U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
CENTERS FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL
SAFETY AND HEALTH

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ADVISORY BOARD ON RADIATION AND
WORKER HEALTH

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WORK GROUP ON TBD-6000

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THURSDAY
DECEMBER 19, 2013

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The Work Group convened telephonically, at 10:00 a.m., Eastern Standard Time, Paul L. Ziemer, Chairman, presiding.

PRESENT:

PAUL L. ZIEMER, Chairman
JOSIE BEACH, Member
WANDA I. MUNN, Member
JOHN W. POSTON, SR., Member

ALSO PRESENT:

TED KATZ, Designated Federal Official
NANCY ADAMS, NIOSH contractor
DAVE ALLEN, DCAS
BOB ANIGSTEIN, SC&A
BOB BARTON, SC&A
SAM GLOVER, DCAS
DEKEELY HARTSFIELD, HHS
JOHN MAURO, SC&A
DAN McKEEL
JIM NETON, DCAS
JOHN RAMSPOTT
JOHN STIVER, SC&A

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

C-O-N-T-E-N-T-S (CONTINUED)

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

10:01 a.m.

MR. KATZ: Welcome, everybody, to the Advisory Board on Radiation and Worker Health, TBD-6000 Work Group. We're going to be discussing GSI today.

Let's start with roll call. Since we are speaking about a specific site, please also, for all agency-related personnel, speak to conflict of interest.

(Roll call.)

Let's, then, go to this last note I'll make. We have a number of documents, I think three documents posted. More will get posted at some point today. We have a longer delay in getting things posted these days due to the processes we have to do on that.

And, Paul, it's your agenda.

CHAIRMAN ZIEMER: Okay. Thank you very much. And good morning, everyone.

I believe everybody has a copy of the agenda. We will go through it just as it is listed.

I do want to mention that if we have not completed the agenda by 1:00 p.m., we will take a break at that point. It is a little hard for me to predict exactly how long this will take. But if we aren't completed by 1:00, we will take approximately an hour break at one o'clock, a lunch break for some, maybe a mid-morning break for the West Coast people.

But, in any event, let's proceed with the agenda. As you know, the complete agenda today is on General Steel Industries, and we are going to begin with the skin dose calculation issue.

You may recall that there was a White Paper in October that Dave Allen produced dealing with evaluation of the ~~data~~ beta doses and the differences in the estimates between NIOSH and SC&A. And then,

more recently, SC&A and NIOSH have been looking at their use of MCNP code and determining their inputs. We have a paper now dated December 5th by Bob Anigstein that appears to, I think, indicate that they have resolved the issues.

Bob, I don't know that we necessarily need to step through all the details on your paper, but I do note in the conclusions -- I'm hearing some kind of whistling. Are others hearing that?

MR. KATZ: Yeah. It seems to have gone away, though.

CHAIRMAN ZIEMER: Okay. In any event, the bottom line from SC&A was that the outstanding differences in the calculation of the beta doses to the betatron operators have been resolved, or he says, "appear to have been resolved". And there's complete agreement on the methodology of calculating the doses.

And then Bob shows Table 4 and

Table 5, and I think Table 5 is his bottom-line table for those.

So, Bob, do you have any additional comments? And then I'm going to ask Dave Allen to comment.

DR. ANIGSTEIN: I was going to present a summary of the report.

CHAIRMAN ZIEMER: Well, that's fine. That's fine. I know everybody has read it. I don't want to take too much time on it because there's a lot of detail in there. But go ahead with your summary, Bob. That's fine.

DR. ANIGSTEIN: Okay. Right. Well, I was going to present something on Live Meeting. I don't know if everybody's -- I mean, I have a little briefing that I prepared for Live Meeting.

CHAIRMAN ZIEMER: That's fine. Go ahead.

DR. ANIGSTEIN: Okay. Let me just open it up right here.

CHAIRMAN ZIEMER: While you're pulling that up, Bob, I assume that everything you say -- Live Meeting is not available to members of the public for Work Group meetings, I don't believe. Am I correct, Ted?

MR. KATZ: You are correct, it is not available.

CHAIRMAN ZIEMER: Yes. But everything you're presenting is in your report?

DR. ANIGSTEIN: I'm sorry?

CHAIRMAN ZIEMER: Everything you're going to present is also in your report, I assume.

DR. ANIGSTEIN: That is correct. That is correct. These are just some tables, summary tables. I simplified some of them to make them easier. And let me just show -- oh, dear.

MR. KATZ: So, it is sideways, but otherwise --

DR. ANIGSTEIN: I just realized that. I don't know how that happened because it's not that way on my screen.

CHAIRMAN ZIEMER: Well, it's sideways on mine.

DR. ANIGSTEIN: Live Meeting has a mind of its own. I was just doing this last night with John Mauro and everything was fine.

Let's see, sharing my desktop. Okay. There we go. Is this better?

(No response.)

Hello?

MR. KATZ: Yes, that's good. That's good, Bob, if you could just shrink it.

DR. ANIGSTEIN: Okay. I think I have to go to 50 percent. There we go. Okay.

MR. KATZ: Bob, if you just move the slide device at the bottom -- oh, maybe everybody can do that themselves. They can,

actually.

DR. ANIGSTEIN: I don't have that.

MR. KATZ: Yes. Okay. So, everybody --

CHAIRMAN ZIEMER: You can do that yourself, Ted.

MR. KATZ: That's right. Thanks. Sorry.

MEMBER POSTON: Ted, I'm on. This is John Poston. Sorry.

MR. KATZ: Thanks, John. Thanks for registering. And just for the record, you have no conflict of interest at GSI.

MEMBER POSTON: Great. Thank you.

DR. ANIGSTEIN: Okay.

MR. STIVER: This is John Stiver. Could somebody please send me the link to the Live Meeting connection?

MR. KATZ: I'll take care of that, John.

MR. STIVER: Okay. Thanks. Bye.

DR. ANIGSTEIN: Okay. So, this is how we went about -- we redid some of the calculations. Once we became aware that NIOSH was going to be using our model, we took another look at it. Before, it was just a sort of check-on-NIOSH thing. Well, okay, let's see what we get. But then we realized the fact that we had another sort of a higher-level responsibility.

And then, also, there are constant developments in this MCNPX code. So, the public version was released a while back. The final frozen version; there would be no more development. So, we just took another look at it.

And in the last round we found that when -- the skin dose comes from irradiated steel and irradiated uranium. The layout man, that's one of our critical paths, the most highly-exposed individual, limiting for this scenario, I should say,

only comes in contact with the steel. There's no layout on the uranium.

So, our runs showed that there were 37 -- the MCNP nomenclature is residual nuclei or residual nuclides thirty-seven atomic species get created when you irradiate this typical steel alloy that we found that was made at GSI. We actually had a former metallurgist send us the formula for that steel. So, we included many small -- mostly it’s iron, but there are many smaller constituents.

And so we found, of these, there were 37 nuclides. Of those, 27 are capable of giving skin dose that had significant fraction of their decay through beta decay. And we ranked them in the order of the time-integrated activity, the activity integrated over the exposure duration of this layout man, and we were able to narrow it to 6/90 now. Out of the 27, six of them accounted for 99.5 percent of the total. So, we went

with that for our purpose of analysis.

And of these, actually, three were very significant. Three of those six were about 98 percent. So, we had an earlier analysis for the other three, and we kept those because there was no point in redoing them because they were such a tiny contribution.

And here are the nuclides. I believe -- no, they're not in order of importance. The important ones are the iron-53, the molybdenum-91, and the manganese-56.

And so these are the specific activities. The reason they're different for the long and the short shots it the long shots were taken at a distance of 6 feet and the short shots were a distance of 9 feet. So, we have less intense radiation and, also, a shorter period of radiation. So, you get somewhat lower activities.

And this is already adjusted

because you get sort of an exponential profile. But the purpose of doing the radiograph, of course, is to penetrate the steel, to darken the film behind it. And so the front surface gets the most intense radiation and the back gets much less. And MCNP gives you the average, but we're able to back-calculate/-extrapolate what would be the activity on the very surface. So, we get that for the higher activity and that's what the worker gets exposed to.

So, then we do the time integration over a period of time that the operator -- this is for the operator -- is exposed to it. It takes at least, fairly optimistically, five seconds for him to get out after the betatron is shut off. In reality it would be longer, but we said at a minimum of five seconds. And then he spends, with the long shots, he spends about 15 minutes in the proximity of the steel readjusting the betatron. His assistant

adjusts the film, setting up for the next shot. And for the short shots, it's five seconds, again, but maybe only 11 minutes.

So, these are the time-integrated activity, the activity of this over this period of time. So, if you have a long-lived one, like this molybdenum-99, 66 hours, it doesn't really matter. You simply multiply by the time. But something that is decaying during -- you know, iron-53, which was the most important constituent, 8.5 minutes half-life. Well, it's busily decaying during this 15 minutes. So, then you do have to take account of the decay curve.

Then, here are the results where we have taken all six of these and calculated the dose from each one in proportion to its specific activity over this period of time. And we found the following doses per shift, per eight-hour shift.

I'm not going to read the numbers. Again, this is straight out of the report. I believe it's Table 3 in the report, or Table 2. The first one is Table 1.

So, this time, something that wasn't done before, we just sort of figured that, okay, the bare skin, the hands and forearms, will be in contact with the steel. The rest of the skin will be covered with clothing, and we very conservatively say it is just the thickness of a thin T-shirt. We don't know what, obviously. A person's body, there must be clothing on it, but we use the least.

And then earlier we sort of figured, well, this is the dose rate at one foot. And NIOSH assumes that half the time they spend it at a distance of one foot and half the time they spend it at a distance of one meter. I think earlier we ignored the meter and just simply took the one foot, or

the contact, and divided it by two.

But we took another look at it and said, no, it turns out that the dose rate at one meter is still significant. And so we calculated that. That was another reason for the new calculation. And we used the average of the two, where they received the contact for the bare skin at one meter, and for the other parts of the body, one foot and one meter.

The contact through the clothing is there. We didn't really use it in the calculation, just showed the effect of it, how much of the absorption there is with that thin T-shirt.

And then we did something similar for uranium, a uranium slab. And it turns out, as it turned out before, that really the only activation product of importance is U-239, which you take uranium-238 and actually a neutron is knocked out of another atom and it gets captured by the U-238 and

forms U-239.

This is by far the highest specific activity. We looked at uranium-237. It's very small. And there are some others, minor contributors. And we are only, again, looking at beta emitters.

And then this is the final calculation from the uranium slice for the dose rates to the skin. So, here we take into account, we assume that here was a cylindrical ingot. And we know from our studies of the Mallinckrodt site that these were sawed like slicing, just like you were slicing a salami. They saw it and take a slice, and they called it a betatron slice. This was a destructive testing.

CHAIRMAN ZIEMER: Bob, let me just interrupt quickly. For those who don't have access to your slides, we are looking at what is essentially Table 4 from your report.

DR. ANIGSTEIN: Yes. Okay. So,

here we have -- so, this has been remelted, and we assume that the size of it, the size of the cylinder, will be subject to what we call the Putzier effect. So, that all the beta emitters, the short-lived, relatively short-lived with 24 days half-life, have migrated, or there is a concentration to the side. And Mr. Putzier's report said that it is from 10 to 15 percent -- sorry -- a factor of 10 to 15 higher than what you would normally expect from uranium. So, we took the average of 12.5 and we enhanced the beta activity on the side. And then we assumed that the worker spent -- half the time that he is handling uranium, his skin is exposed to the side of it, and the other half of the time to the front.

And the front, because this has been sliced, it would not have the Putzier effect. That's only on the surface of the cast shape. But it would have the enhancement from the irradiation, the

betatron irradiation. So, nevertheless, the side is by far the greater activity, the greater beta activity.

And so we take an average of the two, assuming that he spent half of his time, half the contact is from the front, half the contact is from the side. And then, similarly with the others, the other part of the body is at one foot from the front or the side, other than the skin and the skin of the hands and forearms. And then, finally, we do one meter the same way. And then we take an average of the averages.

So, for the bare skin, it is the average of the one meter and the contact, and for the rest of the skin, it is the average of the one foot and the one meter.

So, finally, these are our annual doses. As before, we used the Mallinckrodt purchase orders to determine how many hours per year. This was initially an area of difference between us and NIOSH where ours

were assigned differently, but my understanding is that NIOSH has agreed now to use these same hours, the most claimant-favorable, the maximum hours.

So, based on these hours, these are the number that the -- we assumed that during each year -- this is a very conservative assumption -- that a single worker will have been assigned to the team, the radiography of the uranium. And it's not implausible because the contract actually said it will be done Monday through Friday during the hours of 7:30 to 3:30, something like that. So, they don't have to pay for the shift differential.

CHAIRMAN ZIEMER: This is Table 5, by the way.

DR. ANIGSTEIN: Pardon?

CHAIRMAN ZIEMER: Table 5 is what we're looking at.

DR. ANIGSTEIN: Yes. Okay. And then -- so the remainder of the shift was

spent on the normal work on steel. So, then, using the previous tables, we simply calculate, multiplying the exposure per shift times the number of shifts. So, we calculate the exposure to the hands and the forearms and the other skin from the uranium and the steel. And it's highest -- since uranium is by far the bigger contributor -- it's highest during the years when you had the most uranium. And then it goes down year by year up until -- oops, there is a glitch on the slide in the way -- all of my sudden, my program decided that the year 1966 was a number, and it shows it as 1,966. That is 1966. The last year is 1966. Sometimes this software gets a mind of its own. So, that's really the end of the discussion of the skin dose.

And then, just to say a few more words -- I've already said something about, as I said, we redid some of the MCNP calculations. Actually, in the process of

reviewing this, I was able, we were, fortunately, able to get Dr. John Hendricks, who is actually one of the developers. He is the senior author of some of the reports issued by Los Alamos on MCNPX. And he recently retired and is available as a consultant. He actually still works for Los Alamos as a contractor, but he is also able to take other outside clients.

So, he is probably the foremost, of the people who are -- I don't want to compare his skills to other people who are still working at Los Alamos on this code. But, of the ones who are available to outsiders, to us, he's probably the foremost authority.

He originally was engaged just to help explain some of the new features that were incorporated in an analysis done a year ago. But I, myself, wasn't quite clear about what it did. I just wanted to be able to understand it.

In the process, he reviewed and he pointed out a problem with some of the analyses. And that was that -- this is getting sort of rather technical -- but, basically, MCNP, like any Monte Carlo code, just as you repeat, you know, it's like rolling the dice. So, it is called Monte Carlo. It's like spinning the roulette wheel. And each time it comes up with a new set of parameters from within the things that the physics predicts, but the physics can't tell you in which direction a photon is going to come from a radioactive atom. It can go in any direction.

But they call it histories. It does this thing over and over again, records the results from each one, and at the end presents you an average, a standard deviation, and other statistics.

Well, it has a limitation, and that is, in the ordinary -- there are some special versions of the code, but publically

released version of the code, which is available to most people, the limitation is a little over two billion, and this has to do with the fact that it is represented as a 32-bit number. And the most you can represent is two to the 31st power minus one. So, it comes out to a little over two billion.

And I consider that as something that the developers never thought of. If you run over two billion, you don't get any valid results because it's a bigger number than it can handle and it does not give you an error message. It doesn't give you any indication. It looks like, at the bottom line, if you look at the results, oh, yes, these look fine. Only when you look back -- and the output file is about a thousand lines, so you don't normally read the whole output file, it can be several thousand lines -- and you look at the end, there is a summary table. And the summary table looks

fine.

And then you go back in and say, wait a second, it went past 2 billion numbers, and then it just started doing things that were no longer valid. So, it turns out that the results weren't drastically different, but they were not accurate. So, we redid several of them.

And in the process of looking at that, I asked him to examine other runs. Being a perfectionist, he said, "Well, this could be improved, that could be improved." So, we took some of his suggestions, and it turned out the differences were not great, except for the ones that were definitely an error. We're talking about 10-percent differences. So, we took the best. We did use the best techniques, but there were no drastic changes.

Right now, there is one more. We have done the skin dose, but the other exposure, the direct exposures to the

betatron of the layout man, there is a minor change. I have not transmitted that to NIOSH yet. We are just going to work up the numbers.

And then there's one last run I want to redo, and that's for the uranium activation. We do these activations twice because there are two different types of results. One is the residual nuclides, which I just talked about, that gives you the beta dose. And the other is the direct radiation, what is called the delayed gammas and delayed neutrons that come out of the metal, because of these different radioisotopes that get created, they come out of the metal immediately after the betatron is shut off. So, the worker, again, approaching the metal a few seconds later will be exposed to these.

There are two different ways of calculating the two. We have very good calculations for the beta emitters. And for

the delayed neutrons from the uranium I want to rerun. And it is a run that will take a short while to set up, but it will take a couple of weeks to run, just to get good statistics on it. So, I will be passing all of that on.

All the beta-emitting data dose, skin dose calculations, have been shared with NIOSH already, and they will surely comment on it. But we had some communication where he agreed with the methodology of taking, once you get the MCNP results, you still have to do a calculation, doing it over time and doing it according to the length of the exposure, during the examination, the number of shifts. And I believe we are in substantial agreement. He was able to reproduce the calculations very, very closely, is my understanding.

The external exposure of the layout man, we still need to come to closure on. And, unfortunately, there was a slip-

up, and I never saw, until a couple of days ago -- Jim Neton wrote an email, very detailed, about the information that was obtained by Stu Hinnefeld from Dr. Craig Yoder, vice president at Landauer, about how the film badges were reported during this period of time by Landauer.

And, therefore, Jim stated in his email that NIOSH would be using the SC&A model for those exposures. And I actually wasn't aware of that. I only saw this email a couple of days ago.

So, that's why we did not include this and pass it on to NIOSH. We didn't realize it. We weren't sure they were in agreement with us. But this will be concluded very shortly.

CHAIRMAN ZIEMER: Okay. Thank you, Bob. Let me ask Dave Allen --

MEMBER POSTON: Bob, this is John Poston.

DR. ANIGSTEIN: Yes.

MEMBER POSTON: I've been trying to follow what you did. Looking at the last table where you have the total beta radiation in units of rad --

DR. ANIGSTEIN: Yes.

MEMBER POSTON: I'm a little confused by the steel results, because what you showed on one of the previous slides was somewhere in the range of 1 to 2 millirads per shift. And if I multiply one, just taking the 1950 --

DR. ANIGSTEIN: Okay. I'm just going to go back to the previous slide.

MEMBER POSTON: If I multiply by 54 shifts, that figure, that only gets me 108 or 54 millirads, not rads.

DR. ANIGSTEIN: Just a second. I just went back to the previous slide. So, we are talking about, just looking at -- we're just looking -- you're looking at uranium?

MEMBER POSTON: No, I'm looking

at steel.

DR. ANIGSTEIN: Oh, steel? Okay.

MEMBER POSTON: I want to go back -- if you're going to go back, go back to --

DR. ANIGSTEIN: The third slide.

MEMBER POSTON: -- the fifth slide.

DR. ANIGSTEIN: Pardon?

MEMBER POSTON: Notice at the bottom, at one meter, you have doses between 1.15, say --

DR. ANIGSTEIN: Yes, but remember, okay, yes, that's at one meter.

MEMBER POSTON: But you don't even let me finish the question.

DR. ANIGSTEIN: Pardon me?

MEMBER POSTON: How can I ask you a question if you're not going to let me finish?

DR. ANIGSTEIN: Say again?

MEMBER POSTON: I said, how can you answer my question --

DR. ANIGSTEIN: I'm sorry. I thought you were --

MEMBER POSTON: No, I'm not through.

DR. ANIGSTEIN: I'm sorry. I'm sorry. I'm sorry, John. Go ahead, please.

MEMBER POSTON: At one meter, either for the short or the long or the composite, the doses per shift, according to your calculation, are two millirads or less.

DR. ANIGSTEIN: Correct.

MEMBER POSTON: Now, if I multiply that by 54 shifts per year, I don't get something in the order of rads. I get something in the order of millirads.

And so, looking at this table and then going to the last table you showed, there is a disconnect for me. I just don't understand it.

DR. ANIGSTEIN: Okay.

MEMBER POSTON: Now I'm through.

DR. ANIGSTEIN: Okay. The one

meter is there for reference. But, for the purpose of bare skin, you take the average of the contact and the one meter. Half the time they're touching the steel; half the time it's at one meter.

MEMBER POSTON: Okay.

DR. ANIGSTEIN: So, you would take the average of the two, and just eyeballing it, that actually looks pretty easy because I think it's 74 and -- all right. Let's just round off the numbers and say the average is a little bit below 5. So, it's below 5 millirads per shift for bare skin.

Do you agree with that, that it's a little bit less than 5?

MEMBER POSTON: Okay. Yes, I think so.

DR. ANIGSTEIN: Okay. So, then we go to 350, for the years 1952 to '57, we go to 350 shifts, and we end up -- so, you take 5 times 350.

MEMBER POSTON: Oh, oh, yes, I see. Okay. I see what I did wrong.

DR. ANIGSTEIN: Okay?

MEMBER POSTON: Yes.

DR. ANIGSTEIN: Very good.

MEMBER POSTON: I was looking at the 54, and that's the uranium value, right?

DR. ANIGSTEIN: Yes.

MEMBER POSTON: Okay. Thank you for explaining that. I was really confused, but it was my own misunderstanding.

DR. ANIGSTEIN: No problem.

MEMBER POSTON: Thank you.

DR. ANIGSTEIN: Sure.

CHAIRMAN ZIEMER: Okay. Questions for Bob before I ask Dave to comment?

(No response.)

Okay, Dave, what's NIOSH's take on this? First of all, on the data now, do you agree that you're agreement or do you still lack some information?

MR. ALLEN: We're in agreement on the beta dose. We were able to get Bob's MCNP runs, and I was able to reproduce these numbers, at least within round-off error. And the round-off, most of them were exact and some of them one-digit difference on the last digit.

DR. ANIGSTEIN: We can live with that.

MR. ALLEN: Yes.

CHAIRMAN ZIEMER: So you're both in agreement on the skin dose issue. And these numbers that we see on the final table for SC&A, are these the numbers that NIOSH is planning to use, then?

MR. ALLEN: Like I said, they were just a single-digit difference on the last decimal point. It's insignificant.

CHAIRMAN ZIEMER: Yeah, gotcha. Basically, that's the skin dose part.

And then so we still have some open issues on the direct radiation and

relative to the neutron component, it sounds like, is that correct?

DR. ANIGSTEIN: Yeah, that's still in the final stages of being revised. And I think it is even going to be a toss-up.

There are a couple of issues. One of them is going to be, in our opinion -- well, this is actually a policy call. There's no question that the layout man -- the layout man scenario, I should say; it’s not really a distinct individual -- gives you by far the higher photon dose.

Now, does that mean that you should adopt the neutron dose that he gets, which is much smaller than the photon dose, but it is still a separate item in the IREP entry, to that individual? Or should you combine that with the neutron dose to the betatron operator, which may be higher. He will have a much smaller photon dose, but he may have a higher neutron dose.

CHAIRMAN ZIEMER: Well, I think we are going to have to let NIOSH, as you say, that's going to be a call that they will have to make once we get the final numbers.

DR. ANIGSTEIN: Okay.

CHAIRMAN ZIEMER: I'm thinking out loud here, though, but I'm going to pose a question here to Ted.

Ted, we have another Work Group meeting in January. It's a teleconference meeting which we said would focus on Joslyn. But we also heard from the meeting earlier this week, from LaVon, that Joslyn may be clearly straightforward.

And I'm wondering if we could consider including some GSI issues in that meeting as well since there are clearly going to be some open things, such as this neutron dose issue.

MR. KATZ: Oh, right. I mean, certainly, we can. I mean, it's just a

matter of we're going to have to balance that because we really need to get through the Joslyn material as well for the Board meeting. But, yeah.

CHAIRMAN ZIEMER: Yes, but if that Joslyn issue is pretty straightforward, we may well have time to pick up some carryover from the GSI. I really don't want some of these things to drag on. If they can get this external value completed by mid-January, then we could perhaps take that up there as well.

MR. KATZ: No, I completely agree. But I also thought I understood from Bob that, I mean, there's agreement on all the inputs and so on. It's really just cranking out the actual values that Bob needs to do after this meeting from MCNP runs.

DR. ANIGSTEIN: That's my understanding.

MR. KATZ: Isn't that correct,

Bob?

DR. ANIGSTEIN: Yes, that's my understanding. My guess would be, honestly, we could probably wind this up in -- I mean, I would virtually guarantee it won't take an hour, and my guess is it would probably take more like half an hour, just a quick presentation. Because we will be in touch. I mean, I will be.

MR. KATZ: Okay.

DR. ANIGSTEIN: I'm not going to wait until the day before. I'm going to send Dave and Jim our files as soon as they're ready and presentable, and they can have a chance to go through and comment and check the spreadsheet, because there's this calculation that takes place after the MCNP run. And we will do ours; they will do theirs, just like with the skin dose. And if there is a discrepancy, and they did find a discrepancy once during the skin dose exchange, a discrepancy in one of my

spreadsheets, which we corrected. So, we expect to sort of come in in pretty good shape, I think.

MR. KATZ: Right. Thanks, Bob. So, that sounds like it will work.

CHAIRMAN ZIEMER: Okay. Thank you.

I think maybe for the record we need to take Work Group action on the skin dose issue, as to whether or not we accept this agreement that has been arrived at between NIOSH and SC&A on the methodology for calculating the skin dose.

I guess, Ted, I need to ask you, do we need official Work Group action on this kind of matter?

MR. KATZ: Yeah, I mean, Paul, you can do it whichever way you want. You can do it piece-by-piece like this. You can do it in a more general fashion once you're through the materials. It's completely up to you.

CHAIRMAN ZIEMER: Well, we don't really have the final information on the external part -- I mean on what will really be whole body for the neutron. So, I don't feel like we should take action until everybody is in agreement on that. I understand they have agreed to the methodology, but we haven't seen the final numbers.

MR. KATZ: Right.

MEMBER MUNN: I agree with that assessment, Paul.

CHAIRMAN ZIEMER: So, just for the record, if anyone on the Work Group wishes to make a motion concerning the skin dose approach.

MEMBER MUNN: As you mentioned, I prefer to remain silent on it until we have actually seen the results of the runs.

CHAIRMAN ZIEMER: Well, we have the results for the skin dose.

MEMBER MUNN: Yes, I understand,

but we're awaiting the neutrons.

CHAIRMAN ZIEMER: Oh, you prefer to wait until we have the whole thing? Is that what you're saying?

MEMBER MUNN: Yes, that's my preference.

MEMBER BEACH: Yeah. This is Josie. I agree with that waiting, also.

CHAIRMAN ZIEMER: Okay.

MEMBER POSTON: It seems to make sense. This is John.

CHAIRMAN ZIEMER: Okay. So, we'll just hold this until we have the final bottom line on the whole thing, then.

DR. ANIGSTEIN: This is Bob. My understanding from the agenda is that we will be, once we finish this, we will be going through the issues matrix.

CHAIRMAN ZIEMER: Right.

DR. ANIGSTEIN: And, of course, that's listed as one of the items on the issues matrix. So, at that point, I think

we need to make -- I would assume we're going to make a decision on each item in the issues matrix as we go through it.

CHAIRMAN ZIEMER: We would take those one-by-one, that's correct.

DR. ANIGSTEIN: Yes. Okay. So, there will be an opportunity shortly for the Board to take a position on the skin dose?

CHAIRMAN ZIEMER: Or the Work Group, rather.

DR. ANIGSTEIN: Right. I meant -- I'm sorry -- the Work Group.

CHAIRMAN ZIEMER: Right, right. Okay. Thank you.

Let's go ahead with the resuspension factor issue. Now, there we had earlier a paper, I think, back in October, by NIOSH -- or by SC&A -- indicating some alternate ideas on the resuspension factor. And then, more recently, I think on December 10th, we had the memo from Dr. Neton, from NIOSH,

indicating that the resuspension factor had been reviewed by NIOSH and that they now believe it is appropriate to use the 10 to the minus 5th value, which was what SC&A had recommended.

Jim Neton, do you have some additional comments on that?

DR. NETON: Maybe just a few. As you pointed out, there was a discrepancy or difference between NIOSH's resuspension factor during the residual contamination period. We agreed on 10 to the minus 5 during the operational period, but SC&A had some concerns about the abrupt change of the resuspension factor immediately after operations ceased from 10 to the minus 5 to 10 to the minus 6.

We thought about that some, and, in fact, the default value in TIB-70, which is the calculation of doses during residual periods, the default value is 10 to the minus 6, but it does allow for us to look at

the appropriateness of that value based on site-specific circumstances.

So, we went back and did that. And there were three reasons, three factors that entered our mind as to why we thought 10 to the minus 5th would be more appropriate.

Part of it is the fact that the initial starting contamination value was a modeled value based on deposition velocity and such. And the final value was also based on some empirical data in TIB-70. We didn't have an ending point because the facility had been cleaned. We couldn't use those data.

And the resuspension factor and the depletion rates are sort of intertwined, as SC&A has pointed out. So, we're a little uncomfortable with knowing that exactly. But, more importantly, we believe that the facility was so actively involved in steel-processing activities resulting in a very

good potential for resuspension particulate, which would be more appropriately modeled by 10 to the minus 5th. So, we have decided to use 10 to the minus 5th over the entire covered period, including the operational and the residual period. And I think that is the only difference, that was the only difference between SC&A and NIOSH on the internal dose estimation.

CHAIRMAN ZIEMER: So, I believe, then, we have agreement on that aspect.

SC&A, is that your understanding as well? Are we in agreement there?

DR. ANIGSTEIN: This is Bob. Yes.

CHAIRMAN ZIEMER: Okay. Work Group, any questions on that issue?

MEMBER BEACH: This is Josie. None from me, Paul.

CHAIRMAN ZIEMER: Thank you.

MEMBER POSTON: I don't have any problem. This is John.

MEMBER MUNN: No, I'm relieved to see an agreement on it.

CHAIRMAN ZIEMER: Okay. Thank you.

Then we can move on to the next issue, which is the AEC New York Operations 4699 Report. That was a report that was brought to our attention by Dr. McKeel. We did ask at our last meeting that NIOSH review that report in terms of the potential for using some or any of those facilities as surrogates for GSI.

We got the report from Dr. Neton. I'm trying to look for the date on that. I think it was, yes, the 1st of November, I believe, that report was distributed to us.

And then, also, I believe Dr. McKeel provided a critique of Dr. Neton's report, and that was dated -- well, let's see. Maybe it was the 2nd of November.

So, I'm looking at both of those. What I'll do here is I'm going to ask Dr.

Neton to make any summary comments he wants. We all already have the report.

And then, Dr. McKeel, I think, since we're discussing this, I'll ask you to make your comments as well because I know you had some concerns as well.

Jim, do you want to kick this off, then?

DR. NETON: Sure. This was an email that was issued on November 1st, as Dr. Ziemer indicated. And we looked at the two reports that Dr. McKeel asked us to look at for applicability or appropriateness to validate the MCNP model that we're using for GSI.

There were two reports. One, NYO 4699, issued in '53 and '54. Or NYO 4699 looked at 15 accelerators between '53 and '54 for stray radiation around these particle accelerators. And then, to supplement the NYO 4699, did additional surveys between '54 and '56.

We looked at the original 4699 report between '53 and '54, and none of those accelerators were betatrons. So, we didn't believe that they were useful for our situation.

Supplement 1, however, looked at 23 different surveys at 14 different facilities, and three of those were actually betatrons that operated in the 20 MeV range. So, they did appear to be applicable or appropriate surrogates for the one in use at GSI.

But there are a number of factors to consider when you want to do a validation study, and I listed these in the report: you know, the size and composition of the target to the front of the beam, the orientation of the beam, the distance of that point from the beam, the difference of shielding in the beam path, and the composition of the shielding.

Even though the survey results

were reported, the various sketches and diagrams that were available did not, in our opinion, provide enough information to answer those five criteria, or the five issues that you need to look at to do some sort of validation study.

In particular, there was no indication about what was in front of the scattering beam. It makes a big difference in whether you put a patient, nothing, or a piece of steel or uranium in front of the beam.

Some of them were not to scale. The ones that were to scale, the composition material wasn't known. So, the bottom line is we just didn't feel that there was enough information available to make it useful in validating the MCNP model.

That's it in a nutshell.

CHAIRMAN ZIEMER: Okay. Thank you.

Dr. McKeel, are you still on the

line?

DR. McKEEL: Can you hear me, Dr. Ziemer?

CHAIRMAN ZIEMER: Yes. Go ahead. I know you have concerns about that report, and this would be an appropriate time for you to get those on the record.

DR. McKEEL: Okay. Well, I guess I would have to summarize my feeling that I think that Dr. Neton has really mischaracterized not only what I requested, but what was the important information in that NYO 4699 Supplement 1.

One of the things I pointed out was that this was the only measured neutron data for betatrons in existence. And I pointed out in my paper, the first one, and in the reply, that I called on this Work Group back in March of 2012 to please cite for me any paper published that they knew of that had measured betatron, photon, neutron data, and they could mention no papers. I

called for that specifically, for that purpose, to put it on the record. Could not find it.

Well, here is such a paper. And I would say, just on that basis, this is real, measured data for three betatron sites for neutrons, for photons.

And the second point is Dr. Neton didn't mention the fact that the NYO 4699 Supplement gave matching film badge data for those betatron operators, the same three sites.

I also was upset, and continue to be, that Dr. Neton's report doesn't really mention anything about my original paper, which was sent in plenty of time before he replied on NYO 4699. I did a rather elaborate exposition of what I thought was important in those papers, and he totally ignored that.

This is pattern on the part of NIOSH, and I don't think it's fair. I don't

think it's scientifically correct to ignore petitioner information that's sent in good faith. And, actually, it's information that either NIOSH or Members of the Board or SC&A could have turned up long ago. These papers are old papers.

And, I guess, maybe the most serious thing I object to is that I believe NIOSH's decisions that, for instance, the sketches and the drawings were not precise enough to serve as surrogate data to match those sites, those three sites, with General Steel.

Now, I agree that General Steel was a steel company and the three sites were universities and university hospitals. And I certainly agree that there is a difference in the shielding and so forth between industrial betatrons and clinical betatrons.

However, when you look at what information NIOSH and SC&A have used at GSI, and the Board voted on last December, they

are similar-type drawings that are in the NYO 4699 reports. And these are drawings that are in no way -- they're not engineering drawings. They're sketches. They're cartoons. They show some thicknesses of walls. They show some details of what the walls were composed of in both documents, NYO 4699 Supplement 1 and in the various drawings that are used in the GSI Technical Reports.

And I pointed out in my paper that, actually, some of the NYO 4699 site drawings are certainly as detailed as the ones from GSI. They do show where the betatrons were located. They do show wall thicknesses. They do show wall composition.

You know how a betatron is constructed, and you know where the head is, and there are limits to how that head can travel. So, you pretty much know where the target was.

We're not talking about are these

data useful to calculate steel activation factors or uranium activation factors. We're talking about, are they useful to show what kind of doses were delivered by the betatron?

And Jim Neton's paper completely ignores the true value of the fact that these are not just inferred or calculated neutron data. The Health and Safety Laboratory were the experts at the time. And they, in this study of accelerators throughout the United States, they went to elaborate lengths to transport measuring devices, often using several at one site, to determine the neutron doses and use those to cross-corroborate each other, which I think is fantastic. And that was all completely ignored.

So, in my mind, I would have to say that Dr. Neton's analysis of this paper is superficial. It's not thorough. It's not scientifically correct. And I think

that that that data should be used.

And the final thing I'll point out, it really is -- I'm trying to be polite, but I've got to say it's very annoying to me. Because we had long discussions on the appropriateness of surrogate sites used for GSI about the handling of uranium.

And I pointed out, and I think everybody knows, at GSI they handled several different types of uranium metal forms. They handled betatron slices, but they also handled ingots and dingots, which are larger, and they handled some billets. What they did not handle were slugs.

Nevertheless, some of the surrogate sites that were used to compare to GSI, a steel plant, were not steel plants at all. They were places like Fernald, Weldon Springs, which were feed materials plants for nuclear weapons. Yes, they had some of the same machinery as a steel plant, but

they weren't steel plants.

So, in one case, let's just take the surrogate data used at GSI for betatrons and for the uranium work that the betatrons were hired to do, the non-destructive testing. Here we have a situation at GSI where surrogate data was used from other sites, which were different in their design, in their sources, and so forth. And that was all acceptable to NIOSH.

On the other hand, SC&A, the first time they went through the surrogate data criteria, said, no, that none of those sites fulfill the surrogate criteria. In fact, four of the five failed.

The second time SC&A looked at the data, with nothing new being added that I'm aware of, they turned around and said, oh, yes, now we agree, we think they do pass the surrogate data criteria.

Here we have a situation where the data is absolutely unique. It's the

only measured neutron/photon film badge data we can find for betatrons like the ones at GSI, and here NIOSH says that's basically useless.

So, I don't know what more to say. I have written a paper. I have written an objection to Dr. Neton. Here I have expressed the way I feel. I just couldn't disagree with him more. I think that's where I'll let my remarks stay.

CHAIRMAN ZIEMER: Okay. Thank you. I just wanted to make sure that we had that on the record, Dr. McKeel. I know we have the written information.

Let me any of the Work Group Members if they have questions on your issues.

And I do want to ask a question about -- and maybe I'll ask Jim Neton. I don't know really the answer to this myself. Is there anything that you noted, Jim, in the personnel monitoring records in that

report that would have been useful or given us better information on worker doses than we will get the modeling that we have now?

DR. NETON: This is Jim Neton. I don't think so. I mean, it's a measurement taken just like you would take with a survey instrument. I mean, again, it's not so much the fact that we have measured values. We know that betatrons generate photons and neutrons. I mean, that's what the code does. It really is the magnitude of those doses. And without having some detailed descriptions of the conditions under which they were taken and the construction of the facility, I don't feel that they are of value for our purposes.

CHAIRMAN ZIEMER: Okay.

DR. McKEEL: Dr. Ziemer?

CHAIRMAN ZIEMER: Yes?

DR. McKEEL: May I please just comment on that?

CHAIRMAN ZIEMER: Sure.

DR. McKEEL: I don't think that's the point. I think the point is right now you've got MCNPX modeling with no validation, no measured data. And I have said for years -- and by now I've sent you four excellent papers that used MCNPX to calculate radiation doses. They were all from peer-reviewed publications. I've said all along that to get such a model accepted in a peer-reviewed publication, which you and I, probably each of us have several hundred articles in our CVs, and the reason I pointed out those papers is that every single one of them requires measured data to validate the computer codes.

And I said, and those fit right within this guideline, that the maximum acceptable difference that those peer-reviewed journals accept for accepting a computer model of something is plus or minus 20 percent. And all four of those papers, the measured and the modeled MCNPX data were

within two to 20 percent, plus or minus two to 20 percent.

Whereas, when NIOSH used SC&A code to model the betatrons back in 2008, the closest they could come was within 200 percent. SC&A modeled 12 rem per year. I mean, NIOSH modeled 5.6 rem per year. That's not close enough. And they were using the similar or the same input files, and they were sharing those.

So, I think that the value of the measured data is to say, are the MCNPX values that were determined by code, transport code, how do they agree with the actual real measured data in NYO 4699 at three different sites? I think that's important.

And NIOSH didn't even go through the minimal effort to compare the MCNPX results with the values stated in that paper. Certainly that can be done. Certainly that could be analyzed, but nobody

expended the effort to do that.

And I can tell you this: I can send you all the grants at NIH that I've been in. I can send you my CV. I can tell you how many program, projects, and things like that that I have participated in as a study group member on both sides of the aisle. And I am telling you that this sort of methodology would not be acceptable in that arena at all.

Again, I am so frustrated, so angry, and so upset by the way this is being treated in a really unacceptable scientific manner, that it's hard for me to comment anymore. I think I will let it rest at that.

CHAIRMAN ZIEMER: Okay. Thank you.

DR. McKEEL: But I will say this, and I am going to say this to you, Dr. Ziemer, personally: I don't think it's okay for this Work Group to simply say, "Oh,

thank you, Dan, for your comments," and then forget it.

I would like to hear from Wanda Munn, from Josie Beach, from John Poston, and from you, who I greatly respect. I would like to hear what you think about what I said in my White Paper, in my response to Jim Neton, and to what I have just said.

Is there anything that I have said that you would agree with? Do you totally disagree with it? I think, in the spirit of transparency and putting things on the record, you all need to do that.

So, I guess there I really will end.

CHAIRMAN ZIEMER: Right, okay. Well, I'll certainly be glad to make some comments.

First of all, one of the issues that I would have -- and I understand where you're coming from -- the papers that you are referring to are typically medical

papers where the issue has to do with how well patients can be treated. And the margin for using a model, because models are used to treat patients with radiation, and you have to be within probably less than two percent because you can't deliver more dose than the doctor calls for from a treatment point of view. So, those are extremely critical.

And those are the cases where the model and the actual numbers must agree very closely. That is certainly not the same as field measurements of radiation personnel. It’s typically, even for film badges and survey meters, in the range of plus or minus 20 percent when you are actually there doing the data.

And then when you get to the kinds of things where we are bounding, we are not trying to bound within plus or minus two percent. So, philosophically, we're in a very different ballpark, I believe, than

what we are talking about in terms of those sort of validation issues.

DR. McKEEL: Paul, I will have to respond to that because I also sent you all a paper which I found interesting, in spite of the fact that SC&A does not seem to feel that the use of measured data is necessary to validate these GSI betatron data. I did come across a paper, a spectacular paper, by Dr. Anigstein and SC&A in 2005 where they were -- this was on another project -- but they were surveying, they asked the interesting question: could you use local hospital gamma imaging equipment to determine doses after a dirty bomb scenario?

And so they did a tremendous amount of work calculating how these instruments -- this was a contract. And under that contract, they had to prove their methodology.

I was interested to see that they went to some effort, great effort, actually,

to provide measured data to validate their model data. And there were fabulous, lengthy, exhaustive kind of calculations used in that paper.

So, basically, I don't agree with you. I don't think it has got to do with hospitals at all. I think it has got to do with the type of rigor that most scientists require if they are going to accept a computer code as being valid.

And again, in dose reconstruction you're supposed to determine dose with sufficient accuracy. Richard Miller pointed out to me many years ago bounding is a construct he believed was basically -- Dr. Neton for this program.

But that's not what the Act -- the Act doesn't call for bounding. It calls for determining each and every worker with each and every type of cancer with sufficient accuracy.

You guys, it's fascinating to me,

after all these years, 13, you can't define sufficient accuracy quantitatively, you know. And where you all now are, you both are saying, well, why don't we just use it as a general thing and sort of a descriptive term?

But, anyway, I'm saying, you know, that's not something I can control. But to say that all you have to do is loosely bound it, you have to plausibly bound it with sufficient accuracy. And I think this data would help. I don't think it is at all related to just the fact that they are medical photon- and neutron-generating machinery. I think it has got to do with the rigor that science requires these days.

CHAIRMAN ZIEMER: Well, I looked at those papers, and the rigor, certainly the 2 percent level, those were all --

(Chairman Ziemer's phone connection audio is lost.)

MR. KATZ: Paul, we lost you. Paul, I don't know if you're talking and don't realize it, but we can't hear you.

I don't know; his line may have dropped. So, it's just hanging here.

CHAIRMAN ZIEMER: Sorry. Can you hear me now?

MR. KATZ: Yes. Yes, you're back. Okay. We didn't hear really a thing you said.

CHAIRMAN ZIEMER: Sorry. I may have still been on mute.

I was just saying that, you know, those papers that I read were focusing on treatment of patient, where it is very critical that you validate to about 2 percent or less, very critical.

I don't know about Bob Anigstein's paper that you referred to, Dr. McKeel.

And another remark I will make is --

DR. McKEEL: I sent it to you.

CHAIRMAN ZIEMER: Richard Miller says the bounding is an issue that is part of this program. That's nothing to do with this Work Group per se. This is an accepted practice by NIOSH and by the program.

And the bounding was significant with sufficient accuracy. It is a philosophical construct which is not necessarily based on numbers. And I say that in the sense that it doesn't --

(Chairman Ziemer's phone connection audio is lost.)

MR. KATZ: Paul, I think we lost you again.

CHAIRMAN ZIEMER: My phone seems to have slipped onto mute again. I don't know how much you heard of that.

DR. ANIGSTEIN: Paul, we heard you talking about the bounding issue.

CHAIRMAN ZIEMER: Yes.

DR. ANIGSTEIN: That was the end.

MEMBER MUNN: But we didn't hear much of it.

CHAIRMAN ZIEMER: Well, for some reason, it –

MEMBER MUNN: We heard you say it was an acceptable practice.

CHAIRMAN ZIEMER: Okay. Well, let me allow some others to talk.

Any of the other Work Group Members have comments they want to make on this?

DR. ANIGSTEIN: This is Bob. I would like to respond to one thing Dr. McKeel said, and I appreciate the compliment on my 2005 report. There have been some later ones on the same subject that I posted on the CDC website.

But there is a remarkable difference. That work, which we did on several different radiation-measuring instruments used in hospitals and now going for field instruments, I was able to obtain,

having signed non-disclosure agreements, confidentiality agreements, I was able to obtain detailed engineering drawings from the manufacturers of those instruments right down to the dimensions, to the material composition. I contacted the manufacturers of some of the subcomponents, got the chemical composition.

I, then, went into the hospital. I was able to; I have access on weekends to their equipment, with their staff, of course, there. And I was able to set up an experiment where I had a known source, had a known location with a calibrated source that we obtained, with a traceable calibration of plus or minus 3 percent.

And we were able to do radiation measurement under exactly known conditions. We were, then, able to put those conditions exactly into the MCNP code, right down to a fraction of a millimeter. This is how far away it is. This is the dimension. This is

the material. And, yes, we got good agreement, typically, on the order of 10 percent. Sometimes we nailed it right down to 1 percent.

And the purpose of that was not to check does MCNP work. MCNP has been in development for 50 years, and many millions of dollars have been poured into the development of the code and the validation of the code.

What I was doing was validating my model, saying: are we correctly representing this instrument, based on the information we have, because there are always some little gaps? Is the model of the instrument good enough to be used in a situation where you want to actually put a human being in front of this camera? And we got good agreement.

Now that kind of information is just not available to us. We don't have that detailed engineering drawings of the

betatron. Nobody has those. We got through the best we could from Jack Schuetz, who NIOSH brought in as a consultant. He submitted drawings of the betatron tube. The rest of the apparatus, the magnets around it were just very, very complex, and we did not have that.

And most important, we did not have any exposure -- we had nothing to compare it to. There were no measurements made. Well, if we had measurements, if there were measurements of GSI, then SC&A and NIOSH would have been using those measurements. We would not have been resorting to a code. Maybe we would have done the code for in between, where here's a measurement at position X. Now let's use the code to give us a measurement at position Y, first having validated that we get the result at X. Then, we can say why we do not measurement if we go 10 feet away, whatever it is. Those kinds of variations,

those are beautiful. I would have loved to have had that.

As a matter of fact, when Mr. Ramspott put me in touch with -- well, I'm not supposed to mention names -- but a researcher, I believe it was in the Milwaukee School Engineering, if I remember correctly, who had done some studies, I was very eager to get in touch with that person.

I finally did speak to him, to find out did he actually have measurements under conditions that I could reproduce in MCNP. And the answer was he did not. He did not have any measurements. I looked; I was disappointed. He did not have any measurements that we could reproduce. I would have loved to have measurements. There were none.

And I was not, SC&A was not tasked with reviewing these reports that Dr. McKeel submitted, but I certainly trust that Dr. Neton and Dave Allen would have known

what is required for an MCNP analysis, and that the information was just not there.

DR. McKEEL: Dr. Anigstein, I do have to, I would like to comment that I requested at the outset that SC&A be tasked to do this. And basically, Dr. Ziemer refused to do that. So, I thought that was a great idea.

DR. ANIGSTEIN: Okay.

DR. McKEEL: I think you should look at it, and that wasn't allowed.

DR. ANIGSTEIN: The resources, you know, there's only so many resources available.

DR. McKEEL: I understand. I understand.

DR. ANIGSTEIN: But the point is I believe -- and I did take a glance at them, anyway; I did look at them -- the kind of information that is necessary for validating the MCNP analysis, or any other comparable analysis, is just not something

that is normally available. It is not going to be published. We are talking about measurements made 50 years ago. These things are just no one went around with a density gauge to measure the thickness of the walls and the composition of the walls. Those kinds of things, there was not the intention at the time.

DR. McKEEL: Right.

DR. ANIGSTEIN: It's just the validation, I completely agree it would have been nice to have a validation, not to validate the code, but to validate the way we are using the code, because --

DR. McKEEL: Correct. That's right, the model.

DR. ANIGSTEIN: -- the user has some discretion. But that data was simply not --

DR. McKEEL: But I'm telling you some relevant data did exist in NYO 4699 that could be used as surrogate data.

DR. ANIGSTEIN: Yes, I can't, again, I can't comment on that because I did not go over details.

DR. McKEEL: What I hoped to hear was not only from you. You know, I know your thoughts about MCNPX, and, basically, I agree with what you said. I think it is very well-validated code.

On the other hand, as you said this morning, you know, there are nuances to it. It changes a lot. So, I still think that the extant measured data, particularly that on neutrons, and it doesn't take a sophisticated comparison. You can look at the number, you know, the rems per year or the rems per week or the rems per month on the film badges and on the measurements of neutrons, and see what MCNPX and SC&A and NIOSH came up with, and compare those to what the Health and Safety Laboratory came up with for their National Accelerator Survey.

You can do that. You know, it's a number. Compare the number, 25 compared to -- as long as the units are the same, you can do that, and I think it would be useful. And, in fact, nobody has done that.

So, that's really all I'm saying. It hasn't even taken that first simple step.

I would like to hear what the other Board Members have to say about it. And I wish, please, I'm requesting that not just Dr. Ziemer comment, but I would like to hear from the other three Members, please.

CHAIRMAN ZIEMER: Well, that's at their option. I don't think they're required, but go ahead.

Who wants to comment?

MEMBER MUNN: Dr. McKeel, this is Wanda.

And I hear your concerns with great interest, which we always have. It's always disturbing when I hear a person who has contributed so much to what we do

express feelings as you have just expressed.

You seem to feel that your work and your information is not valued, and that we, as a group, are not paying attention to either your concerns or your information. And that's not a perspective that is held here.

My perspective personally is that you have contributed a great deal to what we do. I am disturbed that you do not feel that science is being served here because I prefer to think of myself as a strong advocate of good science and don't see any way that we could have approached the information that you have given us any more rigorously than we have.

So, I'm very sorry that you feel the way you do, but my personal view of what is transpiring here is that your information and your concerns are being given a great deal of weight and a great deal of effort. The fact that the outcome is not always

pleasing for you is understandable. That happens with all of us on many of our activities on a daily basis.

But I assure you, to the best of my knowledge, all of the parties involved here are making every effort to achieve a level of good science, which is admirable and served us as well as we can possibly serve in a situation of this kind.

So, my apologies for your feelings that you're not being properly acknowledged in what we are doing here, but that is not the perspective that can be had from where I sit. We very much appreciate your input, and it is certainly taken into consideration and certainly here is read with interest whenever it's seen. I don't believe you have ever sent us information that I have not made certain that I reviewed as well as I could.

So, if we have done anything to give you the impression that your work is

not being valued or is not being taken into adequate consideration, I personally apologize for that, but that's not the perspective that I have here. That's all I can say.

DR. McKEEL: Thank you.

CHAIRMAN ZIEMER: Any other Board Members want to comment?

MEMBER POSTON: I will take a couple of minutes.

First off, I have read all the papers that you have sent. Some of them I was familiar with before you sent them because I've been working in terrorism for a long time, and I was completely aware of the papers regarding using the equipment in a hospital and a dirty bomb situation.

I have also been working in Monte Carlo calculations for 30 years or more, and I'm familiar with some of the errors, and so forth.

I thought that the things that

Bob and others at SC&A have done make a whole lot of sense. In my belief, there is an error associated with calculations which can't be overcome because there are so many uncertainties in the statistical uncertainty, based on the number of histories. It is just one of those many things.

I have tended to agree with Jim about the medical accelerators versus the accelerators that we're considering at GSI. I believe there is a difference. I understand their problem in trying to do the very best they can to do the dose estimates. I do believe they're different, and I do believe that you need to use a different approach.

Other than, I don't have much to say. I have read all your papers. As I said, I was familiar with some of them before you sent them out because of my interest in other areas.

DR. McKEEL: Thank you.

MEMBER BEACH: And I'll just make a real brief comment here. This is Josie Beach.

Dan, I have always been a real strong supporter of you, as you know. But in this case it is a highly-technical matter, and I'm going to have to defer to the others that have a little bit more technical knowledge in this field than I do.

I really pushed to have NIOSH look at your paper, to review your paper, and I'm going to leave it at that and go with their recommendations, as well as the other Board Members.

DR. McKEEL: Thank you.

CHAIRMAN ZIEMER: Okay, let's see.

MR. RAMSPOTT: Dr. Ziemer?

CHAIRMAN ZIEMER: Yes?

MR. RAMSPOTT: This is John Ramspott. If I could, this is kind of the

chance to make a couple of comments. Could I make one, please?

CHAIRMAN ZIEMER: Yes, go ahead, John.

MR. RAMSPOTT: I'm addressing this to Dr. Anigstein and to John Mauro. It's regarding their report on the external exposures.

And I'm curious, looking at Table 4, and I was trying to figure out Table 4 and 5, just like Dr. Poston was, too.

I have a very basic question, though. I don't think it's real complicated. Why are you using a uranium slice rather than an ingot or a dingot for this calculation when it is one-fifth of the size, the physical size, of a dingot or an ingot?

I believe I have actually sent this Work Group kind of an amateuristic drawing of an ingot, cut it into slices the way the slices were described by

Mallinckrodt documents, being about 3-inches thick or 4-inches thick. And it's real basic. There's five times the matter, the physical matter, there.

And the reason I'm asking this is that DOE more frequently -- I mean by tenfold -- references ingots and dingots. The earlier reference to slices, the only one I could find is a document in 1953 at Mallinckrodt, MCW.

It appears to me that these exposures should be five times what they are if you were using dingots or ingots. Why do you use the slices? That's my question. Again, I appreciate the Board or other Work Group Members kind of answering that same question. Why use the small piece when we know they were doing the other piece at GSI?

DR. ANIGSTEIN: All right. Can I answer this? This is Bob.

MR. RAMSPOTT: Yes, Bob.

DR. ANIGSTEIN: Okay. No. 1 is

at the meeting in Collinsville -- I had read about the slices -- I specifically asked the betatron operators there, one of our departed colleagues and another one who worked with him. I remember there were two, and I forget who the other who the chimed-in.

And I described the slice the way it was described. I did not do the research on the Mallinckrodt Technical Basis Document. But I certainly pursued it, and it seemed, in my opinion -- and it is our job to critique NIOSH, not to be critical of NIOSH but to critique and review it -- and even though I was not tasked with reviewing the Mallinckrodt TBD, it looked to me like one of the extremely careful, extremely authoritative pieces of research.

And they described the slices. The cutting of the betatron slices --

MR. RAMSPOTT: What was the date on that document, though?

DR. ANIGSTEIN: The data?

MR. RAMSPOTT: The date?

DR. ANIGSTEIN: The date on our document?

MR. RAMSPOTT: Oh, on the Mallinckrodt document.

DR. ANIGSTEIN: Oh, excuse me. The Mallinckrodt Technical Basis Document was something put out by NIOSH. I don't offhand know what the date is.

MR. RAMSPOTT: I'm looking at the report; 1953 is when Mallinckrodt -- that's the maturation of Mallinckrodt --

DR. ANIGSTEIN: Excuse me. No, you don't understand.

MR. RAMSPOTT: -- and the slices.

DR. ANIGSTEIN: Just a moment. I'm referring to the NIOSH, the document that was done for NIOSH by their contractor, ORAU, that was prepared during the course of this program a few years ago.

MR. RAMSPOTT: Maybe Mallinckrodt

was more accurate than ORAU or NIOSH.

DR. ANIGSTEIN: Okay John. I did not review that document. Okay? I'll be honest with you. It was not my job.

MR. RAMSPOTT: Okay.

DR. ANIGSTEIN: But I simply said, based on that information, I questioned your workers, I mean the workers that you have very helpfully -- and I really appreciate that. Still, to this day, I am grateful to you for arranging that meeting. It was extremely useful, extremely informative.

And I asked them, "Is this representative of the shapes that you were dealing with?" And they said yes. I said something like 18 inches in diameter, 4 inches thick. I calculated the 4 inches based on that's the maximum thickness that could be radiographed. With the 25 MeV x-ray beam, that was the most. Anything thicker just would not get through the film.

And they said, "Yes, this sounds in accordance with our memory."

And the only information I got about the -- now this is sort of my opinion. When DOE was referring in correspondence, they were simply approving -- it was not "DOE," of course; it was the Atomic Energy Commission then -- they were simply approving the invoices submitted by Mallinckrodt, which was paying GSI to do this work. They were simply being paid to do uranium shapes. They didn't issue a separate work order for each type of thing. They simply had a blanket agreement: we will send you uranium; you will do the radiographs and send those back to film.

So, to say, well, they didn't say "slices," the slices were cut from ingots or dingots. Ingots and dingots is the same thing; it is just a slightly different process of making it. They are big, cylindrical blocks of uranium. They cut

them up and they took out dose rates.

So, I think that that is a semantic argument that really is not very meaningful.

MR. RAMSPOTT: I disagree. I don't think it's semantic. I think it's a --

DR. ANIGSTEIN: Just a moment, John. Let me finish. Please let me finish.

MR. RAMSPOTT: Yes, please.

DR. ANIGSTEIN: They got the uranium. The only information I got from any of the workers that I later interviewed -- I followed up with telephone interviews -- was one gentleman who worked on the day shift, and he came in and the night shift was telling him, "Oh, yes, we had this big shape, this big ingot." A dingot is simply -- there is a different chemical method of producing it. They're both ingots.

And they simply said, "Yes, we did these corner shots on this one." And he

showed me. I sent him --

MR. RAMSPOTT: That gentleman was a supervisor.

DR. ANIGSTEIN: Pardon?

MR. RAMSPOTT: That was a supervisor that was giving you that information.

DR. ANIGSTEIN: Yes, but, anyway, he said he just came in and happened to have talked to the worker going off the night shift. And there was one instance. The others were the slices.

However, regardless of that, this analysis -- you're very much mistaken -- this analysis talks about what comes off the surface of the metal. And the way the analysis was performed was two separate analyses. One is the side of that cylinder. All that really matters is how far away you are, because we did say, "This here is a 4-inch thickness, and here we are touching it." So, when you put your hand on

something, it doesn't matter whether it's 10-feet long. The radiation you're getting is from directly under your hand.

And I took a small area in the middle, just to make sure that we captured that. So, it would make very little difference. The exact shape would not change very much. And most of the radiation comes from that side, and the face of it was 18-inches across. It might as well be 18-feet across because it wouldn't make any difference. The radiation in the center -- the beta particles don't travel that far -- the radiation in the center will be approximately the same.

I stand behind this as being a representative shape. Yes, there were, I'm sure there were other shapes. There were other exposure geometries. We do this one as a representative, and I think it's limiting and I think that saying that somebody has their hand in constant contact

with it during half the setup period is probably overstating it. It is probably on the safe side.

It is the limiting exposure. I doubt seriously that you could get over the course of a year -- maybe at any one moment, any one single operation, you could get something different -- but over the course of a year or as many as 54 shifts that were employed during any one year, I don't think you would get anything that would be different, that would be significantly higher than this.

MR. RAMSPOTT: If I could comment?

DR. ANIGSTEIN: It's a representative shape. We don't have enough information to have done every shape. First of all, we don't have the resources. And even if we could have, we don't know enough detail. So, this is a good, representative shape. The workers agreed that this was,

the one I saw them face-to-face, they agreed that this was representative. And I don't think we could have done any better.

MR. RAMSPOTT: May I comment?

DR. ANIGSTEIN: Sure.

MR. RAMSPOTT: The reason I'm having a little problem agreeing with that is a mass of uranium, like you said, it could be 18-feet wide, but we know it was about 24 to 30 inches tall --

DR. ANIGSTEIN: Uh-hum.

MR. RAMSPOTT: -- and 18 inches, approximately in diameter.

DR. ANIGSTEIN: Uh-hum.

MR. RAMSPOTT: That's five times the size of this.

DR. ANIGSTEIN: Okay.

MR. RAMSPOTT: We both agree.

DR. ANIGSTEIN: The reason that's not of major significance is beta particles of the energies in uranium travel about 1 millimeter through the metal. So, for

instance, when we do the MCNP analysis, we only consider the skin of the metal, simply because if we told MCNP give me the dose from the electrons in the sensor, those I could never get out. MCNP would spend a huge amount of time calculating things that never go anywhere. So, we just --

MR. RAMSPOTT: The reason this concerns me --

DR. ANIGSTEIN: Pardon?

MR. RAMSPOTT: The reason this concerns me, earlier in this meeting there was mention of the Putzier effect.

DR. ANIGSTEIN: Yes.

MR. RAMSPOTT: A dingot would definitely have more of the Putzier effect material on its surface because a dingot, when it went to GSI, according to the photographs, according to worker recognitions, the identifications, it was a crusty, big dingot or ingot.

DR. ANIGSTEIN: Uh-hum.

MR. RAMSPOTT: And it wasn't cropped. They quit doing the cropping because they used the x-rays to figure out how -- and this is from a Mallinckrodt document. They actually did this to look at the crust on there to see how thick it was, so they could, then, do the next steps back at Mallinckrodt. So, the workers would have been subject to much more Putzier effect material on a dingot than it would an ingot.

Now, until you really lay your hands on it, if the size doesn't matter, well, then, you know, you guys are the experts. But my point is we spoke with the supervisor. I think you interviewed him. He actually told everybody exactly how the dingots were done --

DR. ANIGSTEIN: Uh-hum.

MR. RAMSPOTT: -- how they were rotated, flipped --

DR. ANIGSTEIN: Yes.

MR. RAMSPOTT: -- turned. But

the big difference is the shots only took about 10 minutes. On slices they took two hours.

DR. ANIGSTEIN: Yes, I understand.

MR. RAMSPOTT: Two hours in a control room is a safer position. But when you're out there flipping it and turning it, and actually turning it upside-down, the size does directly affect how much the workers handled/touched that material.

So, if you only touch a slice every two hours, but you touch a dingot every -- let's be conservative -- 15 minutes, there's a big difference, four or five times a difference.

DR. ANIGSTEIN: I believe we assumed a one-hour shot --

MR. RAMSPOTT: Okay, one hour. Okay.

DR. ANIGSTEIN: -- and 15 minutes of handling in between shots.

MR. RAMSPOTT: Okay. But, if you are only doing a shot at 10 minutes, you can go in and handle a whole lot more of these, and your personal exposure in touching, handling, flipping, turning the dingot or ingot, that's a real problem. That's a major difference. I mean, you guys need to consider that.

DR. ANIGSTEIN: I hear you. All I can say is this came out rather late. We started off with the slices. We did not get any contradiction early in the first --

MR. RAMSPOTT: Oh, yes, you did. You guys definitely did. I have documents that will prove that.

DR. ANIGSTEIN: I got one report that was one case, one instance. This gentleman said he came in in the morning and he saw this from the night shift. It sounded to me like it was the exception rather than the rule.

The workers at the plant, the

workers I interviewed, the two people -- you know who I'm speaking about -- agreed, when I said, "Is this a representative shape," they said yes.

MR. RAMSPOTT: But that was one meeting. There's transcripts from other meetings that will definitely verify the fact that dingots and ingots were known about.

I might be wrong, but if we take a real close look at those purchase orders, I think even the purchase orders give some --

DR. ANIGSTEIN: I don't consider that to be -- I don't consider that a person writing the purchase order needs to know the exact shape of the uranium. He needs to know that it's radiographic uranium and they're paying for it.

MR. RAMSPOTT: I think they told the production schedule, Bob. I think in that same information, that IL-28 document

that was provided, there's actually about six -- or, no, there's probably 10-12 slides. And part of that whole document, they actually tell the production of what went over to GSI.

DR. ANIGSTEIN: Excuse me. What is that document?

MR. RAMSPOTT: I know IL-28. I'll find out exactly what it is and send it to the Work Group and yourself. There's about 10 -- or, oh, there's probably more than that.

DR. ANIGSTEIN: I believe I looked at everything. I mean, I know I looked at every single document.

MR. RAMSPOTT: Oh, it definitely mentions billets, recasts. It goes on and on.

DR. ANIGSTEIN: And also, I would like to make another point.

MR. RAMSPOTT: Not just the purchase orders.

DR. ANIGSTEIN: Yes, I would like to make another point about the Putzier effect. What we did, we considered the extreme possibility. Here's a situation: you get the Putzier effect. You have to first have uranium that has been purified and aged for 100 days or more for all this activity, all of these short-lived nuclides to grow in. Because when uranium is separated, you don't have -- this is primarily an isotope, protactinium-234m, that gives you the beta. It's not there; it's separated out.

So, it grows in over a period. Like in 24 days, it's 50-percent grown-in. In 96 days, it will be about 95 percent grown-in, and so forth. So, you need about 100 days to get this degree of in-growth.

Then, it has to be melted. The activity migrates to the surface. And then, immediately afterwards, you have to be in contact with it. Because, again, if you do

the remelting, and then, you wait a while, you wait a month, then the stuff on the surface has decayed, the stuff in the middle has grown-in, and you're back to your normal mix of uranium in the starters.

So, we took the two extreme cases, the combination of it's got about 100 days of uranium just sitting around in metallic form before it was remelted. And then, it was remelted and, then, immediately sent over to GSI.

MR. RAMSPOTT: And I disagree. The ingot process was remelted; the dingot process was not.

DR. ANIGSTEIN: In that case, there is no Putzier effect.

MR. RAMSPOTT: No, they said the dingot process is where it came from.

DR. ANIGSTEIN: No. The Putzier effect only takes place because you melt the metal. Once the metal is melted, because of the different chemical properties of the

uranium and the daughter product, the daughter product migrates to the surface.

MR. RAMSPOTT: I'm not --

CHAIRMAN ZIEMER: Look, John, I'm going to interrupt you. We've gone through this Putzier effect over and over again. We're just rehashing old ground.

I think, if I understand the question that John Ramspott is raising, it has to do with how many samples are handled. In a sense --

(Chairman Ziemer's phone connection audio is lost.)

MR. RAMSPOTT: That's probably more accurate, Paul.

MEMBER MUNN: We have lost Paul again.

MR. RAMSPOTT: Yes, we did. He was making a very valid point, though.

MEMBER MUNN: That's true.

MR. RAMSPOTT: Maybe we can get him back on there. Because it's the mass

and the handling that I'm really worried about rather than the --

DR. ANIGSTEIN: John, it's the surface that matters, not the mass.

MR. RAMSPOTT: Well, the surface --

MEMBER MUNN: Paul, can you hear us? We can't hear you.

(No response.)

MR. KATZ: Yes, I assume he's fighting with his mute function.

(Laughter.)

MEMBER MUNN: That's a shame.

DR. ANIGSTEIN: John, I don't mean to sound belittling, but if I can --

MR. RAMSPOTT: No, not at all. That's why I'm asking the question.

DR. ANIGSTEIN: If I can use a very crude -- it just came to me -- but I think a very good example. If you put your hand on a hot stove --

MR. RAMSPOTT: Yes.

DR. ANIGSTEIN: -- and burn yourself, it doesn't matter whether the stove is a foot across or 20-feet across. You know, what only matters is you're touching the stove and you're getting burnt at a certain temperature. This is about the analogy I can think of.

MR. RAMSPOTT: If I've got my hand within a quarter-inch of it, I'm still getting burned.

DR. ANIGSTEIN: Right. Right. This is the best analogy I can think of. The size is a second-order effect.

MR. RAMSPOTT: Yes, but if I touch that stove 20 times, I'm going to get a worse --

DR. ANIGSTEIN: I agree with that, and all I know is, unless --

CHAIRMAN ZIEMER: John, I got cut off there.

MR. RAMSPOTT: You were making a very good point.

CHAIRMAN ZIEMER: Well --

MR. RAMSPOTT: I am worried about the size and the --

CHAIRMAN ZIEMER: I'm trying to understand. The beta doses are not dependent on the size so much unless the size is affecting the sequence of handling.

MR. RAMSPOTT: The handling I am worried about.

CHAIRMAN ZIEMER: Well --

MR. RAMSPOTT: It could be --

CHAIRMAN ZIEMER: Is it the frequency of handling that you're talking about?

MR. RAMSPOTT: The way that workers described an ingot, they would shoot it, which only took about, according to them, I mean, it could be 5 to 10 minutes at the most.

CHAIRMAN ZIEMER: Right. Well, Bob and NIOSH have used, have made some assumptions about the sequence of that. So,

are you challenging that sequencing? It's only dependent on size insofar as you're saying that they could handle more of them in a certain period of time.

MR. RAMSPOTT: Right.

CHAIRMAN ZIEMER: It's not the fact that there's more radiation because of the size. Because on the betas you're very restricted to the actual part that they're touching.

MR. RAMSPOTT: Oh, you're dead right; it's more frequency and it's more handling.

CHAIRMAN ZIEMER: I thought we were agreed on the frequency.

MR. RAMSPOTT: I disagree. Slices is every hour.

CHAIRMAN ZIEMER: Well, is this new information? I'm a little startled here because we have discussed this in the past, and I thought everyone was in agreement.

MR. RAMSPOTT: Definitely not new

information.

CHAIRMAN ZIEMER: Well, I'm going to ask both Dave Allen and Bob Anigstein. I thought we had agreed on the frequency of handling for these as representative of the different types of handling.

MR. ALLEN: This is Dave Allen.

Yes, I thought we had all agreed on that as a representative model, too.

But just one last question that I'm not understanding on this whole thing is we know it took a good hour to get a decent exposure through 4 inches of uranium. Are you trying to say, John, they used a much bigger thing and shot them quicker?

MR. RAMSPOTT: No, not at all. Bob was actually talking about it going through it. My guys, the workers, the people who did it, said they shot the corners, Dave, and the corners are where the crust was. According to Mallinckrodt's own description that I found and presented, they

would shoot the corners. They weren't shooting the uranium. They were shooting the crust.

MR. ALLEN: Right. Now that was with the dingots, correct? That was to see where --

MR. RAMSPOTT: That's correct. Now nobody really knows what they were doing with the slices. I mean, I don't know. I don't think anybody really knows for sure what they were doing with the slices. I mean, I've never seen a write-up of it. Were they trying to go through it? I think that was a best guess because nobody had ever seen the Mallinckrodt document that told what they actually did. And that was to look at the crust, so they could figure out the thickness, so they could take it back, glaze off the oxide.

MR. ALLEN: Okay.

MR. RAMSPOTT: Magnesium oxide I think it was.

DR. ANIGSTEIN: John, our metallurgist, Bill Thurber --

MR. RAMSPOTT: He wasn't there, Bob.

DR. ANIGSTEIN: Just a moment. Bill Thurber, who is a metallurgist, who worked with uranium in those days -- his first job was at Oak Ridge working with uranium alloys. So, he's about as expert as we can find.

MR. RAMSPOTT: He never worked at Mallinckrodt.

DR. ANIGSTEIN: Just a moment. No, he did not work at Mallinckrodt, but he worked with uranium during that time period.

MR. RAMSPOTT: Okay.

DR. ANIGSTEIN: I'm sorry to be losing patience, but these little, tiny arguments -- you know, we were not in this particular place, and every place is different.

We have an expert here, and he

said the idea that they would use a radiograph to decide how much crust of this magnesium fluoride to take off is simply not plausible. And we go with that.

MR. RAMSPOTT: The Mallinckrodt document --

DR. ANIGSTEIN: This is not plausible.

MR. RAMSPOTT: Okay.

DR. ANIGSTEIN: What you are mistaking, what is mistaken in these documents is what is plausible and is a perfectly reasonable practice is that, when you have -- not the dingot -- the ingot, when it is melted in the oven an in induction furnace, and the same thing is comparable to the Putzier effect, what you get on top, you get slag and you get these sorts of nuclides. They're called hot-tops.

Because I interviewed somebody working in one of those facilities at Rocky Flats for a different project. There, it

looks like metal, but you can't tell. There is like a foamy consistency on top. And there, a radiograph would be useful, so that you would cut the end off with a bandsaw. And it would tell them how thick is that end, not the side crust, the end. And that is only for an ingot because that only happens when you melt it in a vertical position and this stuff rises to the top. And that is where it would have been useful. And that's why a corner shot makes sense, because it tells you how long, how big the end is, how much to slice off the end. But that is one of the things that does make sense.

The reports that I got from this person who said, he said there was one instance, he told me. Now, later on, maybe people started getting information and they said, "Oh, yes, maybe that did happen."

The original information I got, I repeat, was on slices. And I got one

interview or there was one instance where he said he came in in the morning and they had been doing that in the evening.

MR. KATZ: Bob, this is Ted. I'm sorry. I'm just going to interject here and ask Paul --

CHAIRMAN ZIEMER: I just said we rehashed all of this before.

MR. KATZ: This has been discussed.

CHAIRMAN ZIEMER: I'm only asking, do we not have agreement on the -- obviously, the frequency is --

(Chairman Ziemer's phone connection audio is lost.)

MR. KATZ: We've lost you again, Paul.

But if you can hear, I mean, we have gone over this turf. There was agreement about all of these parameters before, and this is a complete repeat of discussions that the Work Group has had.

CHAIRMAN ZIEMER: Right.

Can you hear me now?

MR. KATZ: Yes. You're back.

CHAIRMAN ZIEMER: I don't know why this thing keeps slipping onto the mute.

But, in any event, we have rehashed all that part. I was asking if there's any reason to think that the estimated frequencies, which are based on a combination of these, are somehow different today than we had agreed to in the past. I don't understand why this has come up now, because we have had these discussions in the past, and the frequency and all of that. I thought we had agreed to the combination of handling of different things for different times.

MR. RAMSPOTT: Apparently, what the workers said is being overruled by someone who was never at GSI or Mallinckrodt. That's as simple as I can put it. And the worker who described this is

still alive.

CHAIRMAN ZIEMER: Well, we have tried to have a model which applies to all workers over time, based on the orders that were handled and the estimates of the time that it took to handle these different shots. So, is there something different now that wasn't discussed before?

MR. RAMSPOTT: I was discussed; it was just ignored. That's plain and simple.

CHAIRMAN ZIEMER: Well, I don't think it was.

MR. RAMSPOTT: Well, somebody overruled it, Paul.

MR. KATZ: John, this is Ted.

It was discussed. It was resolved before. I mean, now you've forgotten what the discussion was before and we're burning up the day with this at this point.

DR. McKEEL: Ted, this is Dan

McKeel.

I do have to quickly interject one comment about everything being old. And that is that I gave you all new interview information we had with another supervisor, [identifying information redacted]. And this was back in 2012, I believe.

We interviewed him in extenso and asked him like 20 questions about the uranium operations that he had personally observed. And he described in that -- and I sent this to the Work Group. Everybody says they read every one of my papers, so it ought to be easy to come across this. But [identifying information redacted] said that he observed that some Mallinckrodt dingots and ingots, regardless of what the Mallinckrodt TBD says, came over in trucks to the old betatron building, and that they were aligned on pallets in groups of six to eight per truck. And that truck went up to the old betatron building and was apparently

directly unloaded from there. And he also can confirm the corner shots.

And the final comment is that everybody keeps on ignoring the fact that -- and John didn't mention this this time -- but the information that Bill Thurber says is ridiculous and bizarre, and we sent you this quote often, came from the President of Mallinckrodt Chemical Works in St. Louis, Harold Thayer.

The company did an exhaustive report on Mallinckrodt operations, and he clearly says in there that x-rays were used to define the boundary between the uranium and the crust, no matter what Bill Thurber says, no matter what he says his experience was.

And I would mention this: Bob Anigstein keeps on putting on the record things, discussions that he had with Bill Thurber. If Bill Thurber wants to weigh-in on this, let him write a White Paper. Let

him put this information on the record.

DR. ANIGSTEIN: I believe he participated in one of the Work Group meetings.

DR. McKEEL: He did participate in it, but I'm saying that --

DR. ANIGSTEIN: Just a second. You're giving verbal testimony. He gave verbal testimony during the Work Group meeting. He specifically was asked to participate for that reason.

DR. McKEEL: No, we had sent you all the clipping from Harold Thayer, the hard copy of that, that you can read for yourself and decided. I think it's called "Fuel for an Atomic Age," is the publication. But, anyway, we can send that again.

So, I don't want to get into an argument about it. I'm saying that the information we're telling you is from eye witness observers at GSI in the betatron

facilities. And, to me, that ought to outweigh eye witness testimony at Oak Ridge by another person who's never been to General Steel Industries.

CHAIRMAN ZIEMER: So, it is still not clear to me how this changes the handling times that are assumed in this approach.

DR. McKEEL: Well, Paul, if I can just clarify, I think what john is trying to say is that newer testimony obtained after 2007 from GSI betatron operators and supervisors indicates that, for corner shots which were common, that the exposure times were very short between those. And so, the frequency of the shot was less than was agreed on.

You know, I think, again, Dr. Anigstein harps back to two betatron operators from an October 2007 meeting. And there's been subsequent testimony on that that is part of the record.

CHAIRMAN ZIEMER: Yes. Of course, if the shots were shorter, the activation is lower as well. So, I'm still waiting to be convinced that the combination that we used is not appropriate.

DR. McKEEL: Well, this is Dan McKeel again.

I guess what I would echo is my comments from earlier. I would say that, if you look back on the record, you will not find any acknowledgment by the Work Group that they are aware of [identifying information redacted] testimony and his answers to the 20 questions. In other words, the Work Group hasn't actually grappled with the new information.

So, that's why we sent you that information, is so that you can properly look at it, consider it, and factor that into what two other workers said years before in 2007.

So, anyway, I don't know what

else to say.

DR. ANIGSTEIN: This was a report of an interview -- as long as you mentioned his name, I can certainly repeat it -- the report of the interview which I had with [identifying information redacted] on July 2nd, 2009. I interviewed him on the telephone, and I said that we talked about the ingot and he said that this operation took place on the weekend.

And I'm reading from my report. "The operation took place on the weekend. So, [identifying information redacted] wasn't aware of it until told by the workers who actually performed the task. What he was aware of was that, on Monday morning, there was a flatbed truck pulling out, carrying what he was told were Mallinckrodt ingots." This is what he told me on the telephone.

DR. McKEEL: Yes.

DR. ANIGSTEIN: He said -- I'm

just looking further -- he said there would be two shots.

So, this does not strike me as a very frequent occurrence. And this was reported to the Work Group. So, it's not true that he was ignored. This is not new information.

DR. McKEEL: Well, all I can say is that what we sent you was written questions by us to [identifying information redacted] and his written replies. He took the time to do that. And it was a couple of years after you had that, but, basically --

DR. ANIGSTEIN: I see. So, the information --

DR. McKEEL: No, he did confirm what you said, that he --

DR. ANIGSTEIN: Information gets better. So, the longer we wait after GSI shuts down, the better the information gets, is what you're saying, that the later information is the better?

DR. McKEEL: No. No, that's a gross distortion of what I'm saying. You know that.

CHAIRMAN ZIEMER: Okay. I am just going to cut that off.

DR. McKEEL: That's fine.

CHAIRMAN ZIEMER: I still see nothing that changes this model. I think that SC&A and NIOSH had that information when they estimated the time. Unless one or the other can convince me that there's a significant change in how we assigned those times, I think we're going to go with what we had already agreed to.

And the other Board Members, if they want to weigh-in on this?

MEMBER MUNN: I certainly have nothing to add. I think we've covered this territory pretty thoroughly.

MEMBER POSTON: This is John.

I agree.

DR. ANIGSTEIN: And I would just

like to add to clarify -- and I know I'm being a little obstreperous here -- not only was there an interview, did I interview [identifying information redacted], I also sent him a letter summarizing: is my understanding correct of what you told me? Would you please tell me?

I didn't get a letter back from him, but I did call him again. And he said, yes, he read my letter and I represented it correctly.

CHAIRMAN ZIEMER: Okay. Thank you.

Okay. We need to move on here. Let's see. Oh, before we do the Appendix BB thing, also, just for the record, we had, on the matter of how film badges were used and the control badges, we had the contact that we asked Dr. Neton to make with Landauer.

And, Jim, we all received your report. Do you have any other comments on that?

DR. NETON: No, I think it's pretty self-explanatory in the report. Actually, Stu Hinnefeld, who knows Craig Yoder at Landauer, made the contact.

CHAIRMAN ZIEMER: Oh, yes, right, it was Stu that made the --

DR. NETON: Essentially, what we received, what we learned is that SC&A's interpretation of how these badges were being used was correct, and that effectively invalidated our use of those control badges to bound the doses for the workers. And we had no other option, then, but to use the -- well, it made sense to us, then, that the model that SC&A had provided was the more appropriate one to use.

CHAIRMAN ZIEMER: Right.

And, SC&A, do you have any further comments on that?

DR. ANIGSTEIN: No, we're good. We're in agreement with the fact that Jim agrees with us.

CHAIRMAN ZIEMER: Yes, right.

DR. McKEEL: Dr. Ziemer, this Dan McKeel.

Can somebody please tell me why it is that we were not supplied with a copy of that correspondence?

CHAIRMAN ZIEMER: I don't know the answer to that.

DR. McKEEL: You can't possibly think that I'm not interested in that.

CHAIRMAN ZIEMER: No, and I wasn't aware that you weren't provided a copy.

DR. McKEEL: And I don't understand, also, you know, there are papers posted on Docket 140 and under this Work Group meeting on the DCAS website. And, you know, why was that paper not posted? Ted Katz wrote me that that was NIOSH's responsibility. So, I guess I would ask Dr. Neton that.

DR. ANIGSTEIN: Could I answer

that?

DR. McKEEL: No. No. This is really something for --

DR. ANIGSTEIN: No, no, but I have an answer. I would like to interject.

I prepared an update to the issues matrix which has been circulated to the Board, and I believe there is going to be a cleared copy that should be going out; it should have gone out already. And the body of Dr. Neton's email is copied right into the issues matrix. So, it is there for reference.

DR. McKEEL: I don't think that's sufficient. That's a separate communication from Dr. Neton. It wasn't to SC&A. It was a communication that went to the Work Group. Honestly, after all of this time and 50-plus papers, I think I should be considered a Member of the Work Group and get a copy of that.

Now the issues matrix, the PA-

cleared version, arrived in my email at 2:43 yesterday afternoon. And we really haven't had a chance to go through that. I wrote that to Dr. Ziemer and to all of you, actually.

But I still would like to hear from Dr. Neton why that clear-cut White Paper that was assigned, and he agreed to supply, wasn't posted and PA-cleared, put on the DCAS website, and given to me.

I mean, I would answer this in response to Wanda Munn. This is the reason there is an item in the administrative review that's been under review for the GSI SEC since May 17th, 2013. There is an entry in there about just this sort of thing, of NIOSH neglecting to send things, of what I regard as censorship. And I think it's personal.

So, anyway, I should ask it --

CHAIRMAN ZIEMER: Apparently, Dr. Anigstein didn't get a copy of it, either,

from what I have learned earlier today.

DR. McKEEL: Was he shown the matrix.

CHAIRMAN ZIEMER: And I don't know the answer to that. I assumed it had been distributed to everyone, and I certainly don't know why it wasn't.

Has that been remedied? Do you not have a copy of it, Dan? Or did Ted get you a copy of it?

DR. McKEEL: Well, we keep on talking about "it". I got a copy of the revised December the 18th, 2013 --

CHAIRMAN ZIEMER: No, I meant Dr. Neton's one interview.

DR. McKEEL: No, I have not gotten it.

CHAIRMAN ZIEMER: You never got that?

DR. McKEEL: I have not gotten anything from Dr. Neton, no.

DR. NETON: And this is Jim

Neton.

I honestly don't know why you didn't get a copy. My normal practice, when I send out material like this, is to copy both Ted Katz and Josh Kinman, and it gets through the system. I may have inadvertently not copied John Kinman on this, and that would be my fault and I will take responsibility for that. It was an oversight on my part, if that's what happened.

DR. McKEEL: Could you please send me a copy or have Josh send me a copy?

DR. NETON: Sure. We'll absolutely do that.

DR. McKEEL: Thank you.

CHAIRMAN ZIEMER: Okay. So, based on what NIOSH found out in talking to Dr. Yoder at Landauer, they have now proposed to use the limiting value that was proposed by SC&A rather than to rely on the use of the film badge data, as they had

previously planned to do. So, that was the bottom line on that.

Again, any questions, Board Members, on that?

MEMBER BEACH: Paul, this is Josie.

I don't have any.

CHAIRMAN ZIEMER: Okay.

MEMBER MUNN: No, nothing here.

CHAIRMAN ZIEMER: Okay. Okay. Now I would like to move to the issue resolution matrix. And let me point out that not only did Dr. McKeel only get this yesterday, the rest of us didn't get it until yesterday, either, even the uncleared copy. We got both -- at least I didn't get either one until yesterday.

So, I don't know, Board Members, if you have had a chance to go through it or not. Let me ask that question.

MEMBER BEACH: Paul, this is Josie.

I did spend some time looking at it yesterday and was very pleased with Bob's update on the Appendix BB.

So, thank you, Bob, for that.

DR. ANIGSTEIN: My pleasure.

CHAIRMAN ZIEMER: Let me point out a few things quickly. And then, I'll ask the Work Group to decide how they want to approach this.

Bob has added at the beginning of the document a timeline which covers all -- well, I don't know if it's all -- but many actions going back to 2007, including summaries of the various Work Group meetings and Board actions, and all of that relating to this. So, the first, let's see, the first seven-and-a-half or eight pages of this is that summary. And then, Bob also presented a kind of brief summary of the status of each of the issues.

I also want to point out to you, because there were 13 findings, that the

other thing that is included here is that the transferred issues from the SEC petition and those items that were not closed and were transferred to Appendix BB, those also appear in here. And let me point them out to you.

Under Issue No. 1 -- no, I'm sorry -- under Issue No. 3, on page 15 of the document, three SEC issues have been put in here. In SC&A's estimation, these three issues -- they were SEC 2, SEC Issue 6, and SEC Issue 8 -- are all part of this issue from Appendix BB. So, those show up there.

And then, on page 18, under Issue No. 5, SEC Issue 3 has been inserted as being part or the same issue in SC&A's estimation.

And then, on page 19, Issue 6 now includes SEC Issue 9, which has to do with beta dose or skin dose.

So, those SEC carryovers I inserted there. The only thing, Bob, that I

didn't see was what happened to SEC Issue 7.

DR. ANIGSTEIN: One second. One second.

(Pause.)

DR. McKEEL: Dr. Ziemer, this is Dan McKeel.

I have a note in the resolution of these issues that I sent that I said that SEC Issue 7 was --

DR. ANIGSTEIN: Apparently, it's not in here. Let's see now. What is that issue? What was the title of that issue? I have to go back and look at my SEC matrix.

DR. McKEEL: "Scientific Errors in Appendix BB to be Addressed by NIOSH".

CHAIRMAN ZIEMER: That one we agreed to, and it is basically closed, except for it has to appear in the revision. Is that the one you're talking about, Dan?

DR. McKEEL: No, I've got "In progress, SEC Issue 7, Scientific Errors in Appendix BB to be Addressed by NIOSH." And

then, I've got a parentheses "(not explicitly transferred to the BB matrix).

The issue I have is Issue 10. It was not closed and it should be listed as transferred to the Appendix BB issues matrix. So, I don't know.

CHAIRMAN ZIEMER: Well, that doesn't agree with what I -- I show Issue 10 as being closed previously, Issue 10 on the SEC findings.

DR. McKEEL: Uh-hum. Well, I took mine -- oh, I don't know. Okay. I think I took mine from the December the 5th, 2012 SEC matrix document, which is the latest one.

DR. ANIGSTEIN: Okay. Issue 7 is considered to be in progress by action of the Work Group.

DR. McKEEL: There you go.

DR. ANIGSTEIN: And I don't believe it was formally transferred.

CHAIRMAN ZIEMER: Oh, well, okay.

DR. ANIGSTEIN: Only certain issues were transferred. Not every --

CHAIRMAN ZIEMER: Right, right.

DR. ANIGSTEIN: It was the Work Group that decided on transference.

CHAIRMAN ZIEMER: Seven was NIOSH had already agreed to make the correction in Appendix BB. So, although we didn't officially show that as closed because they hadn't actually done it, that one is, for the Work Group, we're done with that one. Because in terms of the terminology that's used by the Procedures Group, that's in abeyance, which means that it's done, but we hadn't seen the actual correction yet in the revision because the revision has not appeared.

And my records showed that Issue 10 from the SEC findings was previously closed.

DR. ANIGSTEIN: Correct.

CHAIRMAN ZIEMER: The ones that

were closed previously were 1, 4, 5, and 10.

DR. ANIGSTEIN: Uh-hum.

CHAIRMAN ZIEMER: Well, actually, 3 was closed also; 1, 3, 4, 5, and 10 were closed.

DR. McKEEL: I have that Issue 3 was there was lack of documentation and it was transferred as an SEC issue.

DR. ANIGSTEIN: Yes.

CHAIRMAN ZIEMER: Yes. And then, it actually does appear -- actually, Bob has it incorporated here. But, if you notice what it says in the document on page 19, it says, "The Work Group voted that this issue should be closed and moved to the Appendix BB issue matrix."

MEMBER BEACH: Paul, this is Josie.

What is the date of the very last matrix for TBD-6000 that you have?

CHAIRMAN ZIEMER: Oh, TBD-6000?

MEMBER BEACH: Yes.

CHAIRMAN ZIEMER: Not Appendix BB?

MEMBER BEACH: No, not Appendix BB, the ones that we transferred over to BB.

DR. ANIGSTEIN: Excuse me. Are you talking about the SEC matrix?

CHAIRMAN ZIEMER: Yes.

MEMBER BEACH: Yes.

DR. ANIGSTEIN: The TBD-6000 matrix has not been transferred.

CHAIRMAN ZIEMER: Oh, it's the SEC matrix? SEC? Or is this the TBD-6000 matrix? Which are you --

MEMBER BEACH: Okay. So, the SEC is where we transferred those over to BB, correct?

CHAIRMAN ZIEMER: Right.

MEMBER BEACH: Okay. What is the latest date of that one that you --

DR. ANIGSTEIN: December 5th --

MEMBER BEACH: December 5th? Okay.

DR. ANIGSTEIN: -- 2012.

MEMBER BEACH: I think it might be helpful if we updated that matrix with all the transfers and the closeouts.

DR. ANIGSTEIN: That's been done. The December 5th --

MEMBER BEACH: December 5th, okay.

DR. ANIGSTEIN: The December 5th version, the December 5th, last December 5th, lists, as Paul was reading, it lists on page, scrolling down, on pages 4 and 5, it lists every issue, and every issue is either closed or transferred. So, there is nothing more to be done with --

CHAIRMAN ZIEMER: And the ones that are transferred show up in Bob's document that we all got yesterday.

DR. ANIGSTEIN: Yes.

CHAIRMAN ZIEMER: But now what I'm asking, having identified those items as, in a sense, where those are, this new

document includes everything that has to be dealt with. What I want to find out is whether or not the Work Group is prepared to deal with this today or do you want to wait until the January meeting? And have you had time to look at these? That's what I'm asking.

Bob has entered new material. You will note that there are a number of items that SC&A recommends being closed, which means that they now agree that their issues have been resolved.

And Issue 2, 3, 5, and 7, 9, 11, and 12, they are recommending that those be closed. And then, Issue 4, 6, and 10 remain open pending some things.

Again, what I want to determine is whether or not you want to act on these today. And I know that the petitioners have not had time to look at these, either. I guess they have not had. I know Dan indicated to me that he just got his

yesterday, which, of course, we all got it yesterday. And I didn't even see them until late, late in the evening because we were away.

But, in any event, what's your pleasure on these?

MEMBER BEACH: This is Josie.

We should probably wait until the January meeting to have more adequate time to look at these.

CHAIRMAN ZIEMER: Wanda?

MEMBER MUNN: Excuse me. I took time to go through the ones that were shown as not closed. I haven't paid any attention to the ones that were listed as closed on the status summary. So, I haven't even reviewed those, but have taken a look at everything that was marked either "in progress" or "open". And that's a relatively-small number.

I guess the question is how thoroughly do we actually want to go through

this. If we are going to look at the items that are shown as open, then that's, from my perspective, a possibility for today. But, certainly, Josie's sentiment is echoed as well, especially since the petitioner hasn't had an opportunity to go through this to their satisfaction. It seems to be rushing it a little bit for us to spend too much time with it today if the petitioner is not going to be happy with the opportunity to review it.

CHAIRMAN ZIEMER: John, what about you?

I'm not hearing him.

MEMBER POSTON: Can you hear me now?

MEMBER MUNN: Now we are.

MEMBER POSTON: Yes. I was in meetings all day yesterday, didn't see this until I came in the office this morning. So, I would like to defer it. I haven't had a chance to do anything with it.

CHAIRMAN ZIEMER: Okay. I think, based on that as well as the petitioners' concerns with having a chance to look at this, we will defer it.

And I'll ask Ted this. Ted, I think what we would like to do at the January meeting, we will have a chance to get the rest of the external dose information, the neutron runs, which SC&A is going to provide their figures for NIOSH, and they can cross-check those.

And then, we can focus on these, all of these. Well, the focus would be on the matrix then, assuming that we can get through Joslyn. We've got to do the Joslyn first. But I think, based on what LaVon said, we should be able to get that done within an hour, I would think.

MR. KATZ: Okay, Paul. So, anyway, I'll put Joslyn first on the agenda. So we can get through that. And this will be second up, and we'll do the best we can

to get through this as well.

CHAIRMAN ZIEMER: Okay. Is that agreed then? Everybody okay with that?

MEMBER BEACH: Yes.

CHAIRMAN ZIEMER: Okay. The overwhelming deliverables now are for SC&A to provide the rest of that external dose information to NIOSH. So you guys can compare the numbers, right?

MR. KATZ: That's correct, Paul. And that shouldn't be a problem. I've already chatted with Bob about this.

DR. ANIGSTEIN: And at the same time, I'll make a final update to the matrix to incorporate that information.

CHAIRMAN ZIEMER: Okay. Okay. Very good.

Let's see. Now the other thing here, we have already had a fair amount of public comment, but we do have that on the agenda.

Dan, do you or John have any

additional comments you want to make at this time?

DR. McKEEL: This is Dan. Can you hear me, Dr. Ziemer?

CHAIRMAN ZIEMER: Yes, I can.

DR. McKEEL: Oh, okay.

Well, I had some remarks that relate to things other than -- I've given my remarks about Dr. Neton's review of NYO 4699. I did have a couple of other comments, if I may make them now, please?

CHAIRMAN ZIEMER: Of course. Sure.

DR. McKEEL: Okay. I just want to comment that I understand that the Work Group is using Live Meeting, and I also understand that Live Meeting is available to the public and petitioners for regular Board meetings. And I wonder if it would be possible to request exploring the possibility of adding Live Meeting, being open to the petitioners who participate in

Work Group meetings. And that's just a comment. No answer required.

I appreciate deferring the Appendix BB update to January, and I concur. And I would feel much better. I would like to read it.

I think it is very important to go through the issues that SC&A recommends closing because they're not closed now. And that means there's been no discussion on that. I think we have got to go through each issue and discuss it and, then, close it or resolve it.

I just have a couple of comments about the three White Papers this morning. I know we have been through those in great detail.

But the two things are, really the main thing is I wanted to point out that, although the skin dose is calculated for one type of steel at GSI, we have testimony from [identifying information

redacted], who was their Chief Metallurgist, that they used many, many different types of steel at GSI, all of which had a distinct composition.

So, just so everybody understands, there certainly is no evidence that this model of steel is bounding to all the other types of steels. And, in particular, one component that is important is the high-nickel steels. And so, that's just an issue and a comment about that particular paper.

Probably the most important thing that I wanted to bring out is that I am assembling a new White Paper, trying to draw together all the information about the film badge issue at GSI because it seems to me that's going to be central for Appendix BB Revision 1, to see how that's handled.

And as I looked at it, there are at least 10 different sources of film badge data, including the Landauer dataset I

received. There are Landauer datasets that NIOSH and SC&A have reviewed. There are film badge records that GSI individual people have shared with us. I have seen data from five different people, and I want to review that in this paper.

But one of the themes that is common in all those papers, and looking back as far as the very important meetings that were held by this Work Group on November the 10th, 2008 and October the 14th, 2009, those two meetings dealt heavily with the film badge issue.

And it's quite apparent that all of us had the same problem, which is, in particular, the 1964 GSI film badge records, which are pretty important for the operational period, were difficult to read. Bob Anigstein noted that he had much trouble. He had to get a better copy from NIOSH, and they supplied that to him. All of the film badge records that I have seen -

- and like I say, that includes the 30 annual doses that I got from Landauer plus individual records from five people -- have problems with readability of the data. And so, I certainly we can address that.

As I looked through all those previous reports, even though there are details back in the 2008-2009 papers about the number of weekly badge reports, nobody clearly states the percentage of all those records that were not readable. There are some comments that you can make inferences on what some of the unreadable badges must have said, some assumptions, but I'm not sure, at least to me, that that's good enough.

But the main thing that I really want to bring to the attention of this group -- and I'll save it for the paper -- but in the records from [identifying information redacted], who is the gentleman who was kind enough to share his 1962 report that shows

the 18 quarters of data, of film badge data, that he received, that set of reports, he gave us eight different reports. That set of reports is on a different form than Landauer. They are not Landauer film badge reports. They are AEC film badge reports.

And if you look at that whole dataset, there are some glaring, glaring discrepancies between the Landauer reports on the same gentleman, who we have recently gotten through a Privacy Act request, and his GSI film badge reports. Mainly, that in the Landauer reports for years 1966 and later, [identifying information redacted] got doses at least of M. And in the very late years, '72, '3, and so forth, some of his values were slightly elevated above the M level.

Whereas, in all his GSI reports for 1966 through '69, which are the ones he has, plus '64 and '63 and '62, he's missing '65 from his own personal data reports and

he's missing '64 and '66 from the Landauer badge reports that NIOSH sent to him.

But, anyway, for the years 1965 through '69, his dose is listed as none -- none -- zero. And what that means is that, apparently, GSI was not counting his minimal detectable level dose of 10 millirem per week after 1964. It appears they were counting that dose up to 1964.

So, it just seems to me that that whole set of reports marked AEC -- one is for Nuclear Consulting Corp., and so forth -- that that set of reports is so different from the Landauer reports that it really calls it into question as far as its validity.

And I'm not going to try to go into it today because there's not time, but I'm going to put that in a carefully-constructed White Paper. And I really ask you all to please read that paper. And I would like to make that a focus. I wish the

paper could be responded to by both NIOSH and SC&A. I think that would save us a whole bunch of time because those issues still need to be clarified, and they will come up when the Appendix BB outstanding issues are resolved.

So, anyway, I would appreciate it if you all would stand by for that and read and act upon it when we get it. I guess that will be sufficient for me to say for today.

And I appreciate your all allowing us so much time to vent our concerns.

MR. KATZ: Paul, are you still with us?

DR. McKEEL: Hello?

CHAIRMAN ZIEMER: I'm sorry, I was still on mute.

(Laughter.)

Yes. So, I was just thanking Dan for his comments, and we will look forward

to getting that paper from him.

DR. McKEEL: Thank you, sir.

CHAIRMAN ZIEMER: Let's see. Well, we have already discussed what we need to do on different things.

And then, preparing for the January Board meeting, Ted, we can actually do that after our next, after the January teleconference, right?

MR. KATZ: Right. Exactly.

CHAIRMAN ZIEMER: So, we will defer that to our next meeting.

MR. KATZ: Right.

CHAIRMAN ZIEMER: So, I think that concludes our agenda for today.

I thank you all for your participation and wish everybody happy holidays.

MR. KATZ: Yes, happy holidays to everyone.

And thank you all for your participation.

CHAIRMAN ZIEMER: We are adjourned.

(Whereupon, at 12:41 p.m., the meeting was adjourned.)