

CENTERS FOR DISEASE CONTROL AND PREVENTION
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)
ADVISORY BOARD ON RADIATION AND WORKER HEALTH
ARGONNE NATIONAL LABORATORY WEST (ANL-W)/IDAHO NATIONAL
LABORATORY (INL) - WORK GROUP MEETING

WEDNESDAY, DECEMBER 17, 2025

The meeting convened at 11:00 a.m. Eastern Standard Time (EST)
via teleconference/videoconference, with
Paul Ziemer, Chair, presiding.

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Members Present:

Ziemer, Paul, Chair
Anderson, Henry, Member
Beach, Josie, Member
Martinez, Nicole, Member

Registered and/or Public Comment Participants:

Roberts, Rashaun, Designated Federal Officer (DFO)
Adams, Nancy, NIOSH contractor
Barton, Bob, SC&A
Behling, Kathy, SC&A
Buchanan, Ron, SC&A
Burgos, Zaida, NIOSH
Burns, Bob, Oak Ridge Associated Universities (ORAU)
Chalmers, Nancy, ORAU
Cook, Madeline, NIOSH
DeGarmo, Denise, Public/Special Exposure (SEC) Petitioner Representative
Freilich, Justina, Public
Gleckler, Brian, ORAU
Hawkinson, John, ORAU
Holzberger, Malia, Department of Health and Human Services (HHS)
Jerison, Deb, Public
Lobaugh, Megan, NIOSH
Mangel, Amy, SC&A
Marion-Moss, Lori, NIOSH
McCloskey, Pat, ORAU

Registered and/or Public Comment Participants continued:

Murry, Maisha, NIOSH

Nelson, Charles, NIOSH

Ostrow, Steve, SC&A

Rutherford, LaVon, NIOSH

Ryan, Judith, ORAU

Sharfi, Mutty, ORAU

Smith, Matthew, Public

Ulsh, Brant, NIOSH

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PROCEEDINGS

(11:00 a.m. EST)

WELCOME AND ROLL CALL

DR. ROBERTS: Okay. My computer just chimed for 11:00 a.m. Eastern. Good morning everybody. The Advisory Board on Radiation and Workers Health meeting of the Idaho National Lab/Argonne National Lab West Work Group is today. And my name is Rashaun Roberts. I'm the Designated Federal Official for the Board. And as usual, the agenda and presentations for today are located on the NIOSH website under meetings for December 2025.

I'm going to go ahead and do roll call. And if people could make sure that they're on mute as I do that, that would be great. Since board members who have conflicts with regard to the sites can't sit on this work group, there are no conflict of interest for the work group members. Other staff do need to state any relevant conflicts as I move through the roll call.

So, let me start with the new Chair of this work group, Dr. Paul Ziemer.

CHAIR ZIEMER: Yes, I'm present.

DR. ROBERTS: Okay. Anderson?

MEMBER ANDERSON: Present.

DR. ROBERTS: And Beach?

MEMBER BEACH: I'm present.

DR. ROBERTS: Great. So, we obviously have a quorum for today. So, let's move to Division of Compensation Analysis and Support (DCAS) and

Oak Ridge Associated Universities Team (ORAUT).

MS. MARION-MOSS: This is Lori Marion-Moss, DCAS.

MR. RUTHERFORD: This is --

MS. MARION-MOSS: No conflicts.

MR. RUTHERFORD: This LaVon Rutherford, NIOSH, no conflicts.

DR. ROBERTS: Thanks.

DR. NELSON: This is Charles Nelson, NIOSH, no conflicts.

MR. ULSH: Brant Ulsh, NIOSH, no conflicts.

MS. LOBAUGH: Megan Lobaugh, NIOSH, no conflicts.

DR. ROBERTS: Anybody else for DCAS or ORAUT? Okay. Let's move on to SC&A.

DR. OSTROW: Steve Ostrow, no conflicts.

DR. BUCHANAN: Ron -- Ron Buchanan, no conflicts.

MS. BEHLING: Kathy Behling, no conflicts.

MR. BARTON: Bob Barton, no conflicts.

DR. ROBERTS: Anyone else for SC&A? Okay. Let's move on to HHS and contractors.

MS. NANCY ADAMS: Nancy Adams, NIOSH contractor.

DR. ROBERTS: Okay. Anybody --

MS. HOLZBERGER: Malia --

DR. ROBERTS: -- else?

MS. HOLZBERGER: -- Holzberger, Malia Holzberger, HHS, OGC, no conflicts.

DR. ROBERTS: And Nancy, no conflicts?

MS. ADAMS: Correct.

UNIDENTIFIED SPEAKER: -- any conflicts.

DR. ROBERTS: Okay. Anyone else HHS or contractors? Is anyone here from DOL or DOE? Okay. Hearing none, let's move on to any members of the public who would like to register their attendance.

DR. DEGARMO: Dr. Denise DeGarmo, authorized petition representative for 256 Pinellas Plant, 266 Weldon Spring, and 267 United Nuclear Hematite.

DR. ROBERTS: Okay. Thank you and welcome.

Anyone else in the public who would like to register attendance at this time?

Okay. Well, thank you. And again, welcome. I do need to go over a couple of items before I give the floor to Paul, the Chair. In order to keep everything running smoothly and so that everyone can be clearly understood, please make sure that you're muted on Teams, if you're on Teams, or that your phone is muted when you're not speaking. The mute button should be somewhere on your screen in Teams. If you're attending via telephone, please star six to mute if you don't have a mute button, and if you need to take yourself off mute, press star again.

The agenda and presentations that are relevant to today's meeting, as I said before, can be found on the NIOSH-DCAS website. If you're on Teams, you should be able to see the presentations through Teams and follow along that way. If you're participating by telephone, you can find all the materials on the website. You'll need to open up the files and follow along that way. And all of the materials were sent to the board members and to staff prior to the meeting.

So with that, I will turn the meeting over to you, Paul.

CHAIR ZIEMER: Okay. Thank you very much, Rashaun. And I do want to especially thank Rashaun for her persistence this -- the past several months and actually getting us back up and running. We -- we have a full board meeting online tomorrow, as well as some upcoming work group meetings after the first of the new year. But it's -- it's been a -- a difficult year for many of us in a lot of different ways, and the board really hasn't had an opportunity to meet during this past year just for any regular business. So, we're glad that we're back and starting, and Rashaun, we appreciate the work that you've done to make sure we're getting there.

I -- I should also mention I am new to this work group. Any of you realize that currently the numbers of our board members are -- are down a bit. We've had some folks retire, and so those of us who are still around have had to pick up some additional assignments. For me, this is one of them.

The -- the INL facility itself is very large and complex. And then the part that we're focusing on today, Argonne West, which is on the INL site and which I think previously was considered a completely separate facility but now is part of the overall INL site, we -- we had originally a work group that goes back into the early 2000s. I believe Phillip Schofield headed that up.

And as I looked at our members, I think Josie Beach, you're -- you're the one with tenure on this subcommittee. You've been there a long time. I see that --

MEMBER BEACH: Yeah.

CHAIR ZIEMER: I see notes and records that show you back in the early 2000s, maybe 2008 or '9, somewhere in that range. And but -- and then, Henry Anderson, you came aboard a little later. But the two of you are the -- the remaining ones. Some of the others, like Phil Schofield, the -- the previous chairs, is retired from the board. And Gen Roessler, previous member is retired from the board. So, I -- I'm personally pleased to have both Henry and Josie here to provide some continuity.

I'm getting up to speed on Argonne West. And itself, a pretty complex area, let alone the whole INL facility. And so, I've had to recently be -- be reading a lot of old documents, ones that go back a number of years, sometimes more than a decade, and old transcripts and other reports. And I do appreciate the continuity that's been provided by the NIOSH staff people who've been on this for quite a number of years, and also the SC&A folks who have continued on this. And I'm relying on all of you a lot to get me up to speed.

I'm -- I'm still learning the details of the site, although I have physically been at that site on a number of occasions for various reasons. But the details on the site and all the site profiles and all the other areas of the site that are so complex, it's -- it'll take me a while to fully catch up. So, I appreciate those who are here, and I'm learning from you as we go along. And I thank you for that.

Well, with all of that preliminary discussion, we want to move ahead onto the agenda. Now, those of you who have already looked at the documents on -- on the website that are on our documents list for today, you'll notice that the two main ones really have been presented before to

the work group, and there's been some additional activity by both NIOSH and SC&A since that time. But this -- this work group, as far as I can tell, last met in 2020.

And then there was an additional report to the board, I believe in 2022 from -- well, it was a report on ORAURPRT0089 that was given by John Cardarelli. And I believe there was some recommendation to the board at that time. Maybe we'll revisit that. But in any event, we -- we have some catching up to do because it's been a while since this sub -- subcommittee has -- or this work group has met. So anyway, thank you all for helping me get up to speed. And we'll -- we'll pick it up from there.

I -- we show in the agenda that the status and overview of -- of that will be given. Now, I'm not giving the overview really except for what I just said, but the -- the presentation that we have here on OTIB-00 -- or I'm sorry, on EBR-II and BORAX-IV applicability, which is ORAUTRPRT0099, that presentation, I believe, was given before by someone who was -- it was Bob Burns, wasn't it? And I don't believe he's here. So, someone from -- from NIOSH -- who's going to give that report?

MS. LOBAUGH: Hey, Dr. Ziemer, this is Megan. I'm going to --

CHAIR ZIEMER: Oh, good.

MS. LOBAUGH: Yeah.

CHAIR ZIEMER: Yeah. Well, --

MS. LOBAUGH: So, I can share --

CHAIR ZIEMER: Welcome, Megan. Thank you.

**NIOSH/DCAS PRESENTATION (BRIEF SUMMARY): "EVALUATION OF
EBR-II AND BORAX-IV FOR ORAUT-OTIB-0054 APPLICABILITY,"
ORAUT-RPRT-0099**

CHAIR ZIEMER: Okay. I'm seeing here the original report, and this again is the Bob Burns' report from 2020, and I think you'll give us either an update or just a summary. But please -- please proceed.

MS. LOBAUGH: Okay. Turn on my camera, too, so everyone can see me. So, I am sharing the presentation. Now let me just make it a little larger for anyone who's on a laptop. A full-screen now. There we go.

Okay. So, as Dr. Ziemer said, this has been previously presented at the last work group meeting in July of 2020 by Bob Burns. I'm going to give kind of a history and bring everyone kind of up to speed on the discussions, and then go through a quick overview of the report itself. But I want to give a shout out to ORAUT. Thanks to Bob Burns for presenting this last time around, and to Brian Gleckler and the other folks at ORAUT who have really been working on all aspects INL and ANL West for NIOSH.

So, I'm going to skip ahead a few slides to just start with the intro. I'm going to talk a little bit about how we got here first before we really get into this. So, the question of whether OTIB-54 is appropriately bounding for the reactors at INL West, actually, initially came up during TBD reviews prior to the SEC evaluations. INL's an interesting site because of the number of reactors it had and the number -- the different research it was doing into reactors. So, reactor development, as well as lifetime, how reactors operate. So, it has a very unique mission within the DOE for reactors.

So, it was a good question. Does OTIB-54, this programmatic methodology that we have for pretty much all sites who work with reactors, is that applicable to the INL situation and any specific reactors at INL or ANL West. So, like I said, that question initially came up during a TBD review. And then when we presented our evaluation reports for SEC-219 and 224, the question became more generalized. So, the TBD question kind of started with very specific reactor experiments that were done. And when the SEC evaluation came out, the question kind of became, as I see it, a bit more generalized, does OTIB-54 fit, basically, all reactors at INL and ANL West, because the evaluation report said that internal dose is feasible for these reactors.

So, a little bit more about OTIB-54. OTIB-54, like I said, is a programmatic approach and methodology for assigning internal doses from exposures to reactors and reactor fuels. We need this because typically, we're monitoring workers and the environment using a gross method. So, gross beta, gross gamma, or even Strontium-90. We don't necessarily monitor for all radionuclides that could be in the mix from reactor fuel. So, OTIB-54 provides us that source term and mix that we can then assess and do intake and dose calculations off of these bioassay and other monitoring results.

So, you'll see here, you know, specifically we're talking Strontium-90 and Cesium-137. So, I'll kind of get into that in more detail a little bit later. So, in 2015 and 2016, SC&A reviewed our SEC-219 and 224 evaluation reports. During that review, as I said, there was this question of is OTIB-54 bounding -- appropriately bounding for the INL reactors. And like I said, it's

because of this unique situation at INL in testing reactors. And we know that they had certain tests where they would actually run reactors to failure, which means that there could be exposures. So, very valid question.

This report specifically -- so, let me take a step back. I want to talk a little bit about the discussion that we've had with the work group so far and the documents that have come out prior to this report. So, it -- there was SC&A's review of the SEC evaluation reports that kind of asked the initial question, and then there was a discussion with the work group. And the work group discussion kind of consisted of all these reactors, how are we going to look at them, what -- what kind of approach can we take, what path forward should we do.

So, out of the work group discussions came a request for SC&A to prioritize the reactors; what reactors do we need to do this for, are there any reactors we don't need to do it for, and then what priority of those reactors we do need to look at, what -- what should they be. So, SC&A (indiscernible) the reactors into high, medium, and low priority reactors. And then NIOSH, we responded to that and had a few suggestions. Namely, one suggestion was let's not prioritize INL and ANL West separately; let's keep them together because the analysis is going to be the same. So, let's prioritize all reactors in general.

Administratively, we're going to track them under the different SECs that is appropriate for each site. Because, as Dr. Ziemer said, prior to 2005, INL and ANL West are separate sites. We have one TBD for both of those sites, but they are separate sites, so we have separate SECs.

So, administratively we'll be tracking them separately. But in terms of

our work and our resources, we need to prioritize them all together. So, that -- that was done. And Report-99 discusses the first two of the high-priority reactors.

So, I --I believe there were approximately ten high-priority reactors. Between the discussion between NIOSH and SC&A, came up with ten high-priority reactors. Four of those are the SPERT reactor, which we will end up reviewing and determining which one is -- would be most bounding and -- and further analyzing that one. So, I think it comes down to really six reactors, high-priority reactors. So, these are the first of -- first two of those high-priority reactors are what we discuss in Report-99.

So, I'm going to get into kind of how these two reactors were chosen. As I think I said it earlier, there were 52 reactors at INL and ANL West, so that's a huge number of reactors to kind of look at. They're doing everything from just low-power experiments to handling and processing of the irradiated nuclear fuel, just looking at disposal of the radioactive waste and, like I said, some were even run to failure. So, they're doing a wide range of experiments even with these reactors. So, as I mentioned previously, there were high, medium, low priority reactors, and these are the first two. So EBR-II and BORAX-IV are the first two that we ran our review of.

A little bit about EBR-II. It's an unmoderated sodium-cooled, fast-breeder reactor. And the -- the fuel elements really -- the fuel type is what makes this kind of unique. So, it was selected for this review as a high-priority reactor because the fuel type was different than the typical mixed Pu and U oxide fuel that was in the fast flux test facility, the FFTF, the fast flux

test facility, is one of our representative reactors in OTIB-54.

So, there is a sodium-cooled fast-neutron reactor within our OTIB-54 programmatic approach, but the fuel element, the fuel type is really different for EBR-II, so that's why this became a high-priority reactor and was one of the first ones we looked at. In terms of how it was run, it was steady state, so that's very similar to reactors that were used in development of OTIB-54.

So, BORAX-IV, it was selected for really three different reasons. Again, a different fuel design, the thorium-uranium mix there. This also had a very different operating time. It was a short operating time with about a half day at power, followed by 8.6 days of downtime over just one year. So, that -- that turns out to be very low burnup over its lifetime.

And the burnup really is kind of -- what it -- what it changes then in terms of the source term is -- is those relative ratios of the mixed fission and activation products within the fuel to what we are using as our indicator radionuclide Strontium-90 or Cesium-137. So, that's why this became a question and kind of higher on the priority list is because these were -- because of this very low burnup, could these ratios be very different from what we use in OTIB-54.

So, I'm going to go into a little bit more -- how OTIB-54 was done a little bit later, but before that I'm going to talk about how we actually did this reactor modeling and the source-term generation. I'm going to talk more about the OTIB-54 process later, and that's because how we did this comparison, the OTIB-54 process, it's (indiscernible) from there.

So, skip ahead a little bit here and talk about the actual reactor modeling itself. While my degree is in nuclear engineering, I am not a

nuclear engineer by trade. I'm a health physicist. So, I am not super familiar with these -- these tools that we use to do this reactor modeling and source-term generation, but I'll speak as eloquently as I can right now.

So, the first thing we had to do was actually model these fuel setups -- the fuel setup and assemblies that were used. And to do that, we use the SCALE software. And TRITON is the module within that software that does the actual fuel lattice setup. So, you'll see some pictures here. I think pictures are helpful. You'll see how these two reactor cores are -- are set up in TRITON. And then TRITON actually comes up with a radionuclide inventory as a function of burnup. So, we put in more realistic power histories for EBR-II and then the BORAX-IV. So, this is the exact same setup that we would have done for OTIB-54 reactors that we haven't included in there. So, the same software, and we had in -- within OTIB-54, the document itself, it'll say the power histories that we assumed in all of that for each of those reactors as well.

So, TRITON comes up with the -- the radionuclide inventories within the -- the fuel elements themselves after looking at burnup. And then from TRITON, that output is put into ORIGEN to do the actual decaying of that fuel over time. So, OTIB-54 has four set time frames that we do decays; ten days, 40 days, 180 days, and 365 days. So, those -- those radionuclide inventories from TRITON were then decayed to those day speeds.

So, here's one of those pretty pictures I talked about the -- of the TRITON lattice for the EBR-II. You'll see each of those colors represents a different part of the -- the lattice itself. Can't really speak about anything else about this, so I'm going to go on to the next one and show the next

picture. If you do have questions about the specifics of these modeling, we can put that to ORAUT and get some answers for you.

So, the next one you're looking at here is for BORAX-IV. Again, the colors are representing different parts of the assemblies and set up there. So, as I said before, we are using the SCALE software, the TRITON and ORIGEN modules to come up with a source term. So, we want to put -- basically, what that modeling does is it takes the fuel, it burns it up to come up with what the radioactivity -- the radionuclide mix looks like at the end of burnup, and then ORIGEN decays that to these different time periods that we talked about.

So, I'll skip ahead to the next slide here, which is really the bases. So, what I talked about, what -- what are the inputs that we used for these models that are pertinent to what source terms we get out. So, you'll see in the left-hand corner of this table the description of the different subassemblies that were used, the modeled uptime and then lifetime of the reactor as well as the uptime average power level and then burnup. That was for EBR -- that was for the EBR.

Now we're on BORAX-IV. Same setup here. We have the -- the subassembly or the core description as well as the modeled uptime, lifetime, and for average power level and burnup. You'll note the very low burnup here, which is, again, why this is one of interest.

So, this is what I'm going to get into, the OTIB-54 information a little bit more. So, when we're asked the question is OTIB-54 bounding for INL and ANL West reactors, it's kind of a -- a difficult question to think about because OTIB-54 is designed to be a bounding approach for all reactors. So,

there were certain assumptions that we made to set that up to be a bounding approach for all reactors.

So, what we wanted to do was look at this more realistically, if that makes sense, for INL. So, using the very INL-specific source terms, doing the exact calculations of OTIB-54. So, that's why we're going to kind of go through those calculations here in this section.

So, what we did in Report 99 was basically a direct comparison of the OTIB-54 doses that we would get to doses we would get using the INL-specific source terms and the OTIB-54 approach. So, we're using the exact same setup to our calculations. The only change is that source term input at -- about the reactors.

Our exposure pathway assumption is inhalation. And we're really looking at dose to 28 organs. When we're looking at the source term, we're removing the noble gases because we don't have DCFs for them and actinides, so we're really just looking at mixed fission and activation products within these source terms.

So, one thing that's really important when we're looking at these source terms and trying to -- again, like I said, we're using gross beta, gross gamma, or strontium samples. We're using a bioassay sample that's not measuring everything within the source term. So, we need to make it a back calculation to the urine or a forward calculation from the urine back to the intake, however you want to think about that. So, what we need to worry about is the type of sample, type of bioassay sample or other monitoring sample we have.

So, we have a few different bins of sample types within OTIB-54.

There's gross beta minimally processed, there's gross beta chemically processed, and then there's gross gamma minimally processed. So, these are all for the urine ratios that we're going to talk about in a little bit.

So, this is where I'm going to take a breath and try and go a little slow because this is where it gets a little complicated. We have our source term output from ORIGEN, which is a decayed, like, spent fuel setup, basically. A burn up -- burnup fuel with decay times at 10, 40, 180, and 365 days. Whatever the four buttons are. I forget what the middle one is.

What we -- what do we do with that? So, we know what the fuel looks like at this certain point post burnup. Now we have to take that and figure out how many -- what's the ratio, what's the relative amount of radionuclides to this indicator radionuclide of either Strontium-90 or Cesium-137. Strontium-90 is used for the beta, Cesium-137 for gamma. We need to, basically, make this available for intake. So, that's how I think about it.

So, we have to apply release fractions. So, we use release of fractions from DOE 1027. This is important because different elements are -- have different volatility. And so, because 100 percent of one element it may be easily released, only 10 percent of another element may be released. So, this is basically normalizing and taking into account the volatility of each element within that fuel mix. Once we do that, it's called -- we call it a normalized intake fraction.

The next step would be determining which of those radionuclides are actually contributing to dose. So, we actually -- we have a huge -- I didn't really say this, but we have a huge inventory of radionuclides that can be in the fuel. In order to make this practical and be able to do these

calculations, we need to pare it down in some way. So, the next step is doing that. First we're going to pare it down to the radionuclides that actually contribute more than 1 percent to the dose to any organ. And then we renormalize them.

So, within OTIB-54 this is Table D-1. So, OTIB-54 has a lot of tables in it, so this is one of those tables that we're replicating here for the INL source terms. And then these -- these normalized fractions are then -- basically, we have to look at the amount of our indicator radionuclide, either Strontium-90 for beta or Cesium-137 for gamma. What part of the urine sample -- what fraction of the urine sample would be from those indicator radionuclides so we can figure out the fraction of the other radionuclides.

And then the next step would be to assign, basically, a unit in -- unit activity to the urine sample to determine the relative contributions, like I said, from the other radionuclides. That's still a large list, so we need to bring it down even more manageably.

So, the next thing we look at is normalizing to any radionuclide that contributes more than 1 percent to the committed effective dose. And these are called -- this is called Table E-1 within OTIB-54. So, now we have our table E-1 for the INL-specific source terms. And then from there, we can use our Table E-1 ratios to actually compute the doses to the 28 organs for the 24 cases.

So, I'm gonna take a breath. So, we have four decay times. We have the two beta -- two types of beta analysis possible, one type of gamma analysis, and then we have with and without radionuc -- radioiodines. So, that ends up being 24 cases. We have 24 different tables of ratios that are

possible for each of the reactor setups that we do.

So, this is pretty time intensive, like, pretty -- not -- not time intensive. I want to say just intensive calculations, a lot of things that you have to follow through for each of these reactor simulations we do when we -- when we get to this dose part.

And then the final step would be we have our dose from F, which was -- from Step F here, which is really our dose from the INL-specific reactors. And we're going to compare it to the dose that we would get from OTIB-54. And what I mean by "the dose that we get from OTIB-54," OTIB-54 has a series of reactors, and typically when we run OTIB-54, we run all reactors, and we assign the highest dose. So, it -- sometimes we may limit the reactors that we look at, but for the most part we're looking at all reactors, all decay times, and we're assigning the highest dose. So, in this case, we're going to look at all reactors, and we're going to assign the dose that's the highest for each of those decay scenarios that we talked -- that we talked about.

So, that was a lot. OTIB-54, we have a tool that does the typical calculations for us for the -- Report-99, we had to use a spreadsheet because of using the different source terms. So, I consider the Report-99 calculation quote/unquote, manual. The -- the spreadsheet is verified and -- and validated, so it's not -- not necessarily manual, but it is more of a manual calculation versus our OTIB-54, which we have a tool for.

So, let's talk about the actual comparison. So, like I said, this is our -- our first pass here is a direct comparison of OTIB-54 doses to the doses we get from these INL-specific source terms. I'm going to skip ahead here and

just show -- this table is the smallest dose ratio that we found for each of the situations. So, in the left-hand side is our sample description. It's the type of bioassay that we're talking about. Minimally processed beta with iodines, minimally processed beta without iodines, chemically processed, etc.

So, each row is a different type of sample, monitoring sample, that you would have. And then each column is the different cores. Well, the two different reactors and the different cores that we looked at for the EBR-II assembly. And this number that's entered in here is the ratio, the OTIB-54 dose to the INL-specific dose.

And then in parentheses is the organ that this dose is from. So, we're looking at the smallest dose ratio. So, the smallest difference between OTIB-54 and the BORAX or OTIB-54 and the EBR. So, you'll note that all ratios are greater than one.

For more detailed information, Report-99 refers you to the supporting documentation and the reference for all the calculations. So, Report-99 provides a summary similar to this where it's the smallest dose ratio and not all numbers, but all numbers are available in the supporting documentation for that report.

So, what does this mean? OTIB-54 is our primary approach within the program for assigning mixed fission and activation product doses from exposures to reactors when we have gross beta, gross gamma, or -- or measurements for only one of the -- or indicator radionuclide bases. So, the question about whether INL and ANL West reactors are, you know, appropriately bounded by OTIB-54 came up, and we looked at that. And for these conditions that we looked at for the EBR-II and BORAX, we found that

it is bounding, because all of those ratios of the doses were greater than one.

So, this is just the first two of those high-priority reactors. We have began -- begun looking at the other high-priority reactors. We have started with modeling. We have not progressed on to the actual dose calculations and dose comparisons yet.

As I briefed in previous emails to the work group, we've had a lot of change within our ORAUT team, and we are limited resources. We used to have two HPs serving the INL/ANL West work, one for SEC and one for TBD, and now we're down to one who's doing all work. Basically, all the HP lead for the site completely, I would say, instead of one for SEC and one for TBD. So, we've been slowed down a little bit for that. And the TBD has become higher priority for the last year or two at this point. So, -- so, we have done some work on this -- other high-priority reactors, but have not finalized anything for sharing with the work group.

With that, take any questions.

MEMBER BEACH: Megan, this is Josie. Hi. Good reporting. Thanks for bringing us back up to speed. You did a good job on it.

Is there a time line? Do you guys have -- I know you said you're shorthanded. Is there a time line on when you think you're going to get through the other reactors, the high prior -- high-priority ones at least?

MS. LOBAUGH: We don't have a time line at this time. Right now it's paused awaiting the TBD update. So, we recently updated the TBD to implement the SEC information. And then, now we're working to implement and discuss the internal co-exposure models. So, it's -- the next step in the

reactors is, basically, pending that.

And there's one other topic, which would be burial grounds. So, we kind of still need to figure out priority and if we need to change, you know, our current priority. But right now, the priority is the TBD -- getting the TBD updated.

MEMBER BEACH: Do you know when that's going to be out, the TBD?

MS. LOBAUGH: No. Yeah. We haven't -- we have not seen a draft of that yet, so it's still being worked.

MEMBER BEACH: So, that's a ways --

CHAIR ZIEMER: Megan, thank you --

MEMBER BEACH: -- off.

CHAIR ZIEMER: -- very much for that presentation. I -- I do want to point out, so basically, it's the same information that the work group got five years ago, and I noticed in the transcript when we -- when the question period was asked for, neither Phil nor Josie nor Henry had any questions on it, but it was pointed out that the material had been assigned. And actually, I believe, at that meeting, SC&A was tasked with doing an official review of that report. That report -- well, there was -- there was one other question that arose then, and I don't want us necessarily to discuss it now, but I think Steve Ostrow from SC&A raised the question about what does it mean if that isotopic ratio goes below the -- goes below one, that is, if it's 0.9 or 0.8 or something, what does that actually mean. And there may be further discussion on that. There was some discussion at that time.

But in any event, SC&A was tasked at that point for doing the review. And that review was issued. I think Steve Ostrow did present that, and that

re -- that is, he authored it, let's put it that way. And that was authored in or -- actually, released, as it were, early in 2021, but never officially presented to the work group. So, that will be the next thing on the agenda.

But let's see if there's any other additional questions first, because in five years you might have thought of some other questions, the work group members, either Josie, you asked about the time line, that's a good issue. And unfortunately, right now, I think we're all strapped in many ways on moving things ahead at the rate we would like to, but they're still at it.

But Henry, do you have any questions also on this, or Josie, --

MEMBER ANDERSON: No, (indiscernible) --

CHAIR ZIEMER: -- any additional ones?

MEMBER ANDERSON: The only question I have is when we talk about bounding. Well, how -- how higher does the -- the bound have to be or the estimate have to be than -- these numbers that you presented in that table are all pretty close to each other. Is -- is there a goal for -- I mean, it -- it involves a whole lot of estimates in there of what we really don't know too much about. So, I mean, is there a target to say you -- you want it to be this much over or just any amount over?

MS. LOBAUGH: So -- so, I think this is a good question, what Dr. Ziemer brought up about what does it mean if we go under one.

MEMBER ANDERSON: Right.

MS. LOBAUGH: So, this is something that -- so, no, I would say there is no target for what number we need to be above one to say that we're good. I would say that was the first -- the very first approach we needed to take was hey, let's look at this substituting out the source term. So, all we

basically did was take out the generic source terms that we used in OTIB-54 -- they're not really generic, they're just specific reactors, some of them not at INL -- and swap in and put in our INL-specific source terms and see what we get.

So, this -- for these two reactors, we see that just swapping out that source term, OTIB-54 is going to assign a higher dose every single time. Because the -- what I displayed here was the lowest ratios we got. Some of them could be considered close to one. But that still tells us OTIB-54 is going to assign a higher dose than what we would do if we would use these INL-specific source terms. So, I think that's something to keep in mind.

What is the really hard question here is what is bounding enough, because what happens if we see a ratio less than one? Because of the way that we have designed OTIB-54 with the conservative assumptions that we made, we don't think that a number less than one necessarily means that OTIB-54 is not bounding for reality. And what is hard to prove is reality, right? So, OTIB-54 is providing us an approach, a methodology, a way to assign doses for these reactor mixes after -- at certain times, post irradiation for when we have bioassay data.

So, we -- we have ratios now to assess these monitoring data from. But what I think is really hard to grasp is how do we prove that the conservatisms we built into OTIB-54 are bounding? Like, it's a very hard question.

So, what we're looking at -- what we have done, in addition to modeling -- starting the modeling of these other high-priority reactors is we're trying to approach this more from reality. We have monitoring data.

We have these gross data, gross gamma whole-body counts. So, basically, at INL we have whole-body counts is a main one and gross beta urinalysis. So, we have bioassay data that we can look at. And so, we kind of have been trying to approach this question more from reality by going backwards with the bioassay data to the source term relative ratios to see should we have seen something.

Like, if -- if there were these exposures that we are assigning from OTIB-54, would we have seen it in the bioassay data, and we think we would have. And so, that's -- that's kind of our path forward and what we've been looking at in parallel to modeling these other reactors.

So, did I answer your question, Dr. Anderson? I know --

MEMBER ANDERSON: Yeah, in the last part. Yeah, it does. I mean, when you apply it, you believe, you know, you would have found it or you would have seen it if there was something different. So, I think --

MS. LOBAUGH: Yes.

MEMBER ANDERSON: -- that's very helpful. But again, it's -- you don't want to -- in bounding, you don't want to have it be so high that it's terribly unrealistic, but you want to be sure it's not unrealistically low either.

MS. LOBAUGH: Yeah.

CHAIR ZIEMER: And that's a good point, Henry. You don't want the bonding to be unrealistically high as well. So, --

MEMBER ANDERSON: Yeah.

CHAIR ZIEMER: Yeah, that's a good point.

Are we ready to proceed then with the next presentation or any other questions at this point? Okay.

MEMBER BEACH: I'm ready.

CHAIR ZIEMER: Important for us now to --

MEMBER ANDERSON: Yep.

CHAIR ZIEMER: -- hear directly from SC&A. Steve, are you going to do the presentation?

DR. OSTROW: Yes, I am. Give me a second, and I'll share my slides hopefully.

CHAIR ZIEMER: Great. Okay. Thank you.

MEMBER ANDERSON: Steve and Paul, I like that your background is the same.

DR. OSTROW: Yeah. It's -- yeah. It's just -- one's a mirror image of the other.

MEMBER ANDERSON: Yeah.

CHAIR ZIEMER: Right.

DR. OSTROW: Okay. (Indiscernible) looking up --

CHAIR ZIEMER: (Indiscernible).

DR. OSTROW: Yeah. Can everyone see this --

CHAIR ZIEMER: We're seeing your screen now, Steve. We're good.

DR. OSTROW: Yeah.

CHAIR ZIEMER: Go ahead.

**SC&A PRESENTATION: "REVIEW OF ORAUT-RPRT-0099 EVALUATION
OF EBR-II AND BORAX-IV"**

DR. OSTROW: -- amazing. That's my only trepidation about giving these presentations is whether I can get Teams to actually work, you know?

So that's -- so, now I feel good.

Okay. I'd like to give a preface. First, I applaud NIOSH virtuoso presentation and their exploitation -- explanation of the OTIB-54 modeling. As a nuclear engineer, I'm sort of the reverse of Megan, I'm a nuclear engineer and sort of an amateur health physicist. My heart is a flutter when I look at OTIB-54. This is amazing.

And I just want to apologize for any repetition in my prep -- presentation, since I hadn't seen NIOSH slides when I made my slides. So, I'll go a little bit faster in those port -- portions. Just to ensure -- just to give a preview here, we reviewed the report thoroughly and agree with its treatment and conclusions. So, that's the bottom line for it.

So, let me just go through everything now. Okay. So, background. We went through -- this has been going on, as Paul, I think, mentioned, this INL review is going back about 20 years or so, I mean, literally been working on it.

Specifically for this, we reviewed the two SECs, one for INL and one for ANL West, and identified a potential issue. And the issue, as we've been discussing, does the OTIB-54 adequately model the source terms of the INL reactors and yield claimant favorable results when you -- when you don't have the actual mixtures of activation and fission products available, and you only have gross beta and gross gamma measurements. So, that's the basic question that we're dealing with here.

NIOSH asserts that it does. And they say that the -- using OTIB-54 you could expect it to produce upper bound exposure results in most cases. Just a note at the bottom, it was mentioned before, that Argonne National

Laboratory West is physically located inside the overall Idaho National Laboratory site, and the combined site is now referred to as INL. And NIOSH/ORAUT have been -- when they're doing the reactor modeling and we've been reviewing, I've been treating it as, you know, one overall site, not making any distinction between the two.

Paul mentioned this, I think, in his introduction. We made two evaluations in 2015 to determine whether OTIB-54 produced acceptable results for six INL reactors that operated during the SEC evaluation period. The heat transfer reactor experiments, HTRE, one, two, and three, which we use in the aircraft nuclear propulsion program, which is located in test area north on the site and the -- the react -- three reactors that were test reactor area, materials testing reactor, engineering testing reactor, and advanced test reactor. So, those were three similar reactors, but they got bigger as you go from left to right.

And after a lot of discussions, we were directed at the November 2, 2015, meeting to create a prioritized list to examine OTIB-54 applicability for the remaining reactors. Okay. As mentioned, at INL, the overall site, had 52 different reactors at various times. It's like if you ever look at the reactors in detail, it was like a zoo of exotic animals. Thirty-four were the INL, 12 for the ANL West, four for the naval research facility, which was also there, which is not considered part of our program, and two never operated at all as nuclear reactors anyway. So, we looked at all the reactors already not -- that weren't already analyzed at the time, and the 26 -- 2016 report, we categorized them into high, medium, and low review categories, considering the reactor designs and operating characteristics. And we went

back and forth with -- with NIOSH and with the work group to refine these -- these characterizations.

So, after discussions, we -- NIOSH analyzed the two high-priority reactors we're talking about today, the EBR-II, experimental breeder reactor II, and BORAX-IV. There were several BORAX reactors. This is the fourth one in their report. And this is what we've been -- that's what we're discussing today.

Okay. So, in -- specifically, NIOSH produced their Report-99 May 2020. We commented on that report, as we usually do, in 2021, and submitted the report and so forth and so on, but we haven't reported on it yet. This is -- today's the first day we're reporting on the -- or presenting our report.

Just briefly EBR-II was built by Argonne as a scale up from the EBR-I, which is the famous reactor. If you're into nuclear reactors, this one demonstrated, the EBR-I, that you could actually generate electricity. It produced enough electricity to light four light bulbs. It was just proof of principle that it could be done. And EBR-I is a national historical site now on the -- the INL reservation. You can go visit it and take a tour and so forth.

So, EBR-II was bigger though. Liquid metal, fast-breeder reactor passively safe design, which means it didn't require -- it wouldn't require any operator actions to bring it to safety. Unmoderated core, it's a fast reactor, 67 percent enriched uranium, U-235, and it sits in a tank of liquid sodium, primary coolant, and it's cooled by a closed-loop liquid sodium secondary loop. So, it's a sodium reactor. Maximum power level with 62 megawatts thermal and 20 megawatts electric. And it demonstrated on site

reprocessing of spent fuel.

The EBR-II is placed in the high category because the only sodium-cooled fast reactor in the -- in the OTIB-54 default library is the fast flux test facility at the Hanford, which used mixed uranium and plutonium oxide fuel, while EBR-II used only high-enriched metal alloy fuel. One of the -- also, one of the reasons EBR-II is that -- one of the criteria, which I'll talk about in a minute, I think -- why it was select -- of selecting which reactors to do, what -- what was the potential for exposing personnel to radioactivity during operation.

EBR-II had a lot of people operating it. Experimenters from all over the country doing experiments there. So, in -- in theory, a lot of people could have been exposed to EBR-II radiation. If

I can just go a little diversion here. Just interesting that EBR-II is an old reactor. It's been there a long time. You know, it's (indiscernible) 1961. Right now, you know, the big thing is small modular reactors. And TerraPower has the Natrium small mod -- modular reactor, which they're actually building right now in Wyoming. And it's based on the EBR-II design.

It's modernized scale-up and so forth, but it's -- it's actually using EBR-II design. It's going to produce 840 megawatts thermal, pool-type, sodium-cooled fast reactor. And interestingly, it has molten salt energy storage system that when it's not operating -- when it doesn't need to deliver all the power to the grid, it heats up this molten salt, and it can deliver up to 500 megawatts electric to the grid. So, that's a -- that's a serious power plant there. And it's built deliberately to model EBR-II.

Okay. BORAX-IV. -- There was a series of BORAX experiments

located in ANL West, which tested the feasibility and safety of -- of boiling-water reactors, which produces boiling-water reactors that produce steam inside the reactor vessel as opposed to pressurized-water reactors, which produce steam in the secondary loop. And it operated for two years from '56 to '58. Maximum power was 20 megawatts, 2.5 megawatts electric and 300-psi pressure primary coolant.

It also tested U-233, U-235, and thorium oxide ceramic plates, which is different. And some of the experiments direct -- intentionally caused fuel failure to see what would happen. They wanted to see how a boiling-water reactor would respond to fuel fail -- failure.

And the reason it was placed in the high category because its fuel consisted of a mixture of uranium and thorium oxides, which is outside the range of fuels found in OTIB-54 and because it operated for only very short campaigns, resulting in very low fuel burnup. And as you know, the mixture you have of radionuclides in a -- fission products and so forth depend on the fuel burnup. So, that's why we -- we decided -- NIOSH decided to pick those two reactors.

Okay. Megan gave a sterling explanation of how OTIB works. It's -- I've said it before in other presentations. It's the most complex code that I've seen used on this project. I mean, it goes into everything. So, it's very complex. We're -- we're reasonably familiar with how it works because we had years ago gone over it in great detail and, you know, how it works and so forth and agreed with its modeling process.

And as she mentioned, source terms were generated with TRITON and ORIGEN modules and the SCALE code system. SCALE is a -- this was all

done for the NRC, a lot of this research and development. SCALE is this -- is the computer program. It's a whole code system that the NRC uses for safety analysis for nuclear power plants.

All right. And this is a little bit repetitious, too, that the this modeling that they did for Report-99 used the ORIGEN to generate radioisotope inventories for the two reactors. And it compared the doses calculated with two approaches. The first one was using OTIB-54 with its built-in source terms and other data, where its archetypical fast flux test facility, advanced test reactor, and trigger reactors, and the -- compared that to source terms that were generated specifically for EBR-II and BORAX-IV based on available operational and physical information.

And Megan had a nice slide earlier that showed some of the reactor cross-sections and how it was modeled. And to the extent possible, the last bullet, the operational and exposure scenarios were the same for the two approaches, as were the assumed growth beta and gross gamma measurements. So -- so -- so, it seemed to us a pretty fair test. Look at the OTIB-54 model versus the very specific one for the EBR-II and BORAX and compare them.

All right. So, what -- so, the Report-99 compares the doses calculated using the generic OTIB-54 library to those calculated using reactor-specific data. And Megan explained -- I think it was her last slide or one of her last slides, and showed -- it was a nice one and looks (indiscernible) -- it looked at the -- the different chronic -- chronic exposures to the different organs. Ratios greater than one imply that the generic OTIB-54 evaluation is more claimant favorable.

Ratios less than one imply that the generic approach is less favorable. And the result, all dose ratios are greater than one for the two reactors, which indicates that the generic OTIB-54 approach is more claimant favorable than the reactor-specific approach. The slide that Megan showed were the ones that were closest to the ratio of one, all above one, but close. But if you look at the whole set, the degree of, I guess, conservatism, whatever, is up to about a factor of nine, which is a large number.

And in summary, we reviewed OTIB-54 extensively and all findings have been resolved. We understand how it works. It's based on pretty much standard industry methods of doing reactor core analysis in general. OTIB-54 uses claimant favorable assumptions.

There's a lot of assumptions built into it, and all the ones that we looked at are always on the claimant favorable sides. If in doubt, they made it kind of claimant favorable. However, as we noted, experimental reactors, EBR-II and BORAX-V, have physical and operational characteristics that place them outside the space in which OTIB-54 was intended to operate.

Just to repeat, EBR-II is liquid-metal cooled and used highly-enriched uranium metal fuel. BORAX-IV fuel consisted of uranium and plutonium oxides, and the reactors operate for only short campaigns with low fuel burnup. So, we reviewed the report and relevant data.

And what's our conclusions? We can -- we can -- conclusions concur with NIOSH's assertion, at least for these two reactors. The standard OTIB-54 approach can be used to determine claimant-favorable internal doses when only gross gamma or gross beta data are available. However, it appears that under certain circumstances, the standard OTIB-54 approach

may overestimate the reactor-specific organ doses up to a factor of nine, and we gave some details in our actual report.

The -- and, I think, Paul had met -- brought this up earlier. We recommend that NIOSH -- NIOSH follow up its analysis with a discussion of why and under what conditions significant overestimation might happen, and whether this can result in unrealistically high dose assignments. Now, because we looked at this lots of times, not just for this report, but throughout the history of the project, it's easy to produce overestimates, but it's harder to have overestimates that are actually based on physical characteristics and reasonable.

I mean, you can always make the dose bigger, but it has to be -- it has to be realistic. So, we were concerned about that, and we recommend that NIOSH, in its next report, whatever, characterize this a little bit, you know, discuss it.

And future react -- reactor analysis, EBR-II and BORAX-IV were part of a group of six reactors that operated during the SEC evaluation period that we all classified as high priority needing further evaluation. And we note that NIOSH stated -- Megan stated that they're going to look at other priority -- high-priority reactors if they ever get a chance to and report on them separately.

Just to refresh people's memories, the six reactors that were picked, in addition to EBR-II and BORAX-IV, there's the OMRE, O-M-R-E, organic moderated reactor experiment, which has unique moderator and coolant. PBF, power burst facility, which has ceramic fuel, SPERT, which is a special power excursion reactor test. Just what it says, as you'd expect, there were

power excursions. What happens if the power goes up tremendously quickly? And EBR-I in core-IV, which was also picked. So, there's like four other high-priority reactors to take a look at.

And that's it. Questions, if anyone has...

CHAIR ZIEMER: Thank you very much, Steve. And particularly for pointing out that -- the other end of that issue, not just what happens when it goes a little below one on the ratio, but a ratio up in the range of seven to nine, you're almost looking like an order of magnitude high on the bounding, which has its own implications as well. So, but you've made a specific recommendation to the board in your -- in your conclusion as well, with a follow-up analysis for NIOSH.

But let's see if we have questions first. Josie or Henry, any questions?

MEMBER ANDERSON: Yeah. I just -- I mean, this is kind of a general question on the facility. There's -- there's different workforces. And given the large number of reactors here, were the workers mostly work -- individually working on a single reactor, or were there general folks that would be doing maintenance throughout all the operational reactors?

DR. OSTROW: Henry, my impression is the answer is yes. You -- both. You had crews that would work, let's say, on EBR-II. And that was their job; they worked on EBR-II. You know, they had a lot of operators. EB -- they had a lot of glove boxes and things and people were there. They had other -- and for the other facilities too, they had people who were dedicated to them, but they also had, like, a maintenance workforce that could be working anywhere in the different places. So, you actually had both situations.

MEMBER ANDERSON: I mean, that makes it much better to have that single approach of -- talked about here rather than having to rely using the specific reactor data or individually, or if a person had two different reactors, combining all of that. So, and kind of --

MEMBER BEACH: (Indiscernible) --

MEMBER ANDERSON: -- my last -- my other question was the -- the catch phrase of "in most cases" it's going to be adequately bounding. And that to me basically -- are we able to identify what would be the cases where it might not be a problem and we'd have to do a different kind of analysis?

DR. OSTROW: I think it's open (indiscernible) question. We don't see (indiscernible) because we (indiscernible) we didn't --

CHAIR ZIEMER: Steve, you're kind of breaking up, Steve. Can --

DR. OSTROW: I'm sorry.

CHAIR ZIEMER: Try it again.

DR. OSTROW: Yeah, okay. I'm just saying that I -- I put in most cases because we didn't examine all cases, so there might be cases theoretically, that wouldn't be adequately bounding. That's part of the reason we're doing this analysis, you know, looking at a different high-priority reactors.

MS. LOBAUGH: Yeah, I would say that's basically how we came to the prioritization of reactors is because there are so many reactors there, you know, which ones can we prioritize to look at and make sure that, you know, we know what's going on there.

MEMBER BEACH: Well, and can I ask a question, Paul? Mine --

CHAIR ZIEMER: Sure.

MEMBER BEACH: Mine was kind of on the same lines of -- as Henry's, except for I was curious to how you were bounding the doses to the individual workers, because I'm sure they moved from reactor to reactor, and if you've only just started on this analysis, how are you matching those doses with those individuals?

MS. LOBAUGH: So, currently how we reconstruct dose for INL is basically anyone who's on site who has bioassay data, we're using OTIB-54. So right now, that's the approach. And what we have in the TBD is we -- we give some guidance as to which decay schemes are appropriate for which facilities.

For example, the operating reactors will get a one-year decay scheme. When they shut down for more than one year, it would go to one year -- or sorry. The operating reactors get a ten-day decay scheme. When they are shut down for more than one year, they go to the one-year decay scheme.

And then, like, other facilities on site, have different assumptions based on what kind of work they were doing within the OTIB-54 guidance. So, OTIB-54 gives guidance on which decay scheme's appropriate. So, right now what we're doing is we are assigning those to OTIB-54 doses to any INL worker with bioassay data. Okay?

CHAIR ZIEMER: Megan, do you know or does, you know, any of the staff members at NIOSH know, on the dose records from INL, can we identify specifically when a person worked and for how long at a particular reactor site?

MS. LOBAUGH: So, I'll answer generally, and then maybe Brian Gleckler can speak more specifically if I -- or correct me. But if you'll

remember, the SEC for the internal dose for CPP, we learned that we can actually track people to facilities based on their external dosimetry.

So, for that time period, and I'm not going to remember the years right now, but for -- for the time period where -- I think it's prior to 1970 and after 1974, we know the facilities the individual worked in because they were assigned facility-specific dosimeters. So, --

CHAIR ZIEMER: Okay. Thank you.

MS. LOBAUGH: -- but that doesn't mean reactor specific, right? So, certain reactors might have had their own facility codes, but I don't know that all reactors have their own facility codes.

But maybe Brian, could you confirm or correct me on that?

MR. GLECKLER: Can you hear me?

MS. LOBAUGH: Yes, (indiscernible) --

CHAIR ZIEMER: Yeah. Go ahead, Brian.

MR. GLECKLER: Okay. It's yes and no. It's, like -- and it's variable for times. And as Megan indicated, we generally -- except for that all-area badging period, and that can tell what major operating area that the worker was at for any given external dose monitoring period. And in order to get into the major operating areas, which were the radiological areas on the site, they had to have an external dosimeter assigned to them.

And sometimes the --- the site had dosimeters assigned to specific facilities within those major operating areas. And so, it's a combination, and it's like -- and sometimes those dosimeters went away. So, it's -- that's why it's a yes and no answer to that question. And we also can tell --

MR. BARTON: This is Bob Barton.

MR. GLECKLER: -- from other records --

MR. BARTON: -- confirm that.

(Whereupon, Mr. Barton and Mr. Gleckler spoke simultaneously.)

MR. BARTON: -- is the CPP issues. It was -- it was an issue on how we could actually place workers going into that specific facility. And there was a period of time where the site switched over to, basically, an all-site external dosimetry badge, so we really couldn't say what facility they were going into. And then they switched back a couple of years later in the 1970s to where, I mean, we saw workers that might have six different dosimetry badges for six different locations on the site.

Now, how that applies to exposures to an individual reactor, that might be more difficult to do. But as for the major facilities, for the majority of time at INL, workers would basically leave their badge at the facility, go to another facility, pick up another badge. And so, we were able to track them, at least in a general sense.

MR. GLECKLER: Okay. (Indiscernible) --

MR. BARTON: I don't know if that's helpful or not or more -- more muddying the waters.

MR. GLECKLER: I'd like to add a clarification for the all-area badging period. During that period, they were actually assigned operating area-specific dosimeter for their primary work location. But if they went to another operating area on the INL site, they took that same dosimeter rather than changing it for an area-specific dosimeter. And so, we know where their primary work location was. We just can't tell if they visited any other areas on the INL site during that time period.

So for example, if a worker was at the -- the CPP facility during the all-area badging period, we know that that's where they were primarily assigned, because that's what their external dosimetry records will indicate. But if they went over to the test area north for a visit and that -- they won't have any test area north dosimeters. They would have worn their CPP dosimeter at test area north.

CHAIR ZIEMER: And if they did such a visit, you wouldn't know when or how long it was. So, if -- if we can -- if -- if one were able to get a good bounding method, that would take care of that. But I think an individual dose reconstructor would have to have some guidance as to how to handle those kind of situations where they only have the one badge for everything. But that's beyond what we're considering right now, today. But some interesting questions arise as you think about applying this in a practical way.

I want to ask the work group in terms of the specific recommendation that SC&A made, which recommended that NIOSH follow up its analysis with a discussion of why and under what conditions this might happen, that is the -- the -- this might happen is the issue of ratios that are extremely high or under one, I guess, and whether potential -- oh, it is the high -- and whether that potential overestimation can result in unrealistically high dose assignments. That's the recommendation from our --

MEMBER BEACH: Is that for --

CHAIR ZIEMER: -- (indiscernible).

MEMBER BEACH: Is -- is -- sorry. Steve, is that for this -- these two reactors or going forward?

CHAIR ZIEMER: Well, it -- it's for --

DR. OSTROW: It's designed going forward.

CHAIR ZIEMER: It's for the OTIB-54 approach --

MEMBER BEACH: Okay.

CHAIR ZIEMER: -- right now --

MEMBER BEACH: Understand.

CHAIR ZIEMER: Right now we only have information on these two reactors. But it's -- it's --

MEMBER BEACH: Right.

CHAIR ZIEMER: -- it's more -- it appears to me -- and maybe Steve could -- could qualify that -- it appears to me that it's a general recommendation. Obviously, if you had some -- there's ongoing analysis of some of the other reactors, as I understand it, and that we would have to look at those as well as -- as the information became available, I would -- I would believe that would be the case. Is that correct?

DR. OSTROW: Yes, exactly. We saw this in the -- for these two reactors. We don't know if that would be the case, such a large overestimate in other reactors, but this is something NIOSH should take a look at. What's the consequence of this? We don't want to overestimate doses, you know, by factors of ten. It's unrealistic.

CHAIR ZIEMER: So, let me ask if -- Megan, do you have any comments on that in terms of going forward?

MS. LOBAUGH: Yeah. So well, one thing I wanted to say just technically about what's going on. So, and not having looked at this specifically, but if you look at what SC&A pointed out, it's the chemically

processed samples, which means that we have to make assumptions about what chemical processing was done on the urine sample, which means there's more assumptions going into that calculation, which is why I think that number -- those ones specifically are coming up higher. So, that's something I just kind of wanted to throw out there, in general why technically I think these ratios are higher.

And then I think Brant wanted to say something.

DR. ULSH: Yeah. When you're -- when you're talking about sufficient accuracy, the ratios being as high as nine is only part of the story. If it's a ratio of nine times a very small, tiny dose, that doesn't necessarily mean that you have insufficient accuracy. You have to consider the total dose as well. So, I just wanted to make sure --

CHAIR ZIEMER: Yeah, --

DR. ULSH: -- that you all have that in your head as we go forward.

CHAIR ZIEMER: Right.

MEMBER ANDERSON: Do we have any information on the proportion of the samples that were chemically processed?

MS. LOBAUGH: So, at INL, we have some strontium samples that would be considered chemically separated, but it's during only the earlier time period. Later on, we would be using the Cesium-137 whole-body count.

MEMBER ANDERSON: Okay.

MS. LOBAUGH: So, it depends on the time period at INL, what we would -- what would be available to us. But I don't think it's all samples are chemically processed, only some of them are. So, yeah, that's -- I do not

have numbers though.

CHAIR ZIEMER: Well, we already know this is going to be an ongoing process --

MEMBER ANDERSON: Yeah.

CHAIR ZIEMER: -- looking at additional reactors and also -- I'll -- I'll kind of pose this to Megan again. Megan, the -- the issue that was raised here in the recommendation, that's something that could sort of automatically be included in what you do going forward; would that not be true? It's not like it's a --

MS. LOBAUGH: Yeah.

CHAIR ZIEMER: Yeah, it's not --

MS. LOBAUGH: Yeah.

CHAIR ZIEMER: You're aware of the concern, and it's something that needs to be addressed in any event.

Board members, any -- or work group members, any objection to officially endorsing that recommendation as part of what we do going forward? Henry --

(Whereupon, Chair Ziemer and Member Anderson speak simultaneously.)

MEMBER ANDERSON: -- as long as it's feasible, I would say yes, I would do it.

MEMBER BEACH: I agree.

CHAIR ZIEMER: Yeah.

MEMBER BEACH: I agree, I agree with that.

WORK GROUP DISCUSSION AND PATH FORWARD

CHAIR ZIEMER: Yeah. Okay. So, this is going to be an ongoing thing. I -- I don't know that we need any additional actions today, but what I do want to determine going forward -- and maybe Rashaun, you can help us with this -- the upcoming Board meeting -- by upcoming, I'm talking about tomorrow, I believe --

MEMBER ANDERSON: Yeah.

CHAIR ZIEMER: -- the only thing we would do tomorrow, I assume, is just report that we met and that -- and perhaps what we recommended. Is there anything --

DR. ROBERTS: Yes.

CHAIR ZIEMER: -- further that needs to be done for tomorrow's board meeting?

DR. ROBERTS: No, that would be it.

CHAIR ZIEMER: And then looking forward, this work group is going to want to meet again. But it looks to me like there's going to have to be a little time for some additional things to be done. Also, it appears to me that there's some leftover things.

I -- I noticed in reading through the -- the last transcript, there were some issues on the waste disposal site and the group of -- I forget the number -- of interviews were discussed at length, interviews with personnel who worked on the waste site --

MEMBER BEACH: Right.

CHAIR ZIEMER: -- that had been redacted. The information had been

redacted, of course, from the public-issued parts of that whole thing. I -- I understood that the work group members were provided with unredacted copies; however, the new chair does not -- does not have any of these. So, I want to make sure I am able to get those. You know what I'm talking about? The interviews --

MEMBER BEACH: Yes.

CHAIR ZIEMER: -- with the workers --

MEMBER BEACH: Yes.

CHAIR ZIEMER: -- at the -- yeah.

MEMBER BEACH: Yeah.

CHAIR ZIEMER: While (indiscernible) --

MS. LOBAUGH: There was also --

CHAIR ZIEMER: Did you get those already -- now, Josie and Henry, you've gotten those?

MEMBER BEACH: Yeah. Paul, yeah. There was also a group that went to NIOSH and pulled a bunch of data, and we were expecting some kind of a report on that, and it was based on some of the burial -- that was the focus was the burial ground. And it was --

CHAIR ZIEMER: Yeah. Right, right.

MEMBER BEACH: -- within the last couple of years. And so, yeah, we're -- we should at least get some kind of an update on what's coming and what's been prepared.

CHAIR ZIEMER: Yeah.

MEMBER BEACH: Because they should --

CHAIR ZIEMER: So, that's the 2020 -- in the 2020 transcript --

MEMBER BEACH: Right.

CHAIR ZIEMER: -- there was extensive discussion on that. And --

MEMBER BEACH: Right.

CHAIR ZIEMER: -- I just when -- when it's appropriate, we need to get an update on where we stand on a -- particularly the board or the work group, sort of, reaction or analysis of those, was it 38 -- no. How many workers? I forget the number. It doesn't matter right now. But --

MEMBER BEACH: I don't remember either.

CHAIR ZIEMER: -- because there was some difference in understanding of what the implication of those statements were between what NIOSH thought the group was saying and what SC&A thought they were saying in terms of whether or not there was a strict over -- health physics oversight in the -- the disposal area, or whether it only looked that way because health physics was both the operator and the regulator of the site.

MEMBER BEACH: Right.

CHAIR ZIEMER: You remember? Yeah, yeah.

MEMBER BEACH: Oh, yeah. I reread it yesterday, the transcript.

CHAIR ZIEMER: Yeah.

MEMBER BEACH: I wonder if we could get an update, maybe, from SC&A where their work stands, and then maybe get one from NIOSH also today, just a real brief --

CHAIR ZIEMER: I -- I -- I don't --

MEMBER BEACH: -- overview.

CHAIR ZIEMER: I don't I don't know that we necessarily have to

establish meeting times for the work yet, but I --

MEMBER BEACH: No, I meant just --

CHAIR ZIEMER: -- I do realize that there are some outstanding things that we have to deal with as well, not just this, the reactor analyses.

MEMBER BEACH: Yeah. Is that --

MR. BARTON: This is -- this is Bob --

MEMBER BEACH: Great.

MR. BARTON: Yeah. I can maybe give a little bit of back story on that. We're looking really at the 1950s and 1960s at the burial grounds.

CHAIR ZIEMER: Yeah, (indiscernible) --

MR. BARTON: There are some indications from AEC that, based on audits, that the disposal area during that time was a lower priority to health physics oversight. So, that's really the concern. Acknowledge -- fully acknowledging that INL was one of the more stringent facilities for radiation safety, even during those early years. And the majority of waste going to the burial grounds from INL and ANL West would have been mixed oxidation products, things of that nature. But they also accepted offsite waste, notably from Rocky Flats Plant, which --

CHAIR ZIEMER: Rocky Flats waste was --

MR. BARTON: -- that was --

CHAIR ZIEMER: -- going in there after the -- after some period of time and --

MR. BARTON: Right. And it, basically, --

CHAIR ZIEMER: It was in the --

MR. BARTON: -- early 1970s --

CHAIR ZIEMER: -- period. Yeah. Anyway, there are some other issues that we need to deal with. I just want to make sure that when we're able to -- when we're at a point where we have enough information, we need to schedule a meeting.

Again, Rashaun, you and I can be in touch on that, but probably not wait too long into next year to -- to meet again and look at some of these outstanding issues. They're outstanding --

MEMBER BEACH: Paul, --

CHAIR ZIEMER: -- in their field, as they say.

MEMBER ANDERSON: Yeah, --

MEMBER BEACH: Paul, --

MEMBER ANDERSON: -- outstanding really on the SEC as opposed to --

MEMBER BEACH: Yeah, --

MEMBER ANDERSON: -- (indiscernible) --

MEMBER BEACH: -- report -- sore -- sorry, Andy.

CHAIR ZIEMER: Josie, --

MEMBER ANDERSON: Yeah. That's it.

MEMBER BEACH: So, Paul there was a -- there was a report that went out from S&CA, and it was 104 pages on the burial grounds, and we heard that presentation. And I'm curious where NIOSH stands on answering that.

MEMBER ZIEMER: Yeah. Yeah.

MEMBER BEACH: And -- and when will they be prepared, maybe, to move forward on that issue? Because we do have that and CCP issues, like you said.

CHAIR ZIEMER: Yeah. And --

MEMBER BEACH: But I hate to leave it just hanging.

CHAIR ZIEMER: Well, it --

MEMBER BEACH: It'd be nice to have an idea.

CHAIR ZIEMER: Yeah. And I think what Megan said, there's some, perhaps, short -- staff shortages right now and focus that may impact on this as well. (Indiscernible) --

MS. LOBAUGH: I can tell you what -- I can tell you what we've been working on. I don't know of any open CPP issues. So, if -- Josie, if you could fill me in on those, that would be helpful. But the burial grounds is one of the open items from the SEC that we're working on, the 1952 to 1970 time frame, like Bob was mentioning. The last was an SC&A report. We, in response to that report and the discussion about interviews, did data captures, which is what I think Josie was mentioning when she said people came to NIOSH, but I think she meant INL. So, we did a --

MEMBER BEACH: Oh, I'm sorry, --

MS. LOBAUGH: -- (indiscernible) --

MEMBER BEACH: -- yes, --

MS. LOBAUGH: -- INL -- that's okay. We did a trip --

CHAIR ZIEMER: Right.

MS. LOBAUGH: -- to INL for data captures over several years. INL had a huge backlog of documents. They only released them to us last year. So, we are still in the process of reviewing those documents and determining what's applicable and what we can use moving forward and where we're at with that. So, basically -- but again, that is paused.

Right now, our priority is getting the TBD updated based on the SEC information. So, we updated to, actually, implement the SEC, but we have not updated with the information we gathered from the SEC, if that makes sense. And to implement our co-exposure models. So, right now that has been our priority.

So, the burial grounds, we have started and have a path forward on, but do not have anything to present. What is very close to being presented or what I have already presented to the advisory board that hasn't been mentioned is Report 89. Paul mentioned it earlier.

Dr. Ziemer mentioned at the very beginning. But Report 89 is our response to the question about using general area air samples.

CHAIR ZIEMER: Yeah.

MS. LOBAUGH: And -- and, basically, it's related to Report 97, which is our programmatic document giving us a methodology on how we can adjust general area air samples to be -- be used for breathing zone calculations, basically. So, I would suggest that that's actually the topic that is available for the next work group meeting if -- you know, I would put that suggestion out there, basically. But what I --

CHAIR ZIEMER: Yeah.

MS. LOBAUGH: -- don't remember or know if SC&A has actually been tasked with reviewing it yet or not. So, we might still just be in a holding pattern, because we have not received a review from SC&A on Report 89.

CHAIR ZIEMER: Well, in that regard, I -- I also want to ask, the issue of area versus breathing zone samples is the -- not just an INL issue. Was

there a generic --

MS. LOBAUGH: Yeah, so, Report 97 that -- yeah, Report 97 was issued, and it was reviewed by the subcommittee for procedures review.

CHAIR ZIEMER: Yeah. Right. That's the one.

MS. LOBAUGH: Yeah.

CHAIR ZIEMER: Right.

MR. BARTON: Yeah. This is Bob. We, actually -- it's kind of a strange order of events. We were slated to -- to bring that to the work group back in -- around July of 2024, but that got postponed. However, during the full board in August of 2024, both NIOSH and SC&A, basically, presented where we were on that issue and the -- my -- my notes say that the -- the board ultimately, you know, appreciated the update, but wanted to wait until the work group could weigh in on it and make a formal recommendation. But as I recall, there wasn't a whole lot of disagreement, maybe just on how it might be implemented in practice that should be discussed.

I think that's where it's been left off. I don't see any -- necessarily any work to do between now and the next work group meeting on that issue. Like I said, we were slated to discuss it in July of 2024, but for various reasons, that meeting was postponed until now. So, I agree with Megan that I think that could be an item that's taken up by the work group going forward as being productive.

CHAIR ZIEMER: Well, let me ask this question. I think -- is Kathy Behling still on the line?

MS. BEHLING: Yes, I'm --

MEMBER BEACH: I see --

MS. BEHLING: -- on the line.

CHAIR ZIEMER: Yeah, Kathy, I know that last year, in fact, in December, just a year ago, there was one update on Argonne East -- Argonne East -- Argonne West on evaluation of incomplete internal dosimetry records. And I think there's a SPR-approved document focus PER-17 on that, but is there anything on the breathing zone issues that is sort of pending, or where do we stand? Or maybe Josie, you might have an answer to that in terms of the procedures review committee.

MEMBER BEACH: I don't. I haven't reviewed that for a while. We do have a meeting scheduled though.

CHAIR ZIEMER: Yeah, yeah.

MS. BEHLING: And this is Kathy Behling. As was mentioned, we did review Report 97, I believe, is the -- is what -- and Bob did, I think, present that to the full board. But we have not reviewed -- or this subcommittee hasn't reviewed -- or work group, I'm sorry -- Report 89, I believe, that you're talking about. But Report 97 has been reviewed by the procedures subcommittee.

CHAIR ZIEMER: Okay. Thank you. Well, I'm going to suggest, in terms of scheduling the next meeting, if -- Megan, if you can kind of keep me updated on where things stand as far as progress, maybe you can help me and help Rashaun find a suitable time for our next meeting in terms of what we have available to look at and at least get an update on, would that be satisfactory?

MS. LOBAUGH: Yep, I can do that.

MEMBER BEACH: Can -- can we task SC&A with reviewing 89 in

preparation for that?

CHAIR ZIEMER: Where do we stand on 89? Has that tasking not been done? Is that --

MEMBER BEACH: No, I don't think so.

MR. BARTON: It may have been covered under 97. I -- I need to look into that. But I mean, basically, 97 was not site specific necessarily. It was a -- basically, a review of studies concerning general air to breathing zone samples --

CHAIR ZIEMER: Yeah, that's --

MR. BARTON: -- and produced a range of ratios --

CHAIR ZIEMER: I think that --

MR. BARTON: -- that could be used.

CHAIR ZIEMER: -- probably is a board tasking issue, isn't that? It wasn't specific to INL, right?

(Whereupon, Ms. Lobaugh and Mr. Barton speak simultaneously.)

MR. BARTON: Go ahead, please.

MS. LOBAUGH: I was gonna say, Report 97 is the general one and then Report 89 is the INL specific. So, Report 97 lays out the methodology for using the ratios that we developed and discussed in Report 97. And it lays out how we would implement it at a site or determine if it's appropriate at a site. And so, we took the process that was laid out in Report 97 to determine whether it was appropriate for INL --

CHAIR ZIEMER: Yeah.

MS. LOBAUGH: -- and where we would use it at INL. So, Report 89 is the INL-specific implementation of Report 97.

CHAIR ZIEMER: Okay. And we need tasking on that one then?

MEMBER BEACH: I -- I believe we do need to task that.

CHAIR ZIEMER: Okay. Yeah.

MS. BEHLING: And this is Kathy Behling again. It's a -- if I could just --

CHAIR ZIEMER: Yeah, go ahead.

MS. BEHLING: -- yeah -- interject. I'm looking at my spreadsheet here. I did see that when we reviewed Report 97, we did just a focused review of 89, I think, a -- yeah. A focused review of Report 89 in light of the work at the ANL West. But we haven't done a complete review. We have done a focused review based on my notes, if that helps.

CHAIR ZIEMER: Well, -- well, that's helpful. I mulling over in my mind, we -- what do we gain if we do a full review? Is there something else that -- I mean, you're just looking at how well they matched up, are you not?

MS. BEHLING: Yes, --

MEMBER BEACH: That's -- if that's what they're using at INL, we should look at that for INL specifically, right?

CHAIR ZIEMER: Well, you said you did a focused review of that for --

MEMBER BEACH: The subcommittee did. I guess, Bob, --

CHAIR ZIEMER: Yeah, for --

MEMBER BEACH: -- can you look at that and see if it's sufficient?

MR. BARTON: Yeah, I think we're gonna need to regroup on that specific report. I assume that it probably covers the waterfront, but I don't want to put my foot in my mouth right now. So, if I -- we can take a look at

that and then report back, you know, via email or whatever, that would be beneficial, and that might be something for the -- the next agenda.

CHAIR ZIEMER: Well, I don't think we necessarily want to wait. If -- if it needs to be done, we should go ahead and get it done. I -- I don't see any reason we shouldn't ask SC&A to go ahead on that for the site --

MEMBER BEACH: Sure. I -- I agree with that.

CHAIR ZIEMER: Yeah, and then --

MEMBER BEACH: That's all we have ready.

MEMBER ANDERSON: Yeah, that's a good first --

MEMBER BEACH: It's --

MR. BARTON: -- seems reasonable to me.

CHAIR ZIEMER: Okay. Rashaun, are we okay to go ahead on that --

DR. ROBERTS: Yes.

CHAIR ZIEMER: -- with the tasking? Yeah.

DR. ROBERTS: Yes, that's --

CHAIR ZIEMER: Okay.

DR. ROBERTS: -- fine.

CHAIR ZIEMER: It is done. Consider yourselves tasked from the taskmasters.

Okay. Any more follow up that's needed today? Board members?

MEMBER ANDERSON: I'm fine.

CHAIR ZIEMER: -- was that it?

MEMBER ANDERSON: Very, very good to get up to speed.

CHAIR ZIEMER: Well, I hope you're more up to speed than I am, but I'm --

MEMBER ANDERSON: Yeah.

CHAIR ZIEMER: -- just trying to accelerate.

MEMBER ANDERSON: Yeah.

CHAIR ANDERSON: If not Rashaun, is there any other business to come before us that you're aware of today?

DR. ROBERTS: No, not that I'm aware of.

CHAIR ZIEMER: Okay. And, I guess, we'll see all of you and others tomorrow at the full board meeting.

MEMBER ANDERSON: (Indiscernible.)

CHAIR ZIEMER: Thank you all for your participation. Thanks to our presenters today. You did a great job, and we're just appreciated -- appreciative of not only your presentation, but the work that went behind it and those on -- on your staffs that -- that contributed to that. So, with that, I will --

MEMBER BEACH: Paul, --

CHAIR ZIEMER: -- consider our business complete unless there's another -- oh, hey, was that --

MEMBER BEACH: Paul, --

CHAIR ZIEMER: -- you Josie? Go ahead.

MEMBER BEACH: Yeah, that's me. I --

CHAIR ZIEMER: Go ahead.

MEMBER BEACH: I just wanted to thank you for stepping up and chairing. You saved Andy.

MEMBER ANDERSON: Yes, thank you much.

CHAIR ZIEMER: Well -- well, I am --

MEMBER ANDERSON: I am --

CHAIR ZIEMER: -- (indiscernible). Part of the our shortages that some of the people, which includes our other two work group members here, have an overload of chairing different things, so we're all sharing that questionable honor of being the work group chair. So, anyway, thanks to everyone, and see you all soon. We'll -- we are adjourned.

(Whereupon, the meeting was adjourned at 12:44 p.m. EST.)