of the differences with the inside of the building, that I was going to speak to earlier. John, you raised the issue of, do we have characterization from the AWE period of what the subsurface environment looked like underneath there?

The best thing we have is this document that SC&A used, and we used. It's the characterization of the drain lines inside of Building 10. It's not done during the AWE period; it's done in '96. But we interviewed the D&D manager at the facility; he's on the phone right now. And also in his affidavit, he described this document. It represents conditions prior to D&D activities; therefore, it offers good insight into conditions in which the employees were exposed.

So he believed that that was a good characterization of what was there, even though some of it -- portions of it were removed throughout the residual period.

This remains a good characterization of the subsurface environment in the worst-case area.

Chair Beach: Do you have that SRDB number for that document?

Mr. McCloskey: Yes; 165965.

Chair Beach: I tried to go through as many of those as I could, but as you know, there are a lot of SRDB numbers with this -- yes. I have no time. Thank you.

Dr. Mauro: Once you get to the point where you say, I think we have a pretty good handle on the concentration of the radionuclides that these guys might have been up close and personal to -- guys who were working underground -- the other question is, how long?

We used one month per year, based on the information during the interviews. Of course, that was a guesstimate, a sense, thinking back, because these were the workers who did it, and their recollection was, Well, that's a pretty good number.

So whether one month, two months, three months is the right number, we picked one month, based on the information we had, for better or for worse.

Then the other big question -- and remember, we're talking internal dose -- wait a minute; these guys are under ground. What are they breathing? What's the dust loading? I have a whole appendix that says, Well, what are we going to use? Because I know from doing a lot of this kind of stuff that it's not unusual for concentration of airborne to go as high as a milligram per cubic meter, while you're involved in earthmoving.

But right now in this room, I'll tell you that it's probably about 2 to 10 micrograms per cubic meter. I've done a lot of measurements involved with this stuff, on what normal dust loading is in a room.

So we're basically saying it's about a hundred times

higher; we went with 200 micrograms per cubic meter. So if you know the concentration of picocuries per gram, you know what your micrograms per cubic meter are, an inhalation rate, you've got an inhalation dose.

Now, why did we pick 200 micrograms per cubic meter, and not one milligram, because we talked about that. Well, there's a lot of evidence -- and you can read it; we've got a big appendix talking about the subject, on what the dust loads are. There's a lot of information on dust loadings, and it's all over the place.

But one of the things we found out was that very often, the subsurface environment was moist. And I said, Gee, when you have a moist environment, you're really not going to get up there in terms of dust loadings, so we went with 200 micrograms per cubic meter. And if you look at our appendix, you can judge for yourself, given the range of numbers that are out there from the literature, whether we picked the right number, the sweet spot. And we went with 200 micrograms per cubic meter.

I'm not sure what you folks used -- oh, you used some other data. It came close, though --

Dr. Neton: Yes, we used 220, based on data collected at another facility.

Dr. Mauro: We came at it from a literature review, and you came at it from a specific site, which, by the way, was assured.

Dr. Neton: Well, we totally didn't collaborate on it.

Dr. Mauro: I didn't know about the data.

Mr. McCloskey: We didn't know it existed either, until Dr. Taulbee was involved in some stuff and said, I might have something that helps.

Dr. Mauro: That's good news. All right. Well, now you can see how we did the subsurface environment. That

is the single biggest SEC issue that we're dealing with here; whether or not you've got adequate data, and whether you have a good enough understanding of the activities that took place that you could place a plausible upper bound on the internal dosage from inhalation and inadvertent ingestion.

So your starting point is the concentration distribution. You raised a question that was at the heart of the SEC: Is there anything about the fact that there is ongoing maintenance all the time? Do we feel confident that the distribution that we used for the uranium concentration in the pipeline -- the upper-end number that we picked -- as being a fair upper-bound value that any of the workers might have experienced during the residual period, which was decades before?

Out takeaway was, for the reasons you gave, probably is, for a number of reasons. But this, again, is a judgment call. One, we pick the upper end as being the concentration, and that's in the pipeline, not in the dirt. So right off the bat, we were pretty conservative there. There's no reason to believe the dirt's going to be higher than the pipeline.

Two, the guy that's doing it is doing it one month a year. Now, it could be two months a year; I don't know. I mean, we have workers -- we can talk about that. We trolled them heavily; it's all in the transcript.

We felt that one month a year was good, and we did one more thing, which I consider to be very conservative: we assumed the same guy did it all the time.

Chair Beach: I think in your paperwork here it said six to eight weeks. You guys picked a month. I would have gone higher, but that's just -- that's another point that we don't need to worry about right now.

Dr. Mauro: Fair enough.

Chair Beach: And we just got through the first. We

haven't talked about the other three points you made here.

Dr. Mauro: We're going to get to -- we'll get there. But this is the big one. We're in the middle of the big one right now.

Chair Beach: Part of it, yes.

Dr. Mauro: Yes. Okay. So we just talked about the first bullet on page 12.

Dr. Neton: Just before you go on, John, I might point out that even under those conditions, the intakes that SC&A suggests occurred per annually in that time period is really small.

Dr. Mauro: Oh, yes.

Dr. Neton: So, 1.3 picocuries per year; I mean, we're talking pretty small -- so even if there's some uncertainty there, you could, on top of that, increase these values quite a bit. You're still discussing very small potential intakes if it's a one-month --

Dr. Mauro: I think that has play here, because I know we've had conversations in the past that the level of accuracy and granularity and precision that you demand of your analysis does vary, depending on the magnitude of the doses, and how close you are to it.

Dr. Neton: Right, that's what I was trying to point out.

Dr. Mauro: Yes, and revealing the doses are reversible, notwithstanding all these things that we're talking -- so it's been very good.

Okay. The other pathway that we found interesting, that I expected to be a problem is, they had an HVAC system that was continually -- any dirt, any activity that became airborne, from resuspension or whatever, during the residual period, is going to be drawn up, passed through the HVAC system, and typically what an HVAC does is, it goes through a

filter and some portion of it is recycled back into the building, a large portion, because you want to keep the air conditioning and the depositing.

So what's happening? The uranium's is being re-suspended, it's going up and being deposited on the building. Now, it turns out, every so often the maintenance guys will go in and replace those filters. It was clear, in talking to those guys, that that was a dirty job. The dust -- what would happen is, often the filters crumble and generate a lot of dust, and any uranium that was on there would be part of the crumbled junk that became airborne. These guys would breathe it. We've got to look at that pathway.

How do we come at that problem? In a writeup, we looked at several ways that you could come at the problem. For example, you could estimate that, okay, we know what the airborne -- if you accept the understanding of the concentration that's on the surface -- that 7,000 slide samples -- you know that. You accept the resuspension factor. Now you have airborne concentration. Well, we're going to assume all of that as being swept up and brought into the HVAC system.

So if we know the HVAC system flow rate, which I believe was 14,000 cubic feet per minute --

Mr. McCloskey: That sounds about right. We have it somewhere.

Dr. Mauro: You know the rate at which the number of atoms of uranium or thorium are being deposited on the filter continuously. And then we also found out in talking to the workers that they would replace the filters periodically. And they mentioned that, Well, ideally, we should replace them every quarter and pull out these racks and put in new ones. The guys who did it said it was very dusty work. So we said, This could be in important pathway.

So what we said was, We've got to estimate how many microcuries, millicuries, whatever, are on the

filters when they pull the filter. Was it once a year? Once a month? Well, that doesn't matter, because if it's once a month, there's less activity on it, because you only have a month's worth of accumulation on it. If it's once a quarter, you've got three times more activity on it, but it's inversely proportional to the amount of time. So it doesn't matter how often they replace it. So that sort of went away.

So we ended up going with, I believe, quarterly. We figured out how many atoms of uranium are on the filter at the end of a quarter, and the guy is going to pull it.

Now he pulls it out, and there's this dust. Now, what is that dust? That's dust that very often was crumbled, dried-out cardboard-type filter, and this is very common. It got dried out and crumbled because they probably should have pulled it and replaced it sooner.

In that case you would say, Well, what does one of these things weigh? We know how many microcuries, we know they weigh, now we know the concentration in becquerels per gram of junk, and that becomes your dust, the stuff that becomes kicked up while he's working.

But you know, that might not be the best way to do it. Maybe a better way to do it is, let's figure out what the specific activity is of the uranium that's airborne. In other words, we know the number of picocuries per cubic meter from resuspension, right? And we're assuming it's 200 micrograms per cubic meter; it's sort of like the chronic airborne dust loading, which is a fairly high chronic airborne dust loading.

But I said, Wait a minute; the higher the chronic airborne dust loading, the lower the specific activity. So no, we want to use a low airborne dust loading. So what we did was, we said, We have a certain number of picocuries per cubic meter from resuspension, but we have a relatively low micrograms per cubic meter. So we get picocuries per

microgram of the dust that is being drawn into the filter; picocuries per microgram.

We know we're going to pick a high-end number for that by assuming that the dust loading is not high; in terms of milligrams, it's low, and that's where the uranium is. It's associated with that dust.

So that gives you a high specific activity for the dust, and that's the dust that's sitting on the filter. And it accumulates.

So now we're saying, All right. We now say that we know the picocuries per milligram of dust or per gram of the whatever on the filter, and we're saying, Good, now we've got the concentration of the dust -- not including the mass of the filter, just the dust that's on the filter. And we're saying, All right, guy pulls it out, and the stuff -- puff, it comes off. And what's our problem? Now we've got to figure out what's in the air? How many milligrams per cubic meter?

It turns out we have some really nice work done by several different sources that says, You really can't work for any extended period of time in an area where the dust loading is higher than 100 milligrams per cubic meter. You get to that point, you just can't breathe in the air. So that's a pretty nasty situation.

So we said, Okay, we're going to estimate what would be the dose -- what would be inhaled -- if you had 100 milligrams per cubic meter of air, and we know what the picocuries per milligram was in the specific activity calculation, and this guy is inhaling it for one hour.

So every quarter for one hour, this guy is changing out the filter and being hit with that dust loading. Now, is it one hour? Is it two hours? I talked to a buddy of mine that actually works on building renovation in Newark; he renovates old homes, and he replaces HVAC systems. That's one of the things he does.

I called him up and said, What kind of job is that? He works in old buildings in Newark, big buildings. He said they just pull out a rack and then put it back in again, so it's not that the guys did it all day. So I said, Would you say that every time you did that, it would take about an hour? He said, Oh, yes.

Listen, I'll be the first to say this is -- but that's what we picked. Is it one hour, two hours, four hours? I can't really say for sure; maybe some of the workers talked to that a little bit at some appropriate time. But we used one hour.

And we said, Okay, let's assume then, this guy is breathing for one hour, dust that's 100 milligrams per cubic meter for one hour, and we know what the picocuries are per milligram. So therefore, he's breathing the air in at 1.2 cubic meters per hour, for an hour, he inhales becquerels or picocuries, he inhales every time he changes out the filter, we get a dose. It turns out to be nothing. I mean, a milligram, I forget what we got.

Chair Beach: Not much. So let me stop you and ask some questions. The things they did was change out filters, they vacuumed up there, they wiped down the duct work, is that correct? Are those the -- did they do anything else? The pulled coils or something? What else did they do in there?

Mr. Darnell: I don't remember them talking about wiping down duct work. I mean, it may have happened, but I don't remember it.

Mr. McCloskey: Yes, I think she's right. I think they were supposed to clean, and the one guy said, Did we clean as often as we should have? No, but there was some cleaning going on.

Chair Beach: So do we know the particle size that was up there on the filters? Do we have any indication of that? How much was on the filters? How much was left in the duct work? I just -- there's a lot of question I have about this --

Mr. McCloskey: I think his scenario has adequately bounded all of those things, all of those concerns. Do you remember during interviews if they said they shut down the system when they changed filters, or were they doing it while it was running? I can't remember if we asked that.

Dr. Mauro: I can find that out.

Mr. McCloskey: I seem to remember it was running.

(Simultaneous speaking.)

Mr. McCloskey: You're not going to have a breathing zone -- to be clear --

(Simultaneous speaking.)

Mr. Sharfi: If it's still running and sucking into the system --

Mr. Darnell: -- stop the whole air conditioning for an entire building to change filters.

(Simultaneous speaking.)

Chair Beach: Some of -- we're talking about a lot of different ones, though. They could actually walk into some of them. They were pretty large. So you don't know for sure whether they shut them down or didn't shut them down?

Mr. McCloskey: I seem to -- I was asking about that during an interview, and I seem to remember a guy saying that they'd keep it running; you couldn't shut things down. So if the plumes coming off the filter you're pulling out it's not going to stay in your breathing area for very long at all if the machine is running, right?

Mr. Darnell: You've got to remember, this is manufacturing, non-radioactive manufacturing at the time. So they don't have the same concerns with taking out filters, and HFIR's ventilation system was totally separate at that time.

Chair Beach: So we have no smear samples, no data for any of the duct work in, around filters? They didn't sample the filters at any time?

Mr. Darnell: No, none of that --

Chair Beach: Anything?

Member Anderson: There's really no data expected.

Mr. McCloskey: There's swipe samples from the surfaces of the floors down below that was being ventilated by this system, right? That's our source term.

Chair Beach: But in addition to that, there were samples of the floors, but they ended up finding contamination on the walls and up above. But we don't have any data for that.

Mr. Sharfi: But John's estimate is assuming that the dust is so heavy in the room that it's almost unbreathable. The contamination on the walls --- He's making an air concentration that's almost unworkable. I mean, we still come up with --

Chair Beach: I get that. This is also from non-union -- I mean, you're assuming that that's the time they spent in there, and I'm just pointing out we still have no samples, no data.

Dr. Mauro: Right. But you saw what I did, though.

Chair Beach: I did.

Dr. Mauro: I put the picocuries per cubic meter on the very low dust line, which would place an upper bound on the specific activity picocuries per gram. That's real important.

Member Kotelchuck: Were the workers that you interviewed -- did you ask them how long it took to change the filter?

Mr. McCloskey: Yes, we did. We did.

Member Kotelchuck: You did, and you may have said it, actually.

Dr. Mauro: I got it from my buddy. But did we actually get it from --

Member Kotelchuck: I mean, what you say sounds plausible, but specifically, if you're talking about beta, did the workers report or give you an estimate of --

Mr. McCloskey: Yes. I'm trying to remember it. The one gentleman that was the supervisor of this team said they would go to a lot of buildings. Some of the non-nuclear buildings would do this, right? So he was constantly doing it, and he did put an upper limit on it. I'm pretty sure it was bounded by our one month that we've used for other things. But I'll go and find that data.

Dr. Mauro: Okay. I did not assume that they guy changing out the filter was exposed for one month to 100 milligrams per curie meter.

Mr. McCloskey: No, no, that's not what I meant to say there. I meant to say that we liked some of your approaches here, and we were going to say that the subsurface -- the same pool of workers would be drawn upon to do this kind of work. The facilities -- it wouldn't be the same guys that were digging in the ground, but they would be within that facilities group or production group, and they would draw from it. So the subsurface one-month bounding would accommodate this.

Chair Beach: So I guess I wasn't clear; you're saying that any upper bound, any dose would just be for any work, every bit of work that a worker was there for a year, you're going to look at a one-month time period of any of this type of work?

Mr. McCloskey: Yes, since the same group of workers could be called upon to do any of these sorts of work, we came up with -- we gave them an additional

month of what's in this model here, and we're going to add it to the other exposures, the other model that we already have. We're going to give them 11 months of the subsurface resuspension model; it's already in DR.

Mr. Sharfi: Yes, 30 months of residuals, one month of subsurface.

Dr. Mauro: You see, where we are right now is, we're trying our best to reconstruct the unique exposures in areas that were communicated to us by the interviewees, and make sure we explicitly address those; any data.

Chair Beach: And this is such an unusual circumstance.

Dr. Mauro: It is; these are highly unusual circumstances, you got it. This is where we -- and we're right where we should be, whether or not this is a tractable question or not; that's what we're trying to come to grips with, and here's how we came at it.

We just covered the single most important subject, by the way, in my opinion, the subsurface. The dust, I thought was going to be the limited pathway, using the assumptions I used. I was surprised that we came in so low; that's not a big contributor. We could list inhalation, because it's only one hour every quarter.

Chair Beach: But I'm not sure I agree with that, personally. But that's --

Dr. Mauro: Fair enough.

Member Kotelchuck: But the ORAU folks put in a lot more.

Mr. Sharfi: For the subsurface work, not for the --

Dr. Mauro: You limited your work to the subsurface; you didn't look at this dust thing, the HVAC system.

Mr. Sharfi: I agree with you that the HVAC is short

termed --

Mr. McCloskey: It's going to be in our revision; we're going to address it there, and we do agree with what you've done there. I don't know which one of the models we'll use.

Dr. Mauro: Because there are other ways you could do this.

Dr. Neton: And we do agree that the filter changeout process is a much lower dose than the subsurface model, which we default to. That's the plan.

Mr. Sharfi: I agree with you, John, that even if you say they did it more often, then the buildup is smaller, therefore it offsets. And even if they said they did it weekly, then the buildup is very small. But they're going to do it 52 times, so it turns out washing out. Even if they did it once a year it would be 52 times bigger, and then one hour -- time goes down.

Dr. Mauro: That's why we put it in terms of per-hour exposure. See you have to understand; we didn't say, This is the answer. We said, I think it's tractable. Here's an answer that seems reasonable to us. But certainly others may consider different assumptions, and they can be discussed or worked out, so we get that right.

The third bullet on page 12, outdoor activities. There, you're doing subsurface work outdoors, as you pointed out. Rose did the work, and the outcome was, that was not the limiting pathway, that output there. Rose, do you want to give a little rundown on how you came at the problem, what data you used and what assumptions?

Ms. Gogliotti: Well, that was more of a combination. I did the indoor work more, but there were a number of outdoor samples that were taken from the burial area. We took that data, and we looked at only the subsurface data and aggregated it.

I believe we took the average on that and used more realistic breathing assumptions than we used indoors. This model was more for people that were walking around in the area of the burial grounds. People who were interviewed reported that there was constantly dust on their cars that was blowing directly from over the burial grounds onto their vehicles. So that was more the path that we looked at.

Chair Beach: Rose, I've got a question. Didn't one of the interviewees say that they parked right there on where the burial grounds ended up being? Maybe I'm mistaken about that.

Ms. Gogliotti: It was pretty close to it, I believe.

Chair Beach: Okay.

Ms. Gogliotti: We didn't really look so much at the subsurface, digging; it was more of if you were in the vicinity of the area.

Dr. Mauro: One more thing that I forgot to mention is, remember the subsurface work on the Building 10; we had to assume a breathing rate. We always use 1.2 cubic meters per hour on all of this site Class. We use 2.5, is that right, Rose?

Ms. Gogliotti: Yes, we used 2.5. That's a study from EPA exposure factors handbook for heavy indoor cleanup work.

Dr. Mauro: So we figured the guy down there digging is going to be breathing heavy while he's down there, so that doubles the --

Mr. McCloskey: I remember from the interviews that a lot of the initial digging was done by outside contractors, right?

Ms. Gogliotti: I thought that was just for the breakup of the concrete, and then they came in to do the actual digging work.

Mr. McCloskey: You're definitely right about the concrete; I agree with you there. But I thought also we show that some of the heavy digging was done by contractor.

Dr. Neton: I think the breathing rate is definitely a Site Profile issue.

Dr. Mauro: Oh, yes.

Dr. Neton: Maybe we can pick that up in a different --

Mr. McCloskey: We've been down this path before with other sites, and I've been going back and reviewing the history of this. There's a lot of discussion we've had in the past about what's an appropriate breathing rate. I don't necessarily read 2.5 cubic meters per hour as the right rate.

Dr. Mauro: And Bob would agree with you.

Dr. Neton: I mean, ISO 366 heavy breathing is 1.7, and even at that, underground miners in Africa came out at about 1.3.

Dr. Mauro: Oh, is that right?

Dr. Neton: Yes, with no mechanization, just digging.

Mr. McCloskey: We need to revisit that a little closer, but I'd say that's a Site Profile issue, not really SEC.

Dr. Mauro: I've got one last bullet on page 12. One of the things that was talked about during the meeting was, there was a wastewater treatment program. Water was continually being used for various purposes, for washing the fuel elements, various components. Water was collected in a drain and then pumped to a water treatment facility, where the water was collected, and they separated out the solids. They perticipated out the solids and drained off the water. That had kick, and they would dry that out, and they'd have a press and they would squeeze out the solids that, turns out, had some gold in it,

because one of the things they did was, they made certain devices that involved gold.

Chair Beach: That was in the mid-'90s, right?

Dr. Mauro: I don't know when they were involved in working with gold plating, but --

Chair Beach: No, I'm sorry. I meant when they were dealing with the water. When they were draining the water in --

Dr. Mauro: That was going on the whole time. The wastewater treatment was going on the whole time, so therefore one could assume that the wastewater that was being collected from time to time contained some uranium, particulate material that would find its way into the water and be pumped to the water treatment facility.

And the workers there would drain off the water, compress the solids, ship the solids offsite someplace else, where the people would process it and separate out the valuable minerals. Okay?

I didn't want to look at that thing. I said, You know what? Everything in my bones tells me that that's nowhere near as important as the subsurface guy. So I have to say that I didn't go to that one. It just didn't appear to be a pathway that would seem to be anywhere near as important as the subsurface pathway. But that was another pathway that I mentioned, but I don't analyze.

And now the reality is, we just finished internal.

Chair Beach: We forgot -- can I bring up -- we didn't talk about the rafters, the roof, and that's really a question for NIOSH. I didn't see anything mentioned, and I know in the '90s they vacuumed, they sorted rocks, they took up large sections of the roof that were contaminated, so did you all talk about any of that?

Mr. McCloskey: We talked about it during interviews,

and we are going to add it to the revision of the ER, a section for that. What we're seeing at the moment is, it is dwarfed by the subsurface questions as well.

We have sample data from the roof, where, during AWE, they sampled that material, so we know what that was later in life. Then another good reason why the subsurface environment inside of them encompasses the roof is, a lot of that activity would be washed by rain water into the subsurface of 10 and brought down.

Chair Beach: Right.

Mr. McCloskey: So if you look at the sample data from the roof, as opposed to the sample data in the ground, it's --

Chair Beach: I just wanted to make sure you guys were handling it, and where did that contamination come from? Do we have a pathway of how it got there? Was it some of the --

Mr. McCloskey: Unfiltered ventilation that exhaust and machines inside of Building 10 collected and blew onto the roof.

Chair Beach: That was during the actual AWE period? Nothing to do with the residual?

Mr. McCloskey: It would have been commercial work on post-thorium AWE to offset and later --

Chair Beach: Okay. And then the rafters -- we didn't talk -- I mentioned a little bit, the rafters; there's no smear samples of anything that could have collected on top. I know there was one interviewee that said there was stuff falling down every day.

Mr. McCloskey: It was dirty up there; it certainly was. And there was a certain amount of need to go up there and cut through the roof, make penetrations through the roof from inside the building, and there were statements that stuff would rain down on you during that period.

Chair Beach: Okay. So that was the raining down?

Mr. McCloskey: There are some surveys taken in the '90s in the upper areas of the building, so we can use some of that. But we're going to talk about that in the ER as well; we're revisiting that.

Dr. Mauro: Kathy mentioned that to me the other night. We did not look at that, but I was thinking about was there a way to get a handle on that. I would say, the stuff in the rafters is somehow related to the stuff that's on the surfaces on the floor, but more in the rafters.

The rafters are dustier; that's the sense we got, up on the roof and in the rafters. Of course, there was dust on the surfaces. There's 54.4 dpm a square meter, which is on the floor, and that was the high-end value for the floor.

Now the question is, what about the rafters? Would you expect that the dpm of 100 centimeters squared would be substantially higher than that, and if so, how much higher?

So I say that's a reasonable question, because we didn't model that. But you're right, they did say they did maintenance up there; there's work going on.

Mr. McCloskey: Changing lightbulbs.

Dr. Mauro: So you're right back in the same place. Okay, you've got to come up with a concentration, picocuries per gram on the rafters, or dpm per 100 centimeters squared on the rafters. You've got to be able to do that. That's a plausible bound, and would have to say, What would be the dust loading in terms of micrograms per cubic meter? Can you do it?

Well, I guess the micrograms per cubic meter, you could it. You've just got to pick one of the higher-end dust loadings, because they're working in a dusty setting. So theoretically, some judgment is needed as to what to pick.

As far as the activity goes, my first thoughts are that I would go on the high-end value from the stuff that was on the surface, unless they measured some of the stuff that was up there. If they measured it, then you've got numbers. But if you don't have any data, here's where you start to ask, How far do you go where it's stretching it too far?

But I think that I would be comfortable saying that a high-end value from the surface swipe samples would probably be pretty indicative of what the concentrations might have been up there on the rafters. Whether you accept that or not is a judgment call.

Chair Beach: Yes.

Mr. McCloskey: The timing would be dramatically less.

Dr. Mauro: Of course, and the exposure duration would not be full time.

Mr. Sharfi: The fact that your average to high end is only a factor of four, you're probably time near the floor is much more than the time up top. So in the end, the floor time might be bounding over the rafter time -- the exposure from the rafter.

Member Kotelchuck: Where is the ventilation coming in, in that facility, that building? Where are the air vents?

Dr. Mauro: They mentioned there were two types: there was a general HVAC system that overall maintained the air turnover, air quality. But there was also localized ventilation at particular components. But what was up there in the rafters --

Member Kotelchuck: The question is whether the ventilation is -- whether there is a lot of air movement up there, depending on where the ventilation units are blowing.

Chair Beach: NIOSH should know that.

Mr. McCloskey: Yes, we have maps of what the ventilation looked like for the building. There's large -- two or three --- I was going to pull up the map so I could show them -- that are general area exhausts. They ventilate the entire Building 10, but then there's also those long hoses that come down like in an auto mechanic's garage to ventilate separate machines. These were required, because of the local areas.

Dr. Mauro: Elephant trunks.

Member Kotelchuck: So if it's exhaust up there, that's not going to be quote "windy". I mean, there's --

Mr. McCloskey: There's an optimal amount of ventilation you want to provide; you don't want to suck all the heat out of your building in Massachusetts, or air conditioning.

Member Kotelchuck: But as opposed to a blower, something, a vacuum -- it would not disturb what was on the rafters as much as if things were blowing in. If air was blowing in, then you might not have very much on the rafters.

Chair Beach: Well, and I know our primary concern -- and I mostly researched on Building 10, but there were other buildings too. Are there not other buildings that were storage areas that were contaminated? Was there any work done during this period in any of the other outlying buildings that we -- they're mentioned: Building 5, 10, 11, 12, 17. The interior of 4, 5, and 10, and the rest are exterior. Is there anything else?

Mr. McCloskey: Those are your key areas there that we're concerned about. No, the lion's share of radioactive material work is done in Building 10, and then there was some work done in some of the others; some waste handling in Building 5, there were some AWE operations that occurred in Buildings 3 and 4. We also include people who would have worked in those areas in our dose reconstructions.

Dr. Mauro: The way I was looking at it was, though we know AWE activities took place in multiple buildings, the majority of it took place in Building 10. That would be where the majority of the residual uranium activity exposure might have occurred. So all of our attention was on Building 10.

Chair Beach: Right, and mine too, and that's why I was questioning.

Dr. Mauro: And I think we agree that Building 10 has been plausibly bounded. That probably will be applicable to all the other buildings also because they're nasty buildings.

Member Valerio: Do we have any data from the actual equipment that was used in Building 10?

Mr. McCloskey: Like survey data when they released it? In the '60s?

Member Valerio: During the residual period, or was it all removed at the end of the operational period?

Mr. McCloskey: They sent a lot of the equipment used for AWE operations to DWXT in Virginia -- I think that's in our ER -- as those operations came to a close. They were given to them.

So then there's commercial work that goes on, and there are surveys of those. They were under a pretty rigorous health and safety plan for doing routine surveys, and that work is not covered. We didn't look at the surveys -- well, we do have reference to them, and we compare to them. And there is survey data available, but --

Mr. Darnell: We don't need it.

Mr. McCloskey: I think I can show you some of that.

Chair Beach: They were talking about, in some of the interviews, where the machines were kind of cleaned up, but there were pockets where they found contamination later on. And some of those machines

would have been used during the AWE possibly, but there was such an influx going in and out. I just remember reading one of the interviews last night, where it was talking about pockets of contamination still.

The lube, the oil -- I can't remember correctly, but there may have been some contamination last year. Remember that from the interviews? It might have been interview number 1.

Mr. McCloskey: I remember during, machines being talked about, but those machines being left over from the AWE period, I don't remember anyone saying that.

Chair Beach: I can't remember why it was talked about that they were contaminated machines in pockets.

Dr. Mauro: The question would be -- okay. About that equipment that could have had some accumulations where some rain might have been, and workers that were there could have inhaled some during the AWE period. Is that covered by the scenarios we've described?

If that did occur, it wasn't any worse than what we did with that. And the question would be concentration and duration of exposure. I mean, it's a legitimate question. It's possible that there could have been those scenarios which we did not explicitly address, that could have somehow been worse than subsurface scenarios.

Mr. McCloskey: I'd like to go back to Loretta's question about saving of equipment. For those I found SRBD 114235; 114235, pages 43 through 46. So this is data for commercial work. When I say commercial, understand that to be HFIR. And this is from a five-year period, during residual period. And then there's Table 13.2.3.1, Typical Contamination Survey Results. Then it talks about areas surveyed.

From the fuel-manufacturing area, the walls, floors, and equipment were surveyed. Personal pass-through areas, including the room walls, floors, and equipment; outer clothing for exiting the fuel-manufacturing area; protective clothing within the fuel-manufacturing area, and then in the general manufacturing areas.

So during this period of time, the FMA would have been an island inside of the GMA. The GMA is the general manufacturing area, the FMA is a smaller portion of that, all within Building 10, the primary area.

So within the GMA they surveyed the walls, floors, and equipment. They also have data here; this is a five-year summary for exposed skin of personnel entering the GMA from the FMA, and items and equipment entering the GMA from the FMA.

All the information is available and removable activity per 100 centimeters squared and fixed.

Chair Beach: Pat, I'm sorry. What dates was that on?

Mr. McCloskey: The date of this is February 15th, 1979, but if you read through here, it will say that it's a summary from a five-year period, I believe.

Chair Beach: So mid-'70s?

Mr. McCloskey: I believe so.

Dr. Neton: And what types of levels were they reporting?

Mr. McCloskey: The walls, floors, and equipment were all less than 800 dpm per 100 centimeters squared. Removal of the personal pass-through areas were all less than 10 dpm.

Mr. Sharfi: They were less than 800 in the FMA.

Dr. Neton: In the FMA; what about the in general area?

Dr. Neton: In the general areas, they found no contamination.

Mr. Sharfi: Okay. That's important.

Dr. Neton: So it seems that the general area, it doesn't show that anything coming out of HFIR was actually contaminating the outside manufacturing area.

Member Valerio: But that was coming out of the HFIR.

Mr. Sharfi: So the HFIR, they did find some contamination on the walls, floors, and equipment. But when they surveyed the general manufacturing area, they didn't find any.

Member Valerio: Okay.

Mr. Sharfi: It was under detection limits, so there was no indication --

Member Valerio: Let me see that.

Dr. Mauro: Should I go on?

Chair Beach: Does anybody need a comfort break? Where are we at?

Mr. Darnell: I need a caffeine break.

Chair Beach: It's 11:30.

Mr. McCloskey: I don't think we're near done yet.

Chair Beach: No.

Mr. Katz: Why don't we take another 10-minute comfort break, then? Okay. So, another 10-minute break, yes.

Chair Beach: At 11:40?

Mr. Katz: Yes. We'll reconvene about then.

(Whereupon, the above-entitled matter went off the

record at 11:29 a.m. and resumed at 11:47 a.m.)

Mr. Katz: Andy, are you back on the line?

(No audible response.)

Mr. Katz: On mute maybe. Henry?

(No audible response.)

Mr. Katz: Henry Anderson, are you still there?

(No audible response.)

Mr. Katz: Okay. Well, I think we can get started anyway. We have everyone else in the Work Group here in the room.

So, John --

Dr. Mauro: Sure.

Mr. Katz: -- where are we?

Dr. Mauro: I'm ready to go. We're about to change subject. Go to page 14 on the slides. We're going to be talking about external exposures. Everything we did so far was internal. Now we're going to talk about external. And again, it's important to think in terms of the Evaluation Report as it currently stands and also your addendum that we sent out. It has a certain protocol and uses a certain approach for reconstructing external exposures. Okay?

So we're -- we looked at it from the point of view, okay, let's see what they did and how they did it and the way you do it. And then of course there's the other side of the coin that says, okay, that's what's in the ER, the Evaluation Report. What about this new stuff that we're talking about, the sub-surface and everything else? Is that something that we really need to look at carefully just like we did for internal? So we could break it up into those two parts. Okay?

So the first thing, just to put it out, is the strategy that NIOSH has adopted in their Evaluation Report is

they said, okay, we're going to have to find a way to assign external doses to the workers during the -- the M&C workers during the residual period. And the approach that we understand that you took is that there is abundant external dosimetry data that was collected in 1966 and 1967 that is a body of data from which you could say we could estimate -- get a distribution. And it's that data, external dosimetry data during the end of the AWE period; correct me if I'm wrong, that's used as being representative of the exposures experienced for the same workers during the residual period.

Now there are two things we want to talk about. One is we reviewed that data and the approach and the assumptions and how you came about assigning the values that you decided to assign. And I'm going to ask -- if Bob Anigstein is still on the line I'd like you to summarize, because he did a critical review of that approach to data and what you did and he has some comments about how he would have done it.

So, Bob, if you're still there, could you give a little rundown on -- and that -- by the way, that information, that summary is on page 15 of the slides if you want to follow. And but Bob could go ahead and explain --

Dr. Anigstein: Yes.

Dr. Mauro: -- what his thinking is.

Dr. Anigstein: Now, what exactly?

Dr. Mauro: Well, Bob, we're --

Dr. Anigstein: We're --

Dr. Mauro: Yes.

Dr. Anigstein: -- talking about the film badge data?

Dr. Mauro: Yes, with -- what I'd like is a summary of your review of how they used the film badge data to come up with what I would call a surrogate way of

assigning external doses to the workers and how they used the film badge data. I know you have some comments.

Dr. Anigstein: Okay. First I want to say at this point I just read the White Paper yesterday and I'm a little confused because what -- they planned to use the film badge data for the subsurface scenario in a different way than for the rest of the exposures, so I am not quite sure unless Peter wants to chime in and claim this. Because in the one case prior to the White Paper my impression was that they tend to use the 95th -- the upper 95th percentile of film badge data to assign doses for the entire residual period year-round. I mean, for each year.

And then in the White Paper they said they're going to reprocess -- that's the impression I have, but they didn't use that word; that's my word, the film badge data quarter by quarter, because what they have for 1967 is quarterly -- the Film Badge Program ended on September 30th, 1967. That was apparently -- there were no more film badges, so I assume there were not records. There was probably -- the real end of the AWE period was probably September 30th even though nominally NIOSH continued it through the end of the year.

And what the original intention was to use -- well, there was -- it was not quite clear, but they were going to -- in the White Paper the intention was to take the reading for the three quarters, put them altogether -- in other words, because each film badge record the readings -- most of them are quarterly. There are a few monthly records, but most of them were quarterly. So it has the accumulated dose for the quarter, accumulated dose for -- from the beginning of the calendar year and accumulated dose from the beginning of the Film Badge Program which started in October 1965.

And then sometimes the workers were assigned doses based on their work history prior to that, because at that time the rule was -- there was this

18 -- let's see, 5N minus 18 rule that starting with the age of 18 they were allowed to accumulate five rem per year, and therefore if they had -- say they were at 21 and they had no prior exposures, then already they were allowed 15 rem for the year if they hadn't been exposed or accumulated. Anyway, that's not relevant here. So anyway, that's the data we have.

So originally there was a little bit of confusion I think in the way NIOSH used the data. At least that's my impression. But the latest statement about -- you're talking about data; they didn't actually produce numbers, was they would take all the readings quarter by quarter because the problem had earlier -- I'm sorry if I'm talking a little bit in a zigzag -- problem we had earlier was -- we, meaning SC&A had with the film badge data, is they gave equal weight to the film badge reading of a worker. Let's say he had a reading that ended for the quarter ending September 30th, 1967, but he may have not had any previous film badges for that year because maybe he wasn't assigned to the program or maybe he lost his badge, failed to turn it in. And so there will be a notation in the record, this is the accumulated dose for the year and this is how many film badges have been processed for this particular worker and how many missing film badges there were.

And so what I did was I reprocessed the -- this is prior to the White Paper. I reprocessed the film badge readings and I discarded any that weren't -- did not have all three quarters, because you couldn't put the same thing on the same footing. And then we took only the readings for the -- the year-to-date readings only for those workers, and I believe there were 82 of them left, for which you had readings first quarter, second quarter, third quarter, the accumulation. And then we could go back and look at the first and second quarters.

In some cases the readings were scanned. And the scanning was not always the same quality, so

sometimes the numbers were very clear, otherwise they were very, very faint. But it was possible -- the funny thing was that in the column where it said year-to-date it was faint, but in the column which said for that quarter it was legible. So you had to -- it was very easy to take the reading for that quarter and go back and see. Well, what was the accumulated dose in the second quarter?

So each of the very, very legible readings, some of which NIOSH submitted, were able to reconstruct based on the previous history. And the bottom line was -- ended up with 82 workers that had continuous readings for that year. And then there was a question of -- there was also an issue that some workers were issued two badges and one was labeled with a badge type 1 and there was a footnote on the bottom of the record which says badge type 1 is whole body. And then they would have a badge type 2, which was beta. And often they were the same. The badges were not specifically different.

And we happened to have the great advantage of having on our staff as an associate [identifying information redacted]who was a [identifying information redacted] of Landauer. He wasn't there during that period. He joined that company somewhat later, but he was very familiar with their practices. So he said basically it was the same type of badge but they were processed and read differently. So there were only something like 20-odd beta badges and many more No. 1 badges.

Now what the -- whoever processed the data for NIOSH mistakenly lumped the beta badges together with the gamma badges. So even though it was one -- it said type 1, type 2 with the same worker's name and Social Security number on the -- or the serial number; I'm not it was the Social Security number, also on the record. So obviously those beta doses should not have been included with the photon doses. I mean, that's a separate thing. So that was one mistake that we corrected. And the other one was

making it -- and a couple of places where they was simply mis-recorded.

So we ended up with, as I said, 82 records. And by taking the 95th percentile -- and this is just -- there's more than one way of calculating the 95th percentile. There is a very sophisticated method called regression order statistics where you actually plot the numbers and draw a curve and pick off the 95th percentile off of that. Or a simplistic but actually perfectly good way of just ranking them in order; the Excel spreadsheet does that automatically, and then seeing where the 19th -- 95th percentile would mean the -- if there were 20 readings, it would be the 19th reading. So of course there were more than that, so simply interpolating between the two readings that spanned the 95th percentile. So it's really based on two numbers.

But anyway, we did that. Those were -- we did that. That was a simple way of doing it.

And I came up with a higher dose. I came up with 280 millirem per year because multiplied by -- we added one-third because there were three quarters and a year has four quarters, so to get an annual dose we took the 95th percentile and multiplied by four-thirds. So that was the bottom line. It was -- and it's a little higher. It's just a matter of numbers, not tremendously higher.

Now the uncertainty, the place where I have -- need some explanation is with the White Paper now NIOSH proposes to -- a different approach. First of all, they're going to take the individual quarterly readings, not looking at the accumulated year. And in that case you don't have worry whether that worker had one reading, one quarter badge for that year or three quarter badges for that. But you're just looking at quarter by quarter.

I want to say we were looking at quarter by quarter, then take the entire distribution. In other words, I would take the -- take the geometric mean, the

geometric standard deviation and enter -- if you're doing a dose reconstruction, that would be entered into IREP, but divided by three because it's three months worth and we're only assuming that the person was doing this remediation work for one month.

So I'm not quite sure how that would then be related to the annual dose that they got from taking all the film badge readings.

Mr. McCloskey: Robert?

Dr. Anigstein: It seems to me like there's redundancy there.

Mr. McCloskey: Hey, Robert. This is Pat McCloskey. I can help you out there. You did pick up on a change that we're putting out in the White Paper for the subsurface work, but we're also going to do that in the ER revision for all of the workers.

So you really helped us out here. Initially we wanted to use as much of the 1967 data, the data from the end of the AWE ops as we could. And in the ER we said that there were 100 and, oh, how many -- 162 data points that we had. And then you pointed out that you shouldn't assemble all of those records together because they're there. It doesn't make a good rank order.

So, but we looked at that and although you have -- your 82 people each have a complete 1967 record, we were concerned that we were also omitting some of the workers from 1967 that could have had a complete record. And it would be hard to know for sure because if you just delete all of the people with a number in the column that says they're missing a badge, there's no way to know that they might be missing a badge from 1965, for example, or 1966.

So we wanted a new way to do this that we could incorporate all of the 1967 data. And as you rightfully noted we moved to developing a model that was

based on quarters.

Dr. Anigstein: I hear you, but what we -- but we're able to overcome that problem by essentially identifying -- by looking at the same person's records for the previous three quarters to identify which ones were missing that year and which ones are missing from the previous calendar year. So that's how we're --

(Simultaneous speaking.)

Mr. McCloskey: Oh, okay. So you reduced it down to 82; I thought it was 87, but our new method -- and we handed out an updated issues matrix to everyone here. You don't have it, but we did calculate the numbers. And as soon as it gets through ADC we'll make it available to everyone. But what we do is we come up -- we use every quarterly dose from 1967 and calculate a geometric mean and a standard deviation. And we used that -- we're going to use that approach in the ER revision for everybody. And for -- and then for the subsurface workers we're going to take a third of that and assign it to them.

Dr. Anigstein: So you would use -- you will throw away -- I mean, retire the original approach and just go with the quarterly badges?

Mr. McCloskey: Exactly. You brought up some reasonable --

Dr. Anigstein: Okay. No problem. That's --

Mr. McCloskey: Appreciate your review of that.

Dr. Anigstein: Actually you did that for the beta dose and we agreed to that.

Dr. Mauro: I'd like to jump in now, which almost makes the last conversation moot. I don't think you could use data associated at a time when there was uranium on site where the workers, the M&C workers were involved in AWE activities which was up through the end, I understand, of -- now if you could convince

me that the film badge data that you did work with reflects exposures associated with the kind of exposure pathways that existed during the residual period, fine. But it doesn't look that way.

It looks like the data you used was data from people who were badged during a time when they were working with fuel. And since we know there was no AWE fuel on site during the residual period, you've got yourself a situation where I would call it a surrogate data problem. You're in effect using data from the AWE period as a surrogate for exposures during the residual period.

Bob and I had lots of conversations on this and I came down in a place where you can't do that. In other words, you can't use that data to assign to the residual period. You got to go and model and predict as best you can. Similar to the way we did internal, got to do external.

And in theory it's a tractable problem, and in fact we actually do it in our workup where we say, okay, just like we constructed isotopic distributions and concentrations in various settings we -- from there you could predict using classic dosimetry -- external dosimetry to predict what the doses were that the workers might have experienced. And of course that involves picking a concentration distribution that you think is plausibly bounding and derive based on those concentrations what the external exposure is, just like we did for internal.

I don't think you could use measured data during the time period when there was fuel on site as being representative of exposures experienced during the residual period. So in my mind that whole strategy doesn't work.

Mr. Sharfi: I think we're saying it's bounding for the residual period. And given the small nature of the exposures it was accurate enough -- if the bounding exposures were 15 rem per year and we know the residual is 50 millirem, then obviously it's an over-

estimate, and I understand that. But then these are -- the external dosimetry in '67 doesn't indicate high exposures, and therefore it's a plausible bounding situation where you're -- where you can -- it's an acceptable bounding scenario.

Dr. Mauro: We agree that that approach is likely to be bounding. And interestingly enough when we did it our way, where we didn't look at your data; we just went ahead and modeled it the way it should be modeled, we're not that far away from you, interestingly enough. And that -- I consider that to be a coincidence, not a fundamental.

So in my mind I still feel that you're going to run into what I call surrogate data problems. Because notwithstanding that the doses are relatively small and notwithstanding the fact that when you do do it independently the way we did it we come up with similar numbers, you just can't do it that way. I mean, there is no fuel on site.

Dr. Neton: No, there's a lot of fuel on site.

Dr. Mauro: No, not AWE fuel.

Dr. Neton: Right.

Dr. Mauro: Yes, there's HFIR fuel, but that's not part of the game.

Chair Beach: So that's what that list was. I was wondering why you pulled that.

Mr. McCloskey: Yes, the NMMSS inventory?

Chair Beach: Yes.

Mr. McCloskey: So you're saying since there's no AWE fuel there, the exposures that we've said were there at the end of AWE ops are too high?

Dr. Mauro: No, just not -- I'm not saying too high. Just can't use them.

Chair Beach: You can't use it.

Dr. Neton: Well, I think you're saying they're too high.

Mr. Sharfi: You're saying they're too high.

Dr. Mauro: Well, they're likely to --

(Simultaneous speaking.)

Dr. Mauro: No, I'm just saying --

Dr. Neton: By definition they have to be.

Dr. Mauro: Of course they are expected to be higher because the guys are working with fuel. In the residual period they weren't working with fuel. They were working with just this residue. So the expectation would be that you're going to get higher doses the way you did it, but it turns out it wasn't that much higher. It was bounding, but that's not the point. The point is that you can't use that data to assign doses during the residual period. I mean, well --

Chair Beach: Well, and we just talked about that in the internal.

Mr. McCloskey: Yes, we have to use AWE source term to get our exposures from, right?

Dr. Mauro: Right.

Mr. McCloskey: So don't we often use whatever is left at the very end of AWE ops to show --

Dr. Mauro: Only --

Mr. McCloskey: -- the beginning of the residual period?

Dr. Mauro: Only when you're talking residual. In other words --

Chair Beach: AWE.

(Simultaneous speaking.)

Dr. Mauro: -- no problem when you're talking about residual radioactivity at the end of the AWE period because that's going to be still there at the beginning of the residual period.

Mr. McCloskey: Okay. I see.

Dr. Mauro: But the external radiation field --

Mr. McCloskey: Is gone.

Dr. Mauro: -- is gone.

Dr. Neton: Well, I don't know. I mean, the contract was over, but I don't know how much residual fuel was there. I mean, did they get rid of it? I mean, it's not like they -- immediately as soon as the contract was over all fuel was gone --

Dr. Mauro: Yes.

Dr. Neton: -- from the site.

Dr. Mauro: That's my understanding. Gone.

Dr. Neton: Okay.

Dr. Mauro: The only fuel on site was HFIR fuel.

Chair Beach: Or what was in the drains.

Dr. Mauro: And the residue of course. But as far as fuel itself, we have people handling fuel, assembling different fuel for different purposes. That's under AWE activities, HFIR activities. That was all gone. Taken away. Mr. Sharfi: Are you saying then it's not plausible that it could not be bounding?

Dr. Mauro: No, no. That has nothing to do with it. I mean, theoretically let's say, well, you know what we'll do? We're going to use the reactor exposures from Hanford as a bounding number.

(Simultaneous speaking.)

Mr. Sharfi: Well, it was relatively bounding and

grossly overestimated. That's why I said given the low nature of these numbers, we found it acceptably bounding.

Dr. Neton: I don't know. You've almost proven that if you came up with -- I don't know how close you came to what we've used, --

Dr. Mauro: Well, yes, it's in there.

Dr. Neton: -- but the exposure, the flat exposure to fuel is not necessarily the main exposure route in these people. I mean, you sort of demonstrate that empirically, right? You said --

Dr. Mauro: Well --

Dr. Neton: -- well, I think close is very -- dose is very similar to NIOSH. NIOSH used values at end of operation, so there must have been an exposure pathway that was really not directly related to fuel exposure.

Dr. Mauro: I will agree that during the AWE period workers were exposed to fuel and they were exposed to residue. The residue remained into the residual period, but not the fuel.

Now my sense is that of course the limiting -- the thing that's going to contribute most to your dose is going to be the fact that people are handling fuel. Now the fact that we ended up coincidentally -- that our models of the scenarios during the residual period were not that much different or lower than the actual data, that's just a coincidence. And the coincidence emerges from the fact that we fairly conservative assumptions for how we modeled the external doses during the residual period. That's what we did. And the fact that in the end your approach and our approach are not that much different.

I don't -- I can't see that being an acceptable way to argue your point because it just breaks every rule of the surrogate data. Breaks every rule. Can't do it.

Dr. Neton: I'm not sure. We'll go back. And this is a -- I think this is a Site Profile that you --

Dr. Mauro: Yes.

Dr. Neton: You say you can do it --

Dr. Mauro: This is a site --

Dr. Neton: -- whether it's modeled or not.

Dr. Mauro: Oh, no, no. I'll tell you where -- it's -- the issue is can you reconstruct external doses during the residual period using the approach of the fundamental strategy that we used? You cannot reconstruct doses during the residual -- external doses using the approach you used. If we only had that approach, the approach you used, that would be an SEC, because you can't do that.

Dr. Neton: Well, I'm not so sure about it. I mean, let us take a crack at that bat. I mean, you're saying no, but I'm saying we need to go back, revisit and we might be able to convince you that that's true.

Dr. Mauro: If you can show that --

Dr. Neton: If not, then we will --

Dr. Mauro: -- there was no fuel on site at the time --

Dr. Neton: No, you're --

Dr. Mauro: -- those measurements were made, I'd buy it.

Dr. Neton: But you're assuming that the -- we're using the 95th percentile? That's what we're using?

Mr. Sharfi: No, the mean, geometric mean.

Dr. Neton: The geometric mean value was 100 percent related to people working with fuel. The 95th percentile, I would agree with you is fuel-related. But the average value, the 50th percentile value is not fuel-related necessarily. It could be just general plant

environmental conditions.

Dr. Mauro: I know, but --

Dr. Neton: That's where your assumption --

(Simultaneous speaking.)

Dr. Mauro: Well, I'll reverse it on you. You can't make that assumption that the doses are predominantly from residual radioactivity. In fact, if someone were to ask me, common sense would say of course it has to be driven by the fuel because this residue is relatively nothing. We know these doses are low. Now the fact that you actually ended up with fairly low doses apparently, because our doses were low in our models, our external, and your doses were low -- now does that mean that, well, that means your doses were due to the residual activity? No --

(Simultaneous speaking.)

Mr. Sharfi: I don't think we're making the argument whether it's due to residual. We said it's considered bounding and acceptable.

It's -- the question -- my understanding of what is considered acceptable bounding is is it realistic or is it grossly overestimating? We're saying -- I mean, you're talking about exposures that are really not much more than detection limits.

Dr. Neton: I was also going to ask how much of that data is driven by the LOD?

Mr. Sharfi: Most of it's -- most of the data is right around the detection limit --

Dr. Neton: That's --

(Simultaneous speaking.)

Mr. Sharfi: -- which is indicating -- Dr. Neton: Yes.

Mr. Sharfi: -- really missed dose is -- residual exposure is right around the missed dose level. That

--

(Simultaneous speaking.)

Dr. Neton: Well, if they were badged, we'd come with the same --

(Simultaneous speaking.)

Mr. Sharfi: Yes, if everybody was badged in '68, the dose would be almost identical.

Dr. Neton: That would be --

(Simultaneous speaking.)

Mr. Sharfi: -- point is --

(Simultaneous speaking.)

Dr. Neton: -- data, I say good. We're done. At that point I would say this is good enough. Mr. Sharfi: But that's the point. I mean, if it's driven by missed dose, that's the upper limit to what the people could have been exposed. You can't do any better than that. If you've got badged data and it's driven by missed dose -- the doses are small. That's what we're saying. And it was -- if it's non-detectable and we use missed dose, that's part and parcel of our program.

Dr. Mauro: There's a mechanistic problem here. Mechanistically to use data that was acquired at a time when there was fuel on site and people were handling fuel, notwithstanding whatever dose you got, you can't use that --

Dr. Neton: It does --

(Simultaneous speaking.)

Dr. Mauro: -- time period when there was no fuel on site.

Dr. Neton: It does if you demonstrate that it was non-detectable exposure for the most part.

Dr. Mauro: I don't buy it.

Dr. Neton: LOD over two.

Dr. Mauro: Yes, I hear what you're saying.

Dr. Neton: So you were saying if we had the -- if we had the same data set one year later --

Dr. Mauro: Yes.

Dr. Neton: -- in the same place we'd be okay?

Dr. Mauro: Yes.

Dr. Neton: Then I disagree with you. So let's take a crack at trying to convince you logistically. But I hear what you're saying. I come out differently.

Dr. Mauro: Okay.

Chair Beach: So that's for Fact Finding 2. And does it carry over to Finding 3 as well?

Mr. McCloskey: Yes.

Chair Beach: That's what I thought. Mr. McCloskey: That's the beta doses.

Chair Beach: Yes.

Dr. Mauro: Yes. See, to me, I -- in effect we broke the Work Group into two parts. I said, Bob, review what they did given the assumption that you can do that, use the measured data in '67 or whatever. And what would you come up with? And he came up with it. And he has his comments. And it's a little bit different.

Chair Beach: Okay.

Dr. Mauro: I said -- and this -- we'll move it parallel. Okay. When we were done we actually got into a discussion. Bob argued with you. If he was -- we were having a free and open conversation. Bob would say, you know, I'm okay with that. I said, Bob, I can't do

it. I can't sit in this room and say that's okay. And then that's SC&A's position.

Action Items/Path Forward: NIOSH Evaluation

Report Addendum, other items

Chair Beach: Okay. The first action item. That's going to be a NIOSH action item.

Mr. Darnell: I had a question first. Maybe I'm just not understanding something. If we use the numbers that you say we can at the start for the external, aren't those numbers actually more conservative, more claimant-friendly than what we would use if we found

out --

Dr. Mauro: Yes.

Mr. Darnell: -- what some other number is?

Dr. Mauro: Yes.

Mr. Darnell: Then what's the point?

Dr. Mauro: They have nothing to do with each other. The numbers that you measure have nothing to do with what happened in the residual period. There's no mechanistic reason why those numbers have any relationship whatsoever to --

(Simultaneous speaking.)

Dr. Neton: Except to show the exposures were small.

Dr. Mauro: Except to show that the exposures -- but that's just --

Dr. Neton: It could not be necessarily detected by conventional film badges at that point. So, it makes no difference, then, John. I mean, if you've got a source term there and you can't detect it, and you take the source term and you still can't detect it --

Dr. Mauro: I'm going to show you why that's wrong. Let's say it turns out the models we use that try to explicitly address what deposits on surfaces, the residual activity, and the subsurface activity, and we did all our calculations just the way we did, okay, and we come up with a number that's higher than what you guys come up with. All right? One would say, well, I don't know why that happened; one would never expect that to happen because they don't actually work with real fuel. The answer would be, well, of course, you have to use the models for the residual period.

The fact that, by coincidence, you come in at below, it just happened to come out that way. There's no mechanistic reason why the numbers in 1967 should have any relevance to the exposure -- think of what people were doing. In one case, people were working with uranium, and the other case is people digging holes in the ground, where there was residual reactivity. And there was no uranium, other than the residue. There is no relationship between those scenarios. It's a classic surrogate data issue.

Dr. Neton: I disagree, John. I think you've got two populations. You've got people maybe working directly with the fuel, 95th percentile, and you've got the general workers that are working around the plant at the 50th percentile, which are not detectable, basically.

You're assuming that everybody was working with the fuel that was badged. That's not true. So, you've got two distinct exposure populations there.

Dr. Mauro: Well, do you agree that the data that you used for 1967 reflects exposures workers experienced while working with fuel? At least some of it.

Dr. Neton: Yes, sure. At the high end.

Dr. Mauro: How much of it is -- you don't know. See, I can't do it.

Mr. Sharfi: No, I would say the high-end data, it's likely -- but, since you use a geometric mean, that geometric mean is likely going to be dominated by the people who don't work with fuel. If you're using the 95th percentile, the upper end people are likely to be in that upper end because of what we do in the fuel.

Dr. Mauro: I hear you making your case, but you understand why I'm concerned. I mean, all I'm saying is, I'm explaining to you why I have trouble with that; that's all.

Mr. Sharfi: For the SEC, though, the good news is we all agree with the sample data we have for contamination for subsurface soil --

Dr. Mauro: Oh, yes, I think --

Mr. Sharfi: Do you believe that's good data? And FDR-12 is available.

Dr. Mauro: Yes.

Mr. Sharfi: Your method.

Dr. Mauro: Yes. No, I think you could reconstruct those doses, but not using the methods you used.

Dr. Neton: We're going to look at it. I mean, we may come on the same side, but I think we need to think about it before we just say, yes, I think you're right.

Dr. Mauro: Sure, sure.

Dr. Neton: I mean, I think there is a thought process that's going to go behind this. And I understand your argument perfectly, but I don't know that necessarily we agree.

Member Kotelchuck: It's a little bit ducking around the issue, but do we actually know how quickly the fuel was removed? You say, oh --

Dr. Neton: John says it was immediately gone.

Member Kotelchuck: And another perspective would be everything happens slowly in the world and that lots of things are hanging around. That's answerable.

Mr. Sharfi: The better argument, if the fuel was moved in '66, because, then, '67 would be data that was no fuel.

Dr. Mauro: You show me that there's no fuel onsite in 1966, I'm with you 100 percent.

Member Kotelchuck: That's discoverable, isn't it?

Dr. Neton: We'll take a look at it. I think there's some work that -- yes, we'll look at it.

Mr. McCloskey: We have an SRDB document that shows the inventory. The cover page for that from the person that provided it said that there's four different codes; now they have their three different codes. And we didn't find out which one of those codes is assigned to HFIR or --

Dr. Mauro: Right. You see, this table we're looking at, when all is said and done, it says, yes, there was fuel onsite in 1967; there's fuel onsite in '68 and '69. And you know what that is? That's HFIR fuel. It has nothing to do --

Mr. Sharfi: Yes, but if you look at the number at '66, it drops a factor of almost three or four, and then, it's consistent.

Dr. Mauro: And then, it jumps again.

Mr. Sharfi: No, I'm saying, if you look at the end of '66 --

Dr. Mauro: Yes.

Mr. Sharfi: -- it says 600,000. Then, it drops to about 200,000 and stays constant.

Dr. Mauro: Yes.

Mr. Sharfi: So, it almost looks like, at the end of '66,

the fuel was removed.

Dr. Mauro: Yes.

Mr. Sharfi: In '67, it is likely just HFIR material, because it is consistent. It's about 200,000 --

Dr. Mauro: Right.

Mr. Sharfi: -- after '66.

Dr. Mauro: Okay. So, you're making the case -- if you could make a case that there was no AWE fuel during the badge period, therefore, the badges and the data you have reflects the residual activity.

However, I suspect that whatever you are reading here is probably a combination -- right through 1967, what you're looking at is badge data from workers that were working with AWE fuel and working with HFIR fuel. Okay? And then, once you move into 1968 -- here's where it could be wrong -- there was no AWE fuel onsite, and therefore, that data has no relevance. That would be my position. You show me wrong; I buy your argument.

Dr. Neton: We'll look at it. I think we understand the position.

Member Anderson: So, where are we headed here? We're going in circles.

Dr. Neton: Well, NIOSH has an action item to investigate this issue and we'll get back to you.

Member Anderson: Okay. All right. Yes.

Dr. Neton: I mean, that's one of their findings, and I don't think the White Paper we issued, which was just a subsurface model, addresses it, either. A separate discussion on that.

Dr. Mauro: Now, just to close things out, and I think we're done, at the very end of this writeup, I have a couple of -- it starts on page 17 -- examples of how we modeled the pathways, these new pathways. We

talked about it. We understand it. It's there. If you want to read it, it's good, but I think we're done. In other words, we really have come to the point where we understand why we believe you can reconstruct external or internal doses during the residual period, because you have adequate data that can be interpreted and used in a manner to place a plausible upper bound.

And we give examples at the very end. But we talked about it in great detail as we went through this process. So, if you want to, we could walk through those examples, but I think that we have already done that.

Petitioner's Comments, Concerns, and Questions

Mr. Katz: Why don't we get the petitioner's opinion?

Chair Beach: I was going to ask you if we could do that.

Member Kotelchuck: Let me ask you this: the plausible upper bound, if there were no SEC, or the group decides that the SEC is not acceptable, then you would have exactly the same number for every single person who worked in that residual period. There would be no individual --

Mr. Katz: Well, it's individual, depending on -- because their duration, their tenure there, and all that is different. So, they get a different dose reconstruction, but the same machinery for their --

Dr. Mauro: The only distinction would be we do know that there was a pool of workers that were called the maintenance, repurpose -- there was a lot of people involved in repurposing and maintenance. But there were other workers -- I just did a case, in fact. I just finished a case where, the way I concluded, I said, listen, my critique was, you know, by the way, we don't know if this worker, given this job description, was involved in maintenance and repurposing. But, if he was, you missed those doses. And that's a finding.

Now we have to find out, because you can't tell from the CATI. He was a laborer. He was a laborer. Now a person that's called a laborer, in my mind, well, that means there's a real good chance he might have been in that hole, but I can't say that for certain. So, in a practical sense, you have to make that judgment. Someone has to make that judgment.

And if you say that you are going to give him that dose, fine. But you may conclude that, no, we're not going to give him the in-the-hole dose. Then, you know what he gets? He just gets that other dose from the residual activity on the surfaces, because he was not in the hole.

Mr. Katz: All right. Go ahead, Josie.

Chair Beach: Yes. No, I was going to say, let's get the petitioner --

Mr. Katz: So, if we have the petitioner on the line, and if you want to comment or if you want to ask questions, this would be a good time to do it.

Mr. Elliott: Okay. Sure. This is Mike Elliott, one of the petitioners. Can everybody hear me?

Mr. Katz: Yes, we can hear you really clear. Thank you, Mike.

Mr. Elliott: Great. Thank you.

First, I just want to say, I also participated in the worker interviews back in October. So, I got to meet Peter Darnell, John Mauro -- I believe Dr. Mauro?

Dr. Mauro: Yes.

Mr. Elliott: Rose Gogliotti, and, of course, Pat McCloskey in person. And I just have to say how impressed I was with their professionalism, the thoroughness of their interviews, their patience, their willingness to really describe things to us that to a layperson can be very confusing. So, I just cannot say enough good things. I went away from that

interview feeling really good, knowing that we had such talented people who were really approaching this very objectively. So, again, thank you so much.

As to what I was listening to today, it's hard to really summarize everything that I heard. There were several places where I thought, if I had the opportunity, I might offer a clarifying statement. And certainly, I will attempt to do that, and I assume there will be some kind of opportunity to submit written comments. So, I'll be sure to do that.

But I come away -- and I have to go back to what I seem to be consistently hearing from Dr. Mauro from the very start of this wonderful, if not somewhat complex, presentation that he delivered today. Obviously, a tremendous amount of work. I am really impressed with the effort that went into this.

But, you know, the things that I keep hearing consistently over and over again as he is talking is that, you know, there's really very little data available during the residual period. Yes, he does point out some of the data that he feels they are able to work with, and through some very complex modeling and mental gymnastics, they come up with ways of applying that data.

He used the statement that it was a really tough judgment whether or not the data was sufficient and whether they had sufficient understanding of the scenarios. He said it was kind of a stretch. And all throughout this entire presentation, I was hearing about the assumptions and the uncertainties and how they're starting to get around those.

And just this one example concerns the subsurface drain lines. I feel entirely responsible for the basis of his entire argument there. I was the one who stated the conditions that we found in the subsurface drains in 1994 probably reflected the conditions during the entire residual period. But I have to say, in retrospect, listening to the questions that Ms. Beach was asking, I think I would pause now if you would

ask me again, you know, what do I really know. I had no definitive information on which to base that opinion. All I know is that those were the levels we measured in 1994. So, in retrospect, I wish that Ms. Beach had been participating in interviews because I think the kind of questions she asked would have caused me pause, and I might have been maybe a little less certain about making, stating the opinions that I did. And that's all they are; they're my opinions. Certainly, I don't have any data to back them up.

So, I have to say that, although I greatly respect the work that SC&A has done, at the moment I really don't have a lot of confidence in their final conclusion. And I think that, in light of the EEOICPA guiding principles to be claimant-favorable when there is uncertainty in the science or the measurements, I still believe this petition meets all the qualifications to be recognized as a Special Exposure Cohort.

I just hope the Work Group will keep that in mind because it's easy to get lost in the weeds. Really, listening to you guys today, it seems really easy to get lost in the weeds. And I just hope we keep the big picture in light here.

And I feel confident, listening to the Chairperson, Ms. Beach, I feel very confident that she is in with that. So, I feel very good about the whole process.

Mr. Katz: Michael, this is Ted.

Just let me tell you, with respect to what you started out with, there will be, as you know, I think, a transcript of this Work Group meeting. Just recognizing what you were saying about a lot of material was covered and you wished you had been able to jump in, or whatever, and that you would like possibly to submit written comments, you certainly can do that. The transcript will be out in maybe 45 days or so. It will be available to the public. It will be posted on our website. And you can go through that transcript and, by all means, submit written

comments on any part of the discussion that you would like to comment on. And that's a much easier way to do it than to rely on your own personal notes, or whatever, and worry about what you might have missed.

So, to submit written comments, it's no problem. You just submit them to Pete or Josh Kinman, to the NIOSH website thing. "These are additional comments based on the Work Group meeting." You know, give it some title like that. And then, that will go and all the Work Group members will have your comments, too. Okay?

Mr. Elliott: Great. Thank you.

Mr. Katz: You're welcome.

Chair Beach: Are there any other --

Mr. Katz: And thank you for those comments, Mike.

Do any of the other folks that are associated with this site have comments or questions they want to add to the meeting?

Mr. Lorenzen: This is William Lorenzen. I actually was part of the interview process. I also was a contractor to CPS, who did a lot of the remediation work. And I think I've forwarded some of the documented testimony that was done back in Mansfield last fall, which I appreciated the opportunity to comment on.

I listened into as much as I could today. I didn't realize this was going to be as long a process as it was. So, I did have to step in and out.

But, to reiterate what Mike said, there's a lot of speculation in the discussion today and I heard lots of statements like "common sense" and "everything my bones tell me." I would just get you guys to focus back on the fact that it should be claimant-friendly, and if you don't know, you don't know. But speculation should not be talked about when workers' livelihood is at stake here. So, I think that we should

be very careful how you deal with this residual period.

It still draws me back to my original question I think we talked about during the interview process, which is, if the earlier claim was given because of thorium, I still don't know why we don't have a claim now because there's still thorium onsite. And we don't know anything about the thorium information, and I still find that a little concerning.

I do have a number of pages worth of notes here I've taken over the time I did listen. I'm probably better off submitting it in writing rather than go through it all with you. But just a couple of quick points.

The wipe data you guys are using, you've got to be very careful, in my opinion. I am a health physicist. I've working in the uranium industry for a long time. Wipe data is not activity data in the sense that you can't directly relate that to anything. It's just an indicator of the presence of contamination. And to take actual data and, then, convert it to activity, and trying to use it as a justification for resuspension, I think you have to be very careful about how that is done. So, that's one issue.

The other is, the residual period, there is no data. There's no airborne data. There's no badge data. There's no survey data. There's no subsurface sampling data that represents this Class of workers.

We keep talking about the levels that were found on the pipe being some magical 50,000 picocuries. That was not the highest level. I have quoted that in some of my testimony. We didn't measure the highest levels in the pipe because we knew they were hot. There was no need to measure. The levels, I'm sure, were much higher than that. So, again, to try to focus on one value to be an upper bound, and then, draw the 95th percentile, I think is really not following good science, in my opinion.

Again, in closing, I just want to say I'll submit some

of these in writing. I appreciate what this group is doing, but, to quote Mike here, I think you ought to be really careful about some of the assumptions and the approaches you take when it comes to workers and their lives and their livelihoods.

I appreciate the opportunity to comment.

Mr. Katz: Thank you. Thank you, William.

Is there another member of the public? Comments?

(No response.)

Okay. Not hearing any --

And just on a matter of policy, because this gets confused a lot by people in the public about claimant-favorable or friendly, whatever, that whole philosophy is tied to making sure that your doses are conservative. So, we need to be certain, when we have uncertainty, that we err on the side of the most conservative dose. That's what that applies to. It really doesn't apply to granting SECs or not granting SECs, based on claimant favorability. So, really, it's completely tied to that, making conservative dose estimates.

Now, certainly, for SEC matters, we either to have a rock to stand on or we don't. And that's sort of the bottom line with SEC matters. But it's supposed to be an objective business. And the uncertainty, if we can't deal with the uncertainty, we don't have a rock to stand on. So, it's a little different just nuance, but it gets confused often by folks in the public.

Chair Beach: Okay.

Mr. Katz: Josie?

Chair Beach: So, any more? Did we catch everything that you wanted to on your metals and controls? Or is there any questions that need to be exchanged while we're in the meeting?

Dr. Neton: I think SC&A hasn't had a chance to look at that yet.

Chair Beach: Yes, that's why I'm asking if they --

Dr. Neton: So, I think it's really not worth getting into.

Chair Beach: I know they looked at it, but was there any questions you needed clarified, so we don't have to do a technical call? Or that's kind of where I'm going with that. I was asking SC&A. I know you --

Dr. Mauro: I guess our expectation was that you've issued a White Paper. We had a chance to read it. We did not review the sources. In fact, we suspect that you may have data that we don't have when you put that out, but I'm not sure.

Ms. Gogliotti: John?

Dr. Mauro: Yes? Yes, Rose, yes?

Ms. Gogliotti: It kind of references what they gave me, because I had requested the raw data. It did include the FRD number references.

Dr. Mauro: Yes.

Ms. Gogliotti: And I have gone through just briefly; I didn't have enough time to dig really into the level that I believe would be sufficient.

But, in going through their data, I did find one small coding error. Pat looked at it and agreed with me. He already corrected it. It modestly reduced the dose outside, but nothing substantial to the modeling.

Mr. McCloskey: Do you have access to all the documents, all the references, Rose?

Ms. Gogliotti: I believe so, if they're all FRDs.

Mr. Katz: They are.

Dr. Mauro: So, there were none you added? In other

words, we put our report out in February. Did you folks collect -- I know there was a lot of data, like Appendix A to that report that had some additional information.

Mr. McCloskey: I'll talk to that. Yes, you guys were looking for that Appendix A --

Dr. Mauro: Yes, yes, yes.

Mr. McCloskey: -- to CPS's remediations in '94 --

Dr. Mauro: Yes.

Mr. McCloskey: -- and '93.

Dr. Anigstein: This is Bob Anigstein.

I reviewed the CPS data that we have worked with in the White Paper. There were two new reports, and I was able to download them. So, I believe, John, that we do have everything that --

Dr. Mauro: We do. We do. We do. Okay, good.

Mr. Katz: We do. We do. He's saying he's reviewed them.

Dr. Mauro: Okay.

Mr. Katz: We did.

Dr. Mauro: Well, where I was headed was, that's important because that means that there's nothing that's new here in terms of data. Because, remember, it's the data that is the rock we stand on, and how we use it, and how representative it is for our objectives. Since we have all the data, we're good.

Now a question for you folks is, would you like us to write something that responds to what's in the BRS, our thoughts regarding your work? Because we read it, but we didn't check the numbers like we normally do, but --

Chair Beach: Well, that would be the normal exchange.

Dr. Mauro: Yes, but do you want to wait until you issue a revision? Is that it?

Dr. Neton: No.

Chair Beach: No.

Dr. Neton: We were hoping that, given that we recognize this subsurface model seemed to be used for the biggest issue, we were hoping to get some resolution of that, and we could drop that right into the revision, but rather than issue repetitive revisions to the ER subsurface model.

Mr. Katz: Yes, I think the path forward is we have a matrix now.

Dr. Neton: Updated --

Mr. Katz: And now that we've had this meeting, it will get updated based on the discussions of this meeting. And then, once you have that -- I think you should wait on that matrix from Pat before you, then, go and more deeply respond to the White Paper --

Chair Beach: Okay.

Mr. Katz: -- and the issues that have been raised today.

Chair Beach: Right. And then, the Work Group needs to weigh-in on the SEC issue as well, because we are not necessarily all in agreement that there's not an unusual circumstance or that you've proven that you have all the data and it's adequate. So, the Work Group needs to, I guess --

Mr. Katz: But you need to wait until the --

Dr. Neton: Well, no, there are additional comments here that at least Josie had --

Mr. Katz: Right.

Dr. Neton: -- outside of these general issues. And it would be good if they got put on paper somewhere.

Mr. Katz: Well, those should be ending up in the matrix. That's part of what should be finding its way into the matrix at this point. We have the matrix to cover not just SC&A's findings, and so on, but any issues that get raised here in the meeting, are part of the issue. Right?

Dr. Neton: That's true, but they weren't issued as matrix items.

Mr. Katz: No, no, I know. Of course.

Dr. Neton: Somehow they just crystalized.

Mr. Katz: I'm just saying, normally, when we update a matrix, we add in whatever happened during the Work Group meeting.

Dr. Neton: Who's going to add in the Board's new comments?

Mr. Katz: Well, Pat, I mean Pat can take the beginning and start, and he can --

Mr. McCloskey: Yes, I'll need help.

Mr. Katz: Sure.

Mr. McCloskey: I mean, I don't know that I have all the action items that we've identified today.

Chair Beach: We haven't really identified any in here. I was just throwing stuff in.

Mr. McCloskey: Well, no, but they're there --

Chair Beach: Yes.

Mr. McCloskey: I mean, the contamination of the rafters, representatives of site data, you know, all those kinds of things that were brought in the panel discussion.

Mr. Katz: So, Pat --

Participant: Can I make a suggestion? Writing that stuff down -- Rose Gogliotti is already doing the BRS data input.

Chair Beach: Oh, good.

Participant: Which is where this would go.

Chair Beach: Okay.

Participant: So, why doesn't Rose take care of that?

Dr. Neton: Well, before it gets put in the BRS, we ought to circulate it to make sure we all agree.

Participant: Yes. Yes, of course.

Mr. Katz: So, again, we have Pat drafting a matrix. You can cover what you can cover. Send it to SC&A and the Work Group. We'll all have it. And they can add in what's missing.

Dr. Mauro: What I think is important is that Josie really hit some buttons that we didn't address. One, the rafters, that's important. We've got to have something smart to say on whether it can be reconstructed. There are workers up there, and you create, you identify --

Mr. Katz: That's part of the matrix.

Dr. Mauro: Okay. It's in there. Okay. Then, we can dig it up.

Chair Beach: It will be. It needs to be.

Dr. Mauro: It will be.

Mr. Katz: Please, I said, Pat will draft of matrix.

Dr. Mauro: Okay.

Mr. Katz: You will receive it.

Dr. Mauro: Good.

Mr. Katz: Josie and the group will receive it.

Dr. Mauro: Well, good.

Mr. Katz: If you heard things, you can put them in, whether you said them or whether Josie said them.

And, Josie and the Work Group Members, at the end, can look at it and say, did this cover everything? And if it didn't, the Work Group members can add to it.

So, at the end of the day, the matrix will have all the issues that there are to resolve, yes. And we've done that with other Work Groups.

Dr. Mauro: Okay.

Mr. Katz: It's not new.

Mr. McCloskey: I fully expect that you guys will be adding to this.

Mr. Katz: Yes, that's fine. Don't feel like you have to get a perfect -- you're just getting the ball rolling.

Mr. McCloskey: No problem. I don't mind.

Mr. Katz: But, I mean, stuff that you know and using your head, put it in, regardless of where it came from.

(Laughter.)

Member Kotelchuck: When is the SC&A report on the --

Mr. Katz: Relevant to this review.

Member Kotelchuck: I mean, we're talking about the matrix.

Mr. Katz: Yes.

Member Kotelchuck: Just to understand the process, what about SC&A's comments about the White Paper that's been --

Mr. Katz: So, they were going to wait until we have the complete matrix.

Member Kotelchuck: How to eliminate things out?

Mr. Katz: Wait until we have a complete matrix; everyone is satisfied this covers everything that's been discussed. And then, SC&A will go ahead with its response, knowing what's in the matrix, too, because that will be relevant.

Mr. McCloskey: That White Paper is in the matrix already.

Mr. Katz: Because when you do a paper, John, I mean, you don't need to just respond to that; you'll respond to everything with what you have to combine.

Dr. Mauro: Yes. Yes, it's a good plan.

Mr. Katz: Yes. That way, it will be comprehensive. It will be one report from SC&A, and then, you guys can go from there at another Work Group meeting.

Chair Beach: Well, and this is a bit unusual because, normally, SC&A puts out the matrix. And so, this whole process has been a little different.

Mr. Katz: It's been done. Different Work Groups have done it different ways.

Chair Beach: It's a little different than what I'm -- yes. I'm not saying it's wrong. It's just different.

Mr. Katz: I'm just saying, different Work Groups have had either SC&A -- it depends on who gets the ball rolling with a matrix --

Chair Beach: Right.

Mr. Katz: -- who puts it out first. But it doesn't matter.

Member Kotelchuck: And after the process is completed, we still have to meet --

Mr. Katz: Of course. While they've got a Work Group meeting --

Member Kotelchuck: -- at a Work Group meeting to decide --

Mr. Katz: Yes.

Chair Beach: Right.

Member Kotelchuck: -- on the SEC from our perspective, based on what the two groups --

Mr. Katz: Yes.

Chair Beach: It sounds like we'll have some notes from the petitioners. And is it appropriate -- and I'm talking to the petitioners, too, but I'm asking Ted -- if they want to get a hold of me as the Chairperson, is that --

Mr. Katz: They will send their written comments into the portal. And everyone will get it. It will get circulated to everybody.

Chair Beach: Okay.

Mr. Katz: The whole Work Group will get the petitioners' comments. And for that matter, the workers that were listening, if they want to send in more notes, too, about their thoughts, they're also welcome.

Chair Beach: Okay.

Mr. Katz: Yes.

Dr. Anigstein: This is Bob Anigstein.

In the interim, it would be useful to have the spreadsheets that are referred to in the White Paper.

Ms. Gogliotti: I have those.

Mr. McCloskey: He wants the film badge spreadsheet, Rose, probably.

Ms. Gogliotti: Oh, I'm sorry.

Mr. McCloskey: Right, Robert? You want the film badge spreadsheet?

Dr. Anigstein: No, not the film badge spreadsheet; the other -- there are three spreadsheets that are referred to, for soil samples and other measurements. There are three phases that you refer to. There's spreadsheet calculations, the results, but not the spreadsheets.

Mr. McCloskey: There's only two spreadsheets we have for the White Paper, and Rose has the soil contamination one. And there's a film badge one.

Dr. Anigstein: The film badge spreadsheet I have, but not the -- maybe you sent them and I didn't get it.

Ms. Gogliotti: I can send it to you, Bob. I have the other one.

Chair Beach: Okay.

Ms. Gogliotti: And it's actually been updated since the initial spreadsheet was sent.

Chair Beach: Okay. And then, I'd like to make a comment. From here forward, if something goes out, can the Work Group be copied on all things?

Mr. Katz: Always.

Chair Beach: But we don't always get copies. Some of these things I don't think we got. I'm just saying for the future things.

Mr. Katz: The Work Group should always be getting whatever is going over to SC&A certainly. I mean, I don't know if that's happened, but I haven't seen anything drop. But that should always happen.

The other thing I just thought about, too, is, since NIOSH has a couple items they want to speak to, it's good to get those in before SC&A finishes its review of everything that's been discussed today, because,

then, SC&A can consider your arguments on other matters.

Member Kotelchuck: Your comment, though, about everything should be sent, I have to admit, from the Dose Reconstruction Subcommittee, we have been talking to the different groups and saying, you should have made technical calls and speak to each other before you come to the Committee. So, it is a different --

Mr. Katz: That's different. Those Work Groups haven't been meeting on those issues, those other Work Groups. They haven't met on those issues, which is why nothing -- they haven't gotten any communications.

Chair Beach: Well, those technical calls should come to the entire Work Group because Work Group members do like to sit in and listen to those technical calls.

Member Kotelchuck: As opposed to the DR Subcommittee.

Chair Beach: In addition to the DR Subcommittee.

Mr. Katz: I'm lost on what you guys are talking about.

Member Kotelchuck: Well, the Dose Reconstruction Subcommittee has several times told SC&A and NIOSH, "Please don't bring that issue to us. Talk together. We're" -- I wouldn't say "wasting time," but "We're not efficiently using our time."

So, I just wanted to reflect that. It's a different kind of request here, that, no, we should get everything.

Mr. Katz: Oh, yes, that's different. Okay.

Member Kotelchuck: Is it because we're a Work Group?

Mr. Katz: Well, okay, with technical calls -- this is different. We're talking about stuff that's all coming

to the Work Group. Now you're talking about technical calls. When we have technical calls, we have a memo to document what happened in the technical call, and that always goes to the Work Group or whatever group --

Dr. Neton: and that other group is invited to participate.

Mr. Katz: They're invited to listen in, and then, they receive that memo that summarizes what happened in the technical call.

Member Kotelchuck: Okay.

Mr. Katz: We always do that, yes.

Dr. Mauro: A thought just came from that question. I can't help myself.

So, when we're in DR Subcommittee meeting and we're going over a case, okay, and there are a number of findings, some of those findings are very specific to that person and how they did the dose reconstruction, and we have a concern with that.

Mr. Katz: Uh-hum.

Dr. Mauro: But, more often than not, the concern has to do more with the Site Profile or some other generic approach. We should not be discussing those matters -- see, in other words, my understanding is, during a DR meeting, we will talk about the specific dose reconstruction for that worker and not any of the generic assumptions that come from an OTIB or come from --

Mr. Katz: That's not true.

Dr. Mauro: Okay.

Mr. Katz: We do. We talk about them all the time.

Dr. Mauro: Because I know that sometimes we have found ourselves engaged in a conversation where we're cut off.

Mr. Katz: No. No.

Dr. Neton: Sometimes those get transferred to the Procedures group.

Mr. Katz: We have issues where there are concerns, findings in the DR review that, then, get referred to a Work Group because it's the Work Group is dealing on the Site Profile. That's different. But those go in the DR report --

Dr. Mauro: Okay.

Mr. Katz: -- those issues, whether they are a Site Profile or whether they're just specific to a quality assurance problem, or whatever. They go in the DR report.

Yes, we do, we absolutely do refer matters to Work Groups to resolve because they're either under an SEC or under a Site Profile review, and that's the place where the expertise is the site. So, we do do that. We do that quite often. In fact, there's probably five or six dose reconstruction cases that are sitting with different Work Groups because those Work Groups have to resolve those final matters. We just sort of put them on the shelf there, yes, and that's what I was referring to when I was saying those Work Groups haven't met yet on those issues, because they're not going to meet just for one dose reconstruction case. But, anyway --

Chair Beach: Okay.

Mr. Katz: Anything else, Josie?

Chair Beach: Henry, do you have anything to add or comments, questions?

(No response.)

Mr. Katz: Henry, are you still with us?

Member Kotelchuck: It takes a moment to get on.

Mr. Katz: Yes, yes, sometimes you're on. You don't

know or you think you're on mute and you're not, and you mute yourself when you try to talk.

Henry, are you still there?

(No response.)

Okay. He may not be there anymore.

Chair Beach: And then --

Member Anderson: I'm here.

Member Kotelchuck: Oh, there he is. There he is.

Mr. Katz: Okay. So, Josie was just asking, do you have anything to add before we wrap up?

Member Anderson: Oh, I do not.

Mr. Katz: Okay. Thanks.

Chair Beach: Okay. And then, timeline on the work and scheduling another meeting. Is there any --

Mr. Katz: I think it's too soon to even talk about scheduling.

Chair Beach: That's why I'm asking.

Mr. Katz: Good. Well, we can come up with a timeline once we've wrapped our heads around what's been raised today, right, instead of right now, yes.

Dr. Neton: I will say, it doesn't like we're going to be ready to discuss this at the August meeting.

Mr. Katz: That may not be, right.

Dr. Neton: It's unlikely at this point, I think.

Chair Beach: It still would be nice to be close, so we --

Dr. Neton: Yes. No, I think we might be close, but to get a fully revised, polished ER out in time for August is, given that there's back-and-forth going to happen

and at least one more Work Group meeting probably happens --

Chair Beach: Yes, yes.

Mr. Katz: Yes, and we also want to give the petitioner time to submit their written comments, and so on.

Dr. Neton: We'll work as hard as we can towards it, but I don't think we'll make the August meeting.

Chair Beach: Yes.

Member Kotelchuck: Good.

Mr. Katz: Josie?

Chair Beach: I had one nitpicky thing on here, but I'll --

Mr. Katz: Okay, you could share that.

Chair Beach: -- I'll bring it up to John. Anyway, it's on John's paper. But it's nothing.

Mr. Katz: Folks on the phone, staff, and members of public, petitioner, thank you all for participating.

And we are now adjourned.

Adjourn

(Whereupon, the above-entitled matter went off the record at 12:54 p.m.)