US Department of Health and Human Services
Centers for Disease Control

National Institute for Occupational Safety and Health

Advisory Board on Radiation and Worker Health

Work Group on Carborundum Company

Tuesday, December 4, 2018

The Work Group convened via teleconference, at 10:00 a.m. Eastern Standard Time, Genevieve Roessler, Chair, presiding.

Present:

Genevieve S. Roessler, Chair
Bradley P. Clawson, Member
R. William Field, Member

Also Present:

Ted Katz, Designated Federal Official
Nancy Adams, NIOSH Contractor
Robert Anigstein, SC&A
Robert Barton, SC&A
Joseph Guido, MJW Technical Services
Jenny Lin-Naylor, HHS OGC
James Neton, NIOSH
Mutty Sharfi, ORAU Team
Matthew Smith, ORAU Team
Thomas Tomes, NIOSH
Richard Traub, ORAU Team

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Proceedings

(10:00 a.m.)

Welcome and Roll Call/Introductions

Mr. Katz: So welcome, everyone. This is the Advisory Board on Radiation and Worker Health.

This is the Carborundum Work Group, and today we are dealing with trying to largely, at least, if we don't completely wrap up the Site Profile reviews by SC&A and the Work Group, and the materials for today's meeting are posted on the NIOSH website under this program's portion of the website schedule the meeting with today's date, so anyone on the line can go there.

All the background documents related to today's discussion are posted there, I checked already, as well as one of the SC&A reviews, a presentation on that by Bob Anigstein, and that's also posted, and I want to thank the folks that work for DCAS for getting that up so quickly with really basically no time to do it, so that's great.

Okay, so we're talking about a specific site so we should address conflict of interest for my Board Members, Board Members, you know, by definition don't have a conflict interest if they are on a Work Group for that Work Group.

And as far as attendance, the Chair in this Work Group is Dr. Gen Roessler and she is present as well as members Brad Clawson and Dr. Field, Bill Field, they are all present.

So let's go on to roll call for the NIOSH ORAU team.

(Roll call.)

Mr. Katz: Just remember everyone mute your phones, *6, mute your phones, *6 to come off of mute to get in the group, and, Gen, it's your meeting.

Chair Roessler: Thank you. Well our last Work Group meeting was March 13, 2017, and so I have asked Tom Tomes if he would give us a brief summary of the status of everything so we'll all be up to date, and Tom agreed.

Status Summary - Tom Tomes

Mr. Tomes: Okay. Good morning, everyone. I just had to briefly refresh my memory on Carborundum. It's an AWE. Carborundum is in Niagara Falls, New York.

They have two operational periods. The first -- excuse me for a second. The first operational period was a 3-month period in 1943, and during that period they did some experimental grinding on uranium slugs with a centerless grinder.

That was completed at the end of September, and those slugs were shipped offsite, and that was followed by a residual period.

The second operational period for Carborundum is from 1959 through 1967. During that period Carborundum did experimental work with fuel pellets, mixed carbide, plutonium, uranium. They developed a method to synthesize the compounds, and they produced a number of pellets for use in the radiation experiments at other sites.

NIOSH received an SEC petition, Petition Number 223, for the period of 1943 through 1946. NIOSH prepared an Evaluation Report, and it was presented to the Board in July of 2015.

NIOSH determined that dose reconstructions are feasible and therefore recommended that its petition for an SEC Class be denied. At that time the Board referred the petition to the Carborundum Work Group and tasked SC&A with reviewing the petition and the NIOSH Evaluation Report.

That was followed by a report from NIOSH in January of 2016. That report listed seven SEC findings.

Subsequently NIOSH responded to those findings, and the Work Group held two meetings to discuss those findings and ultimately referred back to the Board to recommend -- agree with NIOSH and recommend that that the SEC be denied.

All of the seven issues identified by SC&A were either closed out by the Work Group or considered Site Profile issues for further evaluation. Subsequently to that meeting SC&A provided more in-depth reviews of the example dose reconstructions that NIOSH provided, and that was issued to the Work Group in June 2017, and those findings are the subject of a White Paper that NIOSH issued in October -- August 16th.

And that basically is just a brief summary of what got us to the current meeting. There were a number of Site Profile issues that we have discussed and posed, and what I have done in the August 16th paper is I provided a comprehensive list of all the issues in Appendix 1, and I am showing the status of each of those issues, and most of those issues have been closed out, but they do require -- most of those issues do require some kind of modification to the Site Profile, which will be completed after we resolve all of the findings.

And also in that paper are nine open issues which I have listed in Table 1, and I believe that is one of the items on the agenda that Dr. Roessler presented. And, Dr. Roessler, if you want we can go through these issues one-by-one or whatever you prefer to do.

Chair Roessler: Okay. Thank you, Tom, that was a nice background summary. On the agenda we listed the discussion of the fuel pellet work first and then the Site Profile issues.

Would it make more sense to start with the Site Profile issues, which certainly includes the pellet work?

Mr. Tomes: To me it would simply because from reading Dr. Anigstein's response to our resolution paper, I believe there -- other than the pellet work I believe the only issue that we have disagreement on currently is a relatively minor issue that I believe we can resolve.

Chair Roessler: Okay. I think probably that's what we should do is go through briefly the two papers on the Site Profile work, and I am wondering how do you want to do that.

In the past, Tom, what you have done is left it up to SC&A to summarize them, or what is your preference on it?

Mr. Tomes: That is fine with me. That sounds very good. I can contribute as needed, or if you'd rather me go through them I can do that as well.

Chair Roessler: Okay. Is SC&A prepared to do that, or how do you want to handle this?

Dr. Anigstein: Whatever is your preference.

DCAS "Resolution of Site Profile..." paper and SC&A review

Chair Roessler: Okay, Bob, I think it would work best if you go through your summary of the nine unresolved Site Profile issues, and if you do that then people can refer to that paper.

It's on the website, and it's the one that -- I'm looking which one that you prepared. It was prepared on November 28th.

Dr. Anigstein: Okay. Okay, so I'm just reading this -- reading from my memorandum of November 28th. And we first went through, what I did first was went through the issues listed by NIOSH.

Actually give me one second. This is not the order I was prepared for so just one second to get my papers out.

Okay. Well the -- sorry. Ah, here we go. Okay, what caught my eye first of Tom Tomes's paper dated August (telephonic interference) Attachment A listed all of the issues.

There were 17 (telephonic interference) for each issue. This is on Page 9 of the August 16th NIOSH paper, listed the issue, the report it was referenced to, and the status.

And the status in each case was that it was -- so the 17 issues were closed as SEC issues, removed them or closed altogether, others were left open as Site Profile issues.

That was -- that appendix actually (telephonic interference) entry point. And then skip over to Table 1 in the main body of the report which lists --

(Simultaneous speaking.)

COURT REPORTER: I'm sorry to interrupt, this is the court reporter. Mr. Anigstein, hold on one moment please. Is anybody else's sound dropping out from time to time?

Mr. Katz: Not here. Not here, it's been consistent to me.

COURT REPORTER: Okay.

Mr. Katz: This is Ted.

COURT REPORTER: All right. I guess I would recommend just continuing. I am not sure if something is happening on my phone connection or --

Mr. Katz: Well do you need to cut off and re-join or --

COURT REPORTER: Yes, I can certainly try that.

Mr. Katz: Why don't you try that before, because --

COURT REPORTER: I'll just re-join in one moment.

Mr. Katz: Yes, thanks. Sorry, Bob. Let's just --

Dr. Anigstein: Sure.

Mr. Katz: We need to be recorded.

(Whereupon, the above-entitled matter went off the record at 10:12 a.m. and resumed at 10:13 a.m.)

Mr. Katz: Okay, go ahead, Bob.

Dr. Anigstein: Okay. So the first of the Site Profile issues as opposed to SEC issues was the dose from x-ray diffraction and the x-ray diffraction apparatus and SC&A, myself, actually, interviewed one of the workers who had done x-ray diffraction.

His name was actually furnished by one of the other workers that NIOSH, that ORAU had interviewed, and we followed up with -- I guess this person was interviewed three times.

I called him first back in I think 2016, 2015, probably, and then the ORAU team called him to verify or get expanded information, and then I had one more talk with him last year.

And the issue was how much time, to get a time in motion sense, of how much time did he really spend at the apparatus, and the latest information was that he spent about five minutes per exposure, and there were I forget how many exposures a day, maybe half a dozen exposures a day, and then -- because sometimes he would, basically he wouldn't leave immediately, he would hang around, but he realized it was a radiation hazard so if it wasn't necessary he stayed away.

At any rate, SC&A recommended a longer exposure duration during the year than NIOSH originally had used, and NIOSH concurred with that in light of the interview information.

And then they also agreed, NIOSH also agreed to apply a factor, a correction factor, this was a -- Joel

Lubenau, I think his first name was Joel, had published a paper in Health Physics in 1969.

He was with the Pennsylvania Department of Radiation Protection, or some similar name, and he had measured 2 mR per hour at the edge of the table of the x-ray apparatus.

And then there was a -- the following year there was a conference sponsored by the U.S. Department of what was then called Health Education and Welfare, Public Health Service, Bureau of Rad Health, that was the predecessor of EPA, and first of all it was generally agreed that there was a hazard potential from the x-ray diffraction apparatus.

That was the whole purpose of the conference, x-ray diffraction apparatus, x-ray spectroscopy, and there was a -- one of the speakers was named Els, E-L-S, and he described that in measuring these low energy x-rays coming out of that apparatus, the scattered beams, the conventional apparatus, the ionization chambers would under-report the dose, and consequently he recommended a correction factor of either 2.42 I think or 2.48 depending on the particular instrument used.

And so we proposed that this, the measurement made by Lubenau, be subjected to this correction factor, so instead of 2 mR per hour it was more like 5 mR per hour, and NIOSH agreed with that.

And so the final calculation, I won't go into all the numbers, basically we were in agreement with the dose. NIOSH was initially using a higher dose, a lower dose rate but a higher dose conversion factor in the traditional 30 to 250 keV, recommended that this should be really under 30 keV because it's low energy, and NIOSH came back and said, well, let's go all the way down to 10 keV because that is the lowest listed in the ICRP Publication 74 which gives the organ dose conversion factors and since the radiation is really between 8 and 8.9 keV the 10 keV dose conversion factor will be the appropriate one, and we

are in complete agreement with that.

So this issue is closed. I mean we --let me restate that. SC&A recommends that this methodology be incorporated in the site, covered on the Site Profile, and once it is incorporated the issue should be closed. So it's up to the Work Group, the Board, to decide whether it actually is closed.

Chair Roessler: Okay. Thank you, Bob. Does the Work Group or anybody have any questions on this item?

Member Clawson: Gen, this is Brad. No, I don't. That sounds good to me.

Chair Roessler: And, Bill, how about you?

Member Field: Oh, that sounds good, yes.

Chair Roessler: Okay. Bob, then I would recommend -- we'll go through these one at a time, but you have a lot on your plate today to discuss, and we don't want to wear you out.

I am going to recommend that you summarize it, don't give all the details perhaps. If somebody has questions -- hit the major items, and then if people have questions they can come back and ask.

And they also have the papers, so with that let's go on then to Item Number 2.

Dr. Anigstein: Okay, yes. No, my voice is okay, I just have a little phlegm in my throat occasionally as you can hear in my voice.

The Item 2 is the use of the -- okay. Oh, yes, that's the description of the uranium source term where actually initially we thought that the source term adopted by NIOSH was too conservative because it was on a large piece of metal which was larger than the amount of uranium that was actually on site at any one time.

So we recommended that they use a flat plate, which is one of the uranium shapes that was analyzed, I believe it's Table 6.1 in TBD-6000, the dose rates from different shapes, and this was the one that was the right mass and it was a flat -- so per unit mass it maximized the dose and NIOSH agrees with that.

So that issue SC&A -- oh, and there was a second issue. There was agreement on the photon dose. There was a second issue on the beta and skin dose, and SC&A did some MCNP calculations using the data for the -- from that shape metal to see what the dose would be at contact and at a distance of one foot, and we came up with 77.6 millirem per hour at contact and 4.05 millirem per hour at a one-foot distance.

We shared our MCNP calculations with NIOSH. They examined the calculations. They accepted them, and, again, we recommend that this be closed given that we have agreement.

Chair Roessler: Okay. Any questions on this item, Item Number 2? And I think we'll go through all of them and then we'll go back and see if we can come up with a motion.

Mr. Katz: No, Gen, you don't need to. I mean if there is no questions in agreeing why don't you just close them one by one. You've already closed number one.

Chair Roessler: So we've closed number one, and if there is agreement then we'll close number two.

Member Field: Sounds good.

Chair Roessler: We'll do it unless there is an objection. That will move --

Member Clawson: Yes, I agree with that. That's fine.

Chair Roessler: Okay. Thanks, Ted. Okay, Bob, then on to Number 3.

Dr. Anigstein: Okay. On Number 3 there was simply -- or probably an error in the spreadsheet because

there were different work hours for different scenarios.

In some cases it said 2400 hours, another case it said 2500 hours for a year. And then later years TBD-6000 indicates that in the early years 48 hour work weeks were common, people worked six days a week.

And then somewhere around 1951, if my memory serves me, the convention was to have 44 hours, five weekdays and a half day on Saturday, and then after 1956 it was down to a 40-hour work week.

And those hours had not been followed in the NIOSH calculations, however, so this was our finding and NIOSH agreed. They said they updated all Site Profiles to agree with the work hours in Battelle TBD-6000.

So this is -- we are in agreement with that resolution, and we recommend that the issue be closed.

Chair Roessler: Okay. And if there are no objections with that then we can move on to Number 4.

Member Clawson: I'm good with it, Gen. This is Brad.

Chair Roessler: Okay. And I don't hear anything from Bill so, Bob, you are ready for Number 4.

Dr. Anigstein: Okay. Number 4 was the type of probability distribution used for external dose within an example DR for 1959 and 1960, and NIOSH attributed this to an error in the Site Profile spreadsheet, and SC&A recommends that once this error is corrected the issue should be closed.

Chair Roessler: Okay. Any objections?

Okay, then Number 5.

Dr. Anigstein: Okay. Number 5 is the unresolved issue. This is the source term and glovebox model to model the dose from plutonium in the glovebox, and

this remains open because we found problems with their analysis, and this would be a second, you know, a separate agenda item.

Chair Roessler: Yes, okay, so I think what we will do with that is we will just hold that for discussion after we get through the rest of these nine issues if that's okay with everybody.

Dr. Anigstein: Yes. Okay. Then Item Number 6 there was a disagreement and also perhaps a misunderstanding of how there -- we have data both on plutonium and on uranium air samples taken in the 1959-1961 time span, and this was done -- we have the original air sampling data in the SRDB recorded by the Health and Safety Laboratory, commonly referred to as HASL, of the United States Atomic Energy Commission.

This is sort of, if I can, an ad hominem argument. What happens is that the person doing this work -- whose name appears, I'm not sure if I'm supposed to mention -- I won't mention his name for privacy.

But a person whose name appears on this sample sheet is well known to, at least, to a couple of SC&A people, who has gone on, this is from 1959-1961, he has gone on to have a career in radiation protection and health physics and was undoubtedly in our opinion a competent worker for his task.

And so the conclusion is if he thought that the uranium and plutonium were co-existing in the same place then he most likely would have at his discretion made the measurements for both radioisotopes at the same time.

The fact that he didn't and that he on the same day sampled uranium and plutonium, a short time period apart, maybe 20 minutes apart, in different locations indicates that the uranium and plutonium are most likely not commingled.

We first thought, well they could be commingled

because the fuel pellets in this uranium facility were actually 80 -- for the actinide elements it was 80 percent uranium and 20 percent plutonium, but that's by mass.

And if you consider the difference in the specific activity, the activity, the dpm of the plutonium would totally overwhelm the uranium, so the uranium would be a very minor contributor.

So I think it's pretty safe to say that if you assigned the dose from plutonium that becomes a limiting pathway. There really didn't seem to be any need to assign, assign -- using the dose from uranium.

They could do as NIOSH -- and especially since there was -- in Tom Tomes paper, something I hadn't seen before, was that NIOSH planned not only to use the plutonium and uranium readings but to actually assign the dpm and then call it plutonium or uranium depending on which gave the highest dose, and so that is definitely claimant-favorable.

Then SC&A has no objection and concurs with the NIOSH solution to give the highest reading, the highest dose from -- based on the sampling data and call it uranium or plutonium, whichever is the highest.

So we concur with their, the originally, perhaps it was not fully explained what they planned to do, but we concur with that, and we recommend that it be closed.

Chair Roessler: Okay. Thanks, Bob, that sounds pretty convincing to me. So if there are no objections then we will move on to Number 7.

Dr. Anigstein: Okay. Number 7 was at the intake category, oh, it was going back in the example DR. The intake category, which means the type of uranium, or three possible classes of uranium which is slow, medium, and fast, depending on how fast it's cleared from the lungs, and they had assigned a fast

class in one case which is just not something that happens in the workplace.

So actually it resulted in a higher dose, but we thought it was -- called this an error, and NIOSH agreed there was an error, and we recommend the issue be closed.

Chair Roessler: And I assume that NIOSH agrees that they will fix the error?

Mr. Tomes: This is Tom. The error I believe was actually in the intake category of the worker, and this was definitely in our draft example DR. It has -- our example did not agree with our methodology, so it was just the draft example DR, and so there is nothing left for us to correct on that.

Chair Roessler: Okay.

Mr. Tomes: Just acknowledge that SC&A is correct.

Chair Roessler: Okay. If there are no objections, then let's move on to Number 8.

Dr. Anigstein: Yes. Number 8 was the external dose, the external dose in the residual period from the contamination on the floor. Oh, yeah, this becomes more of a philosophical issue.

The routine procedure for DCAS has been to assume from uranium that all the radiation is in the 30 to 250 keV energy range because that usually results in the highest doses to any given organ. However, and they were assigning that for the residual radiation from the floor. However, there is explained in the TBD-6000 that only -- let's see. I am at a slight disadvantage because I wasn't prepared to go in this sequence so I'm having to read -- reread what I did.

That most of the radiation comes in the 10 to 30 keV range, and there is a breakdown given. I think it was 78 percent -- and there was a table which lists, yes, Table 3.10, that lists the radiation levels, the exposure rate, from the floor in terms of, you know,

per dpm, per square centimeter, but it has the observation below how much of it is in each energy range, and the vast majority of it is in the low energy range.

So if you apply the dose conversion factors for that energy by energy range you come out in this example that was I believe the organ, the example DR, the hypothetical cancer was cancer of the kidney, and the dose to the kidney would only be one-third of what was assigned by NIOSH in the example DR if you break down the three energy ranges, the 10 to 30, 30 to 250, and then above 250 keV.

And the response was, well, NIOSH does this to simplify the calculation and -- besides it doesn't make much difference because the total contribution of this pathway, the residual period, in this particular example DR was only a small fraction of the total dose, and we agree with that, but since this is an example DR, this should be used for other cases where maybe the major contribution is during the residual period. Now, again, the residual period at Carborundum does not result in a very high dose.

I am counting only 36 millirem during the whole period so that hardly makes a difference in the final analysis, but it sets a precedent, and we have observed this for other Site Profiles, by the way, that if there is a statement in the TBD-6000 about the breakdown of energies, then this is what should be used in the dose reconstruction, and if it is not to be used then either they should, I mean either it should be used or if it's not to be used then NIOSH should issue some kind of a procedure or a TIB, T-I-B, or something saying never mind what it says there, we always should do the 30 to 250, because otherwise you could have inconsistency.

One dose reconstructor for one site could interpret this according to TBD-6000, another one could interpret it, well, this is normal and NIOSH policy. So we just feel that consistency is important even though it makes a small difference in this instance.

Chair Roessler: Okay. So what you are proposing is that either approach would work, and would NIOSH care to comment on that, what approach they would plan to use?

Mr. Tomes: This is Tom. We have briefly looked at this and discussed this some. I believe the best solution to this is to revise our draft methodology to agree with the comment by Dr. Anigstein.

He is correct in what the TBD-6000 photon ratios are specified to be and there are some other issues, such as the radiation effectiveness factors that tend to offset some of the differences. However, I believe the best solution is simply just to agree to the photon split from TBD-6000.

Chair Roessler: Okay. Then if we want to close this issue, Bob, do you have any comments on that, would that be --

(Simultaneous speaking.)

Dr. Anigstein: That would be fine.

Chair Roessler: Yes.

Dr. Anigstein: That would be completely agreeable.

Chair Roessler: So speaking for SC&A would you with that information then agree to recommend to close this issue?

Dr. Anigstein: Yes.

Chair Roessler: Okay. Are there any questions from the Work Group or anybody else?

Okay, then let's move on to Number 9.

Dr. Anigstein: Okay. Number 9 was that there was a slight roundoff error I will call it in applying the TIB, the OCAS-TIB-009 in how to calculate -- TIB-009 has a detailed prescription of how to convert the air concentration to ingestion rate, and then the method was basically a roundoff to use a simpler factor, and

there was a difference, if I remember correctly it ends up to a difference of about -- an underestimate of, what, 4 percent, if my memory serves me, and the response, NIOSH's response was they updated the spreadsheet and resolved that comment. So if that is the case then we recommend closure.

Chair Roessler: Okay. Any comments on that one?

Member Clawson: Well I didn't quite understand that one. Bob, just now what did it take to rectify this one?

Dr. Anigstein: I don't have the numbers right in front of me because it's a summary. The issue was how to -- I think they used a multiplier of the air concentration to get the ingestion rate, and there was a more detailed procedure in TIB-009, and there was sort of a shortcut taken.

Tom or Jim, perhaps you could have a clear memory of this because I didn't write this out in detail. I just made a quick calculation on this.

Mr. Tomes: Yes, this is Tom. I didn't look at my equation specifically to prepare for this meeting, but what it amounted to, there are -- the ingestion dose is a very insignificant portion of the total dose and an insignificant portion of the internal dose.

And there are ways to account for work hours and et cetera and do these ingestion calculations, and an abbreviated calculation was done, that when we looked at it did indicate that there was a very, very slight underestimate of the ingestion so I have modified the spreadsheet to correct for that.

Member Clawson: Okay. I'm sorry, I just didn't quite understand that one, the number changes. That's fine with me. I have no problem with that. Sorry, Gen.

Chair Roessler: That's okay, Brad. That's what we are doing here. So, Bill, any questions on that one?

Member Field: No. Thank you.

Chair Roessler: Okay. So thank you, Bob, for going through all of those. At the bottom of your paper under conclusions you say that NIOSH has successfully addressed and resolved all but two issues, but I think what we are now is down to just the one issue.

Dr. Anigstein: Correct.

Chair Roessler: And that is the one, the doses from the external exposure to photons and neutrons from the fuel pellets. So let's make sure then that we have closed all eight issues, and then we can go on to the last remaining one. Everybody in agreement to that?

Member Field: Yes.

Mr. Katz: Yes, you've closed them all.

Member Clawson: Yes.

Chair Roessler: Okay. So then we have the two companion papers dealing with the fuel pellets, and I'll get mine out here. I am wondering, Tom, is the plan -- or is it okay with you if Bob goes ahead and makes his PowerPoint presentation and --

Mr. Tomes: That works for me.

Chair Roessler: Okay. And then we'll go through that, and then we'll address questions as they come up or when he finishes.

Dr. Anigstein: Okay. I'll have to pause for a moment because I had my screen ready and the CDC laptop logs you out if you haven't been active, so I just need to --

Chair Roessler: That's okay, we have time.

Dr. Anigstein: I need to put it back on the screen so it will take about a minute.

Chair Roessler: Okay. While he is doing that then I'll point out that we have these two companion papers to go along with that, the one from NIOSH dated

August 3rd and the one from Bob dated November -- make sure I'm on the right one -- 27th, and we have Joe Guido standing by to help us on the NIOSH approach if necessary.

Dr. Anigstein: Okay. Can everybody see my screen? Hello?

Chair Roessler: Yes. Hi, Bob. I am following from your presentation. I am not watching that. I --

(Simultaneous speaking.)

Dr. Anigstein: No, no, this is the -- I'm putting up my --

(Simultaneous speaking.)

Mr. Katz: Yes, Bob --

Dr. Anigstein: -- slideshow in Skype.

(Simultaneous speaking.)

Mr. Katz: Yes, Bob. Bob, yes. Yes, Bob, it does show on Skype. I don't know who is using it, but, yes, it shows.

Dr. Anigstein: Okay. Let me give a brief history of this issue. When NIOSH put out and Tom put out the first report on the SEC -- response to the SEC petition, this is back in 2015, there was a report given to the -- at a full Board meeting that summer, and it was accompanied by a report on the MCNP analysis of the plutonium fuel pellets being handled in a glovebox.

This is one of the two external exposure sources during the second operational period. The first one was that uranium bar that was discussed a few minutes ago.

And we examined the NIOSH MCNP analysis. We performed our own analysis using a -- we changed the source term, our -- yeah, we changed the source term, we changed the geometry, the distances of the

worker from the fuel pellet, and we came up with somewhat higher doses.

So then -- and we -- you know, there was an exchange of discussion about it, and the -- ORAU subsequently performed a new analysis which we received the paper from Guido, and, sorry, I forget your first name --

Chair Roessler: Joe.

DCAS "MCNP..." paper on plutonium/uranium fuel pellet work and SC&A review

Dr. Anigstein: Mr. Guido. In August. Then we got the MCNP files and supporting information in October, then it was a little while before we got around to doing this, and the first thing we observed was that the doses were now not only higher than before but considerably higher than our analysis.

So I am going to just focus on the photon dose because as you can see from the slide it's well in excess of the neutron dose, so that's the major -- not that the neutron can be neglected, but also much of the comments that apply to photons were also apply to the neutron analysis, so I won't single it out.

So you can see here that the photon dose at a distance of one foot from the fuel pellet, the way both NIOSH and SC&A did this there was a limitation. One, there was a rule in effect for criticality reasons, that not more than 100 grams of plutonium can be handled in any single process.

So we assumed that they would have enough plutonium pellets -- 20 percent plutonium, 80 percent uranium in terms of the metal and then 95 -- .95 carbide to make a uranium-plutonium carbide compound.

So both NIOSH and SC&A assumed we'll just calculate the dose from a single pellet, so rather than worry about the geometry, and then multiply it with a conservative assumption, multiply it by the number

of pellets that it took to make up 100 grams of plutonium.

So seeing this large difference we started, naturally, scratching our heads, I'm scratching my head, and wondering what could be the reason now. So the first thing we did was examine the input files, and this time around NIOSH chose to separately calculate the external exposure for 15 different radionuclides.

So plutonium and the other plutonium isotope -- all the plutonium isotopes that are likely to be in the plutonium fuel, and also the uranium isotopes and also the decay products, that would be equilibrium or would result from the decay of these isotopes, and the most important decay product in terms of external dose is americium-241 because when you make plutonium you are interested in plutonium-239, which is, you know, that is a fissionable isotope, but you are also making other isotopes, including plutonium-241 which has a -- it's a beta emitter, it has a 14-year half-life, and it decays to americium-241 which among all of these nuclides is the one with the most gamma radiation.

It has a 59.5, I believe, keV gamma that is given off 36 percent of the time. So it is the predominant contributor to external dose, and both the -- examining the NIOSH spreadsheets that accompanied the MCNP files and also looking at our own input to the -- our own MCNP runs and just calculating the total energy of each contributor, in each case we concluded that americium-241 contributes just over 80 percent of the external dose.

So we focused the review figuring anything that applied to americium will apply to the others. And then we just -- normally this is redundant, but I just want to quickly go into the mechanics because we've always been talking about MCNP and everyone has agreed that this is a useful program, but we have never had need to go into the actual guts of how the program works, but in this case we do.

So here is just a little tutorial on the MCNP, this will remind us it stands for Monte Carlo N-Particle. It's a radiation transport code developed by Los Alamos National Laboratory and is being -- it periodically gets updated, every few years a new version comes out.

And what the Monte Carlo method does is here on the right -- is a generic photon source, a volume distribution, and we assume that it's uniformly distributed, but what the program does is it randomly selects in each iteration, and we run as many as two billion iterations, called histories, randomly selects a point in the source term, in the source volume, randomly selects a photon energy from the spectrum that is put in by the user, all of this is user-supplied information that goes into the code, and randomly selects the initial direction.

And then here it just shows the trajectories of the photons, three photons going through an absorber. In this case we just think of it as a glass plate on the front of the glovebox, and then there will be a receptor on the other side.

So all the code does in the way it is constructed it calculates the flux, the photon flux, it can be different particles, I mean, we're talking about photons. So if the photons per square centimeter of a given -- of each energy, with continual distribution of energy, and so MCNP doesn't know anything about dose, you have to teach it to do a dose.

So you collect the photons at a given point, and then through the user-supplied data it calculates -- it then can convert the photon flux to a dose.

And the conversion coefficient that NIOSH uses is, I mentioned this once before, ICRP Publication 74, which came out in 1996, I think. There are some changes going -- in store, but right now this is what NIOSH uses.

And according to the comments entered into the americium-241 input file, and it should be the same

for all the others, what NIOSH did is it took Table A.1 from this publication, and it took the converted coefficient, I am reading from the table for air kerma, kerma stands for kinetic energy released per unit mass, so it's a measure of the ionization of the air in free air, and it takes the radionuclides in this column, I combined the two columns, and I abbreviated, and I took out some of the extraneous, some of the columns are not relevant at this present time, and then for the given energy multiplies it by the ratio of the H*(10), that's one of the measures of radiation dose, ambient dose equivalent, to come up with a product.

However, this was unnecessary because in this case the same table a couple of columns over, I guess there is one column in between I deleted, gives you the H*(10) and is different than the numbers that NIOSH came up with because there is a later, and I don't know why ICRP chose to give that Table A.1 because there was an updated air kerma per unit fluence conversion in this column, the second column from the right.

And the footnote says in one case it was 1982 data and the other case it was 1995 data, which is the most current since the publication came out in 1996.

And this K-alpha is higher. So if you use that one, as ICRP did, you come up with a slightly higher conversion coefficient for the H*(10), and we calculated it both ways, ran, took the input file, the americium-241, NIOSH input file, everything I am talking about now is using the NIOSH input file with modification.

We simply changed -- switched to the conversion coefficient here in this last column, and uniformly, regardless of which type of dose calculation we are doing, it came out 2 percent higher.

So we considered that this -- we made that into a finding because this is not claimant-favorable. It's not using current science, and it's not claimant-

favorable. So that's -- I don't know if I should stop now and wait for a response?

Chair Roessler: I think we should probably stop now. This stuff gets, to my mind, pretty heavy. I wish, Bob, I had taken a course in Monte Carlo from you because you are a good teacher, but I think we probably have some questions at this point and comments. Do I hear anything from NIOSH?

Mr. Smith: This is Matt Smith with ORAU team. The comment I will make on Table A.1 is it is called out in the text of ICRP 74. I don't have the section number in front of me right now.

I believe it's Section 4.3.2, and Rick Traub might have the actual paragraph number to share. In that paragraph within the report text it calls out Table A.1 for use in conjunction with the following tables, which are A.2 through A.20, and those do happen to be the tables that are used on this project to generate our what are called external dose conversion factors that are in NIOSH Publication IG-001.

Certainly, Bob has identified the more recent data that are in Table A.21, but as far as a why was A.1 there at all and why was it used, that's my historical perspective on it, it's because of its call out in the text and its relationship to the DCF that the project does use.

Dr. Anigstein: Well the --

Mr. Smith: And I'll leave it to the Work Group and the discussion to follow as to the final path forward on this one.

Dr. Anigstein: Okay. My response to that would be the organ doses that are listed in IG-001 are not in question.

Mr. Smith: True.

Dr. Anigstein: This is simply how to get --

Mr. Smith: True. I was just giving a historical perspective on why, you know, the question originally was why is A.1 even there, and the reason is is it was called out by the authors of ICRP 74 for use with the subsequent tables.

And then the second question might be well why was it used in this instance, well, again, because of that pedigree of being called out within the text of the report for use.

COURT REPORTER: This is the court reporter, I apologize. Can anybody hear me?

Mr. Smith: All right.

COURT REPORTER: I'm sorry. I think I got disconnected just for a moment. Can we go back to Dr. Anigstein's response about the organ doses? It was just about one minute ago.

Dr. Anigstein: I said we're not discussing -- I just mentioned that the organ doses are not in question. I mean I'm not saying we should scrap IG-001.

Mr. Smith: And I -- I realize that. I am just giving a historical perspective again on --

Dr. Anigstein: Okay.

Mr. Smith: -- you know, why A.1 is there. If one steps back and wonders why did the authors of ICRP 74 include this table --

Dr. Anigstein: But at the same time --

Mr. Smith: -- that's the reason why, and then, number two, why was it used as part of the calculations here, again, Bob, probably because of historical pedigree. But certainly going forward, you know, if it's the Working Group's desire to use the more current data certainly that is something we can do.

Dr. Anigstein: Okay.

Chair Roessler: Okay. I am switching phones because I think mine is dead, if you can hold on just a minute here. Okay, somebody say something else and see if I can hear.

Mr. Katz: Can you hear us?

Chair Roessler: That sounds better, okay.

Mr. Katz: Okay.

Chair Roessler: Okay. So now I have to go back on my sheets. I think for those of us on the Work Group, I don't know if Bill and Brad are more familiar with all of this than I am, but I think we need a little more explanation, and I am wondering on the paper, Bob, you presented your slides, but on the paper what number are you on? Are you not --

(Simultaneous speaking.)

Dr. Anigstein: I am on Slide Number 4.

Chair Roessler: Pardon?

Dr. Anigstein: Are you talking about my slides or my paper?

Chair Roessler: Your paper.

Dr. Anigstein: Oh, I'm sorry. I am not -- I would have to -- one second. My paper it would be Finding 1, so it starts -- Section 4.1 it starts at the bottom of Page 2.

Chair Roessler: That's what I thought, okay. So you discussed 2.1 and you talked about the americium in Section 3.2, so now you are on the 4.1 --

Dr. Anigstein: Correct.

Chair Roessler: Okay. That's great because this gets pretty complicated.

Dr. Anigstein: Okay.

Chair Roessler: So --

Mr. Traub: This is Rick Traub. May I jump in here a little bit?

Chair Roessler: Sure.

Mr. Traub: Okay. Now Matt was saying that maybe I could elaborate a little bit on the ICRP. I am sitting here with ICRP 74 in front of me, and you want to at some point look at Page 36, Paragraphs 158 and 159, 158 talks about the different operational quantities and protection quantities, and then 159 goes on and it talks about units. In the last sentence of Paragraph 159 it says --

Dr. Anigstein: I got you, yes.

Mr. Traub: Okay. In addition so that the conversion coefficients for photons may be presented in a manner consistent with those for neutrons and electrons, i.e., in terms of particle fluence, and to provide as complete a database as possible for a variety of calculational purposes, the data can be transformed into conversion coefficients per unit fluence using the information of Table A.1 of Annex 2.

So it seems to be pointing, at least when I was setting up my tables I was looking at this as saying that use Table A.1 whenever you can, and that's what I did.

Dr. Anigstein: I see. I hear you, and I understand that, but nevertheless we feel that there is an alternative, and here are two alternative sets of data, and by statute, by the -- not by statute, by the Code of Federal Regulations, whenever there is a choice NIOSH is required to use the more claimant-favorable approach as long as it is scientifically valid.

In this case I mean two things, more claimant-favorable and also to use the most current data, and since the 1995 Hubbell and Seltzer paper is more current than the Hubbell 1982 paper, then that should be used in the present instance because there

is a choice and the choice should be the one that gives you the higher doses.

Mr. Katz: Bob, let me just intercede here for a moment. I am not disagreeing with sort of the sense of what you are saying, but actually there is no regulatory requirement, one, to use the most current science.

It's the program is committed to doing that and to advancing as it can, but that's not in real time, and it's not a regulatory requirement and --

Dr. Anigstein: Excuse me. I could quote, I mean I'm not going to do it at this moment, but --

(Simultaneous speaking.)

Mr. Katz: Bob, please. Bob, please, you don't need to quote because I wrote regulations and I am very familiar with what's there, but it is not a regulatory requirement.

It is an aim to advance the science as it can, but as it can may take years in some instances. And the other aspect of what you are saying to be claimant-favorable, again, it does not come to this level of detail about science matters where you have a choice between science matters if you are dealing with matters of uncertainty.

So I just want to be clear about that because those have sort of legal implications, and so I'm all good with whatever -- wherever this goes in terms of using the best science and so on, but these are not regulatory driven, what you are saying, and I just want to make that clear for the record. Thanks. You can go ahead now.

Dr. Anigstein: Okay. So any further discussion on this point, what was our Finding 1?

Chair Roessler: Well I wonder if we ought not come to a resolution on this. Is NIOSH saying that they want to stand with their approach and -- I guess we

need to hear more from NIOSH.

Mr. Tomes: Gen, this is Tom Tomes. I just wanted to ask Matt Smith a question because I had seen some discussion on this and what the actual difference is. I think Bob's paper had about a 2 percent difference. I just want -- have you verified what the difference is on the values?

Dr. Anigstein: Well the result there, if you look at the table here you have the K over phi here, and if you can see my mouse moving, the second column, and the K over phi here in the second from the right column, and at the lower energies the second one is higher, and the energies in these were the americium.

So for the americium I ran the MCNP using the identical input file changing only the conversion coefficients, and for each of the tallies it came out 2 percent higher for americium. I am not saying it will be the same for all radionuclides.

Dr. Neton: This is Jim. I think that this is a pretty minor difference that we are pointing out here, and I think there is a couple subsequent findings that --

Dr. Anigstein: Oh, yes.

Dr. Neton: -- much larger differences, and I think we're going to eventually end up agreeing that something needs to be done in those other two findings I think, so I wouldn't want to hold this up based on this one 2 percent difference.

We can certainly run it ourselves and try to reconcile which one we want to use, but I think we should hold this off, resolution of this until we discuss the other two because I am not ready to commit that we will use this or not at this point. I don't know what implications it has project-wide at this point.

Dr. Anigstein: Okay.

Dr. Neton: I mean I don't know that I want to commit

the -- a 2 percent change that's going to affect everything we've ever done, I don't think so, but --

Dr. Anigstein: No. I said the only reason, I mean in the process when I saw these large differences as shown on my first slide here I started looking, well, the methodology seems to be the same, I mean I'm just repeating the thought process, looking at Joe Guido's paper the methodology seems to be pretty similar.

I don't seem to have a conflict with the methodology, so let's look at the MCNP file rather than going through all the spreadsheets, did they convert, do I agree with the densities, do I agree with the intensity, let me just go, you know, cut to the chase and look at the spreadsheet, look at the MCNP input file, and this was the first thing I happened to notice is that we were using -- we did ours with using this last column.

So I saw that the numbers were different which was why. So, yes, however, I will go on now.

Chair Roessler: Yes.

Dr. Neton: Yes, I have no problem, I just wanted to make sure. We're going to address the other two issues and probably address all three of these things at one time.

Dr. Anigstein: Good, okay. Okay, so the next --

Chair Roessler: Okay. So, Bob, before you go on, you have your slide presentation, I'm trying to follow along also in your paper. Are you now going to address Section 6.0?

Dr. Anigstein: Yes.

Chair Roessler: Okay, good. Okay, well then proceed.

Dr. Anigstein: Okay, thank you. Okay, so the next thing we look at is the methodology used by NIOSH for doing the dose calculation.

So the one I am most familiar with is that you have to have, as I explained before, NIOSH, the program collects photons and how did it evaluate the photon flux.

Well there are several ways, several choices you have. The one I am most familiar with is called a point detector tally where here, this diagram, by the way, I created this diagram directly from the NIOSH input file, the americium input file.

So the method I used, it was taught in a course that I took on MCNP, was it's called a point detector tally, and it's simply all you need to do is specify the X, Y, Z coordinates at the part of dose points that you wish where you calculate the dose, and MCNP will tell you what the photon flux is and then, using the appropriate conversion coefficient, what the dose rate is at that point.

Here Dr. Traub used a different method, which is also a conventionally accepted method, and it's called a Type 4 tally in the MCNP parlance, where you create a simulated dosimeter.

So here they created this blue box, is a volume that is two-by-two inches, two inches high, two inches wide in the direction into the paper, and two millimeters thick, and then you calculate all the photons traversing this volume and you achieve, from that you can get a photon flux per square centimeter.

The two methods, and I have spoken to a couple of experts, as a matter of fact one of our consultants was brought in to this project, his name is [identifying information redacted].

He is one of the authors of the -- He worked at Los Alamos and he was one of the developers of all the MCNP codes through 6.1 and he retired from his job and he works now as a consultant.

And the two should be the same, maybe not to the

third decimal point, but they should be basically the same tally. But first of all we got a very different, taking the NIOSH result and -- the NIOSH input file, excuse me, and simply adding another tally, the Type 4, the point detector tally at the same location, so NIOSH, so MCNP would calculate the tally in the simulated dosimeter.

It would also calculate at the same point in the center of this the point detector. We get vastly different results. So right away that gave us an indication something is wrong.

And pursuing that, I will go back now with an explanation here of what went wrong. In the normal, what I call the usual operation, the most elementary operation of the code, you have this source, which is isotropic, which means that it gives out radiation in all directions.

So every time there is an iteration of the code, as I said, I run it for two billion iterations simply because I have a 32-bit operating system and that's all it allows me to do.

And most of the cases, well most of the histories are wasted from the standpoint of getting a dose because it goes in this direction, it goes in this direction, it goes in that direction, it goes nowhere near your dose point.

So consequently in that sense the program is inefficient. So there is a technique called biasing, where you test, where you put in instructions into the code, and the code then says, okay, we're interested in this direction so I want it to have most of my photons going in this direction.

I am going to kind of focus them in this direction and I am going to have maybe, I'm just thinking of numbers, ten times as many going in this direction as going in that direction.

Now so you come up with a higher score, more hits

on your target region. But, of course, at the same time you are exaggerating a dose so the MCNP program has to keep track of how to compensate for this.

Well, unfortunately it turned out that there was an error in the code. It had existed in the MCNP code, it was existent in Version MCNP X, which is the one we had been using here, and it also existed in the MCNP 6.1.

And here is an excerpt, this is a report put out by Los Alamos. It was dated April 2013, just prior to the release of Version 6.1, which was May 2013, and this document was included with the code on the same disk with the code.

It says it was intended for -- And within this document is a section called "Selection of Low-Priority Bugs in MCNP 6." Item 14 in that table says "incorrect source biasing with the minus 31 function," and that is the code name for this particular biasing function, which is a very aggressive one.

It's supposed to be the one to give you the most efficiency, and there is a reference number, RF23313. And then going further we go, we take release 6.2, which is the most current version, came out last year, and here it continues, the same tracking number and the description is, again, incorrect source biasing if using the minus 31 special function on the HV code, and this has been fixed.

So this is a bug. The bug had been fixed at 6.2, but not in 6.1, which is the version of the code that Dr. Traub was using and once -- So we verified, actually the documentation became later, about going through the program, the input files said well what would happen, I personally put the induction meter with the bias and said what would happen if we just removed it.

Removing it, the program ran a little less efficiently, but when we recalculated we took the results, the

identical file now, and the only difference, we had already corrected the conversion coefficients that we just discussed, and then by removing that source bias and recalculating the dose rate, we simply took what is the dose rate per disintegration of the americium-241, comparing it to what NIOSH had in the original version, the one with only the conversion coefficients corrected, and then with the bias removed, and then we got a ratio, multiplied it by the total dose, millirem per hour, reported by NIOSH, which was nine-something at one foot, and now it comes down to 3.458.

So now, having removed the bias, which would make no difference except -- If everything was working correctly, removing the bias should not change the dose except maybe this slightly less efficient counting.

We are now -- And this is the original SC&A calculation back in 2016. So now the NIOSH recalculated value is 45, instead of being higher it's 45 percent lower at one foot and not quite as big a difference at one meter.

So we said, okay, we're getting warm, but we're not quite there yet. So we then went back, took another look at the geometry, and here is an issue with the -- Oh, and the other thing was, again, we also got differences, even with the bias removed between the point detector and that volume, that simulated dosimeter.

So we took another look and we see here, drawing a line of sight, here is the fuel pellet exactly as it is in the geometry as dictated by the NIOSH input file, and here is the simulated detector and we see that their line of sight intersects the simulated dosimeter just above the midpoint, excuse me, just below the midpoint.

The midpoint would be level with the floor, it's just a hair below. So almost half of this dosimeter is shielded from the fuel pellet by this, if you want to

penetrate, if you want to draw a line to the bottom of this, you are having to go through the floor of the, the metal floor of the glovebox at a very sharp angle, an acute angle, and consequently it is mostly shielded.

Very little radiation hits the bottom part of the simulated dosimeter. So consequently in this particular geometry that simulated dosimeter of that size is just not a good way of measuring the dose rate.

And then we go and we looked at the photograph, this is from a report presented by, a paper presented by the Carborundum staff at a symposium, a conference on hot labs, I think it was called a hot lab conference, and here are, this is the actual plutonium research facility, and we see the gloveboxes.

They are described in the paper as being three feet high, the glovebox itself, and we are looking at the port. This is the arm-holds where the worker stands and puts his arms in.

So first of all, so this is designed to be a comfortable working height for the worker. His body is here. The center of his body would be about level with these arm-holds.

Just think if you are standing up and your elbow bent at 90 degrees, your arms swing forward, and you are at the level of the abdomen. And by scaling the photograph we calculated that from here to here, the bottom of the sort of center of the port is about 24 centimeters.

So we changed the geometry. I don't have a diagram for this, but we simply moved everything up 24 centimeters, take the fuel pellet, which is an eighth of an inch above the floor of the glovebox, and we put the center of it 24 centimeters high.

And we also took the simulated dosimeter and moved that up by 24 centimeters and also put the point

detector in that same location and once we had done that and again recalculated the, again, took the ratio of the per disintegration of americium-241 and ratioed it by the reported hourly dose rate by NIOSH, we came out, which actually I had to say it surprised me, amazingly close.

This is the original SC&A model back in 2016, this is the NIOSH input file recalculated by eliminating, changing the dose conversion factor, eliminating the bias, and raising everything 24 centimeters, and we came up with perfect agreement at one foot and not quite perfect, but close, pretty close, at one meter.

So again, our third finding is that the shielding by the floor of the glovebox just does not represent the geometry. It's not claimant-favorable.

It's not scientifically correct because the dosimeter is partly shielded. A dosimeter can be used when it's in a uniform radiation field when it's relatively, you know, the center of it, the two edges are pretty close.

And here, and we also got, and I'm not showing this, with this geometry, with this 24-centimeter elevation, we also got quite good agreement between the NIOSH Type 4 tally, which is volume detector, and our point detector came out within 1.5 percent.

So we believe that this is an appropriate geometry, and if NIOSH adopts this, we would have very good consensus. So this is the end of the presentation.

Chair Roessler: Okay. Did you say that was the end of your presentation?

Well, I guess I would have a question, because you just presented Finding 3, and yet in your written paper you have a section called "Conclusions."

Dr. Anigstein: Okay. I just went into more detail here in the paper. I was trying to keep the presentation a little simpler. I went into just a little more detail.

I have this Equation 1 in the paper, where I simply

showed how I, when I say NIOSH recalc'ed that's how it was recalculated, by simply taking the ratio -- It's very simple.

I just sort of simply put an equation in words.

Chair Roessler: At the bottom of your conclusions paragraph you say, "This gives us reason to believe that NIOSH is correctly translating MCNP results into hourly doses."

Dr. Anigstein: Oh, yes. Well --

(Simultaneous speaking)

Chair Roessler: Do you mean that overall or do all three of your findings still stand?

Dr. Anigstein: No, what I meant by that was, and maybe we can go back. I am going to now. We received from NIOSH about 40 data files.

It was a bit -- and also besides being, you know, a rather massive amount that included 30 MCNP 15 radionuclides for each one, there were two files, an input and an output, and then there was another ten files approximately, and rather than following in detail how here is the dose per disintegration, which is directly taken from the MCNP output, here is now the disintegrations per unit fluence, per pellet for each radionuclide.

Here is how many pellets or here is the mass of each pellet. So instead of going, instead of trying to follow that, which we incidentally couldn't follow because there was a, we got two different, we got data from NIOSH from two different time periods.

There was an earlier set of files, which were interconnected Excel spreadsheets, but they were not the ones that were reflected in the report from Joe Guido and then the report -- and those were in a separate spreadsheet, which was not related to the others, so you could not reference that.

It just had numbers without, rather input than links, so we actually could not take each MCNP result and relate it to the final dose, but the fact that we could take one MCNP result, the americium, which is the most influential one, and by making these corrections we run it and then taking this ratio as is in my Equation 1 taking the, this is the dose rate per disintegration from the original NIOSH MCNP and divided by the -- Which way? No, take the one, the revised dose rate from americium, divide it by the original dose rate, and take that ratio and multiply it by the reported final hourly dose rate from all radionuclides on all the plutonium pellets.

Since we got almost exactly the same as the SC&A calculation, we thought for efficiency sake we really don't need to probe further into the NIOSH methodology.

It was, however they did it, it gave results that were quite close. So rather than critiquing each individual step, which, again, there were some missing steps because of the revision, that we had one file that was revised, the revised calculation, which was, it didn't have all the supporting files.

So first of all we couldn't do it and second I suppose, we talked about it earlier, I could have requested, I did request it from Tom but apparently it was a last-minute thing so he wasn't able to come through, I'm not surprised. I didn't give him very much notice.

So we're satisfied that if the MCNP runs are corrected, then the rest of the methodology looks pretty good.

Chair Roessler: Okay. I think you've explained that. My naive reaction when I read that statement is that, in spite of all of your findings, that NIOSH had done it in an acceptable way, but I don't think that's what you are saying.

What you are saying is that if NIOSH makes corrections, then you feel that the results are

acceptable?

Dr. Anigstein: My statement is that NIOSH correctly, is correctly translating the MCNP result into hourly dose, not that the MCNP results are correct, but the translation of the, going from the MCNP result to the hourly dose is correct, the second step in the process. Perhaps I should have worded it differently.

Chair Roessler: Okay. So I think at this point, speaking from my point of view, and I'd like to hear what the other Work Group members think, I think we need to hear from NIOSH as to all of the findings and what they propose.

Member Field: This is Bill. I agree. I think I'm following most of the detail that is presented, and from my interpretation it seems like the geometry issue is the major issue that is causing differences. Is that correct from your perspective?

Chair Roessler: Was that Bill speaking?

Member Field: Yes.

Chair Roessler: Okay. So who, I don't know who's going to answer that question.

Member Field: I think it would be good if someone from NIOSH could address their perspectives on the issue that was brought up regarding the geometry.

Mr. Tomes: This is Tom. Joe Guido, are you prepared to address that?

Mr. Guido: Yes. Well the MCNP part we'll have Rick go into, but I believe, you know, there is two pieces there, the re-running of MCNP 6.2 takes care of one, but then there is geometry, so I'll let Rick do that since he is the MCNP expert here from our side.

Mr. Traub: Yes, okay, this is Rick Traub. I have already done some runs with MCNP 6.2.

It turns out that's what we have accepted as our

version of the code that we use, and as pointed out the biasing function does seem to work properly, or at least we get differences of about a factor of 2.5 to 3.0 between 6.1 and 6.2.

So it looks like the 6.2 is running correctly, so we will just have to run that with, just using a different version of MCNP. When it comes to the location of the dosimeter, you know, I think what was said is correct on how it would affect it, and Gen, I'll just kind of defer to the subject matter expert as to where that dosimeter should be.

Mr. Tomes: This is Tom. Maybe I can just give the point of my opinion here based on what I have seen of the facility information.

I agree with Dr. Anigstein on what he interprets from the sketch on the height of the work surface in the gloveboxes and also of the ports and I have seen another picture, a close-up, of actually a worker using the ports, and he is standing there and the ports are positioned so they are a comfortable position to use the ports for his, where his arms are basically parallel with the ground.

So I would assume that the dimensions mentioned by Dr. Anigstein to estimate that distance are at least nominally correct.

And the picture I am seeing shows an apparatus in there, whether it be a furnace or whatever pipe they have in this particular sketch, I don't know, but he is working at a height in that picture I am seeing.

So my interpretation of the information that I am seeing from the facility is that some of the work would have been done at that height.

Now, obviously, there would be more than one operation being done in those gloveboxes with the pellets and some of that likely would have been down to a lower surface.

But I at least would have to say that Dr. Anigstein's

opinion is a plausible exposure scenario.

Mr. Guido: This is Joe Guido. I have one question, because the MCNP part of this, as far as selection of the point tally and the simulated dosimeter, it seems like you are trying to calculate the same thing, but the simulated dosimeter ends up having a vertical dimension that you have to create, and it seems like that vertical dimension is what's causing us our disconnect.

Is that right? I mean, if your point dosimeter allows kind of like a parallel line, you know, a horizontal line from the fuel pellet to the dose point and then if you use a simulated dosimeter then to give it any volume you kind of are forcing part of the volume below into a shielded region where at the 0.1 you're not, is that what's happening?

Dr. Anigstein: I am sorry, who is this question directed to?

Mr. Guido: Oh, to Dr. Anigstein.

Dr. Anigstein: Oh, yes, yes.

Mr. Guido: I am just trying to understand, because it seems like what we are talking about here is a subtle --

(Simultaneous speaking)

Dr. Anigstein: Yes. No, they should be according to, I mean I work, again, as soon as I found there was, learned this problem, I brought in one SC&A associate, Michael Mallett, who is a staff member as a health physics group leader at Los Alamos and uses MCNP regularly, and he said in all his experience the two types, one is called the Type 4 tally dosimeter, and the other one is called a Type 5 and they give, you know, comparable, very similar results.

And then we still couldn't solve the problem because we didn't hit upon the biasing as being the issue so we brought in, he had formerly been a SC&A

associate and we re-inducted him on a contract, John Hendricks, and he had 6.2 running, but we had no proof of that yet, and he said to me there was no difference between the, it was a very simple case, and there was no difference between the point detector and the simulated dosimeter looking just at the flux.

He said let's not bother with the dose, that's another complication, and so at that point we started, he suggested to me I should look at the release documentation, and then we found the evidence or the documentation on this.

So, yes, I do notice that the simulated dosimeter seems to give you a little better scoring, so it has a -- because what MCNP generates at the end is an evaluation of the tallies and does this meet the ten criteria, and one of them is is the error within the desired limits, is something called the variance of the variance, like a second order already, does that meet the requirements and other, you know, it's a technical issue, a technical thing.

And the simulated dosimeter seems to come closer to meeting all the statistical criteria because it has a little better statistics so I can see an advantage in using it.

I personally am comfortable with the point detector because I don't have to worry about what is the proper volume, what is the proper area, and running it long enough, it gives you, I'll try to find the rule.

I have a rather fast computer that was specifically ordered for doing MCNP runs, and I can do two billion simulations, anything between two and five hours for photons.

Mr. Guido: So it sounds like, so if you were to raise the fuel pellet to 24 centimeters, what that does is it prevents the bottom on the simulated dosimeter from being shielded, so being higher and --

Dr. Anigstein: Correct.

Mr. Guido: So that's just an artificial, that's not saying that the work is done with the pellet at that height, that's just an artifact of having to do the calculation, is that correct?

I mean I kind of struggle with what to recommend because, you know, we really don't want to say that the work was always done with these fuel pellets, you know, at 24 centimeters, but --

(Simultaneous speaking)

Dr. Anigstein: As long as they are above, as long as they are at a point where there is no longer interference with the floor, so probably ten -- We didn't do, you know, a parametric study, let's do it one centimeter at a time, so maybe ten centimeters would be adequate.

I am just -- This is just off the top of my head, but definitely resting on the floor, even with the point detector there was some, because the point detector is really not a point.

It takes in the radiation from the surrounding, from the surrounding volume, so even with the point detector you get a reduction in the dose rate from it sitting on the floor because the floor absorbs some of the radiation.

So having it somewhat elevated, and also according to the NIOSH calculation spreadsheet they estimated 374 pellets that comprise the batch, single batch, that it's equal to 100 grams of plutonium, and they are not all going to be sitting on the floor.

They'll be in some kind of a pile, there will be some on top of each other, they are going to be handled, so I would say that having them at some significant elevation off the floor would be probably more realistic and definitely, I think, more claimant-favorable.

Mr. Guido: And but again, some of this is because of the choice of tally, which really causes the trouble, right?

Dr. Anigstein: Well, the two types of tallies should be the same or otherwise there is something wrong with the analysis. So there are two types, and I think there is a surface-like tally --

Mr. Guido: Okay.

Dr. Anigstein: -- and some other choices. So it's a matter of the analyst's choice of which one to use, but it should not affect the outcome.

Mr. Guido: Okay.

Dr. Anigstein: But also with the volumetric tally, volume tally, the choice of dimensions, I think, affect the tally, so with a point detector you don't have that.

Mr. Guido: Yes, I think that was my point, is by using that, that comes into play. Okay. I just wanted to understand some more because what we need to do, you know, with the, we can kind of think of what is the best geometry to specify for this and then take the tally that doesn't get affected.

You know, the geometry isn't causing us trouble like -- I was trying to look at your drawing, and your drawing really does show, you know, the bottom of this simulated dosimeter being shielded, but that could be made smaller, it seems.

Dr. Anigstein: But then if you start making smaller you lose, I think you reduce the scoring efficiency.

Mr. Guido: Oh, okay. All right, I don't have any other comments.

(Simultaneous speaking)

Chair Roessler: -- maybe you should make your other comments at this point.

Mr. Katz: That's for NIOSH, I think, right, Jim?

Dr. Neton: Yes, this is Jim. I don't think we -- Do we have any more comments on our side? I think we just got this document less than a week ago, and it's a pretty complex analysis.

I think we are going to need a little time to digest exactly, you know, what we are going to do moving forward. I don't know that we can agree to put this in abeyance or whatever today.

Chair Roessler: Okay. So Ted, should we approach this that we have looked at nine issues, eight are closed, we have this one issue that is still open, that we need to let NIOSH have some time to address the findings and then present that -- Are we going to need another Work Group meeting then?

Mr. Katz: Well, here's -- Thanks, Gen. Here is what I would suggest. I mean since frankly this finding is impossibly technical for --

Chair Roessler: For the Board.

Mr. Katz: I mean for at least most members of the Board with a few exceptions and for everyone else other than the technical people that can deal with this, so I guess, yes, I would suggest, I think the Work Group can present on this, present and provide -- You have enough detail on all the other findings I think you could do that, Gen, based on -- It was very nicely done how, at the outset of this meeting, the first half of this meeting, you could run through all those issues, you could key up this one issue that is remaining to be sorted out technically between NIOSH and SC&A, but honestly I don't think, I think, I would assume the Board would be comfortable with NIOSH and SC&A coming to agreement on that terrifically technical matter of how to exactly model this.

It's not really an item for which the Board will ever need to discuss it and come to a judgement or, however you want to put that.

So I think the Board can really close out, for the purposes of presenting the Site Profile to the Board, I think the Work Group can present and suggest to the Board that really the Board is basically done with this, but that the technical staff need to work out exactly how this modeling gets done with MCNP to be appropriately claimant-favorable and correct, and leave it at that. That is my suggestion.

Chair Roessler: Okay. I think there is a -- From the Board's point of view though I think there is a motion that has been tabled.

Mr. Katz: Right. There is a motion even for the, to close out the Site Profile.

Chair Roessler: Right.

Mr. Katz: Right. And I guess what I am recommending to you is I think the Board doesn't need to take this up yet again when this issue is done but you could close it out at the Board level and still, the final work would get done between NIOSH and SC&A and of course, they would run that by the Work Group, but I don't think it requires further Board action. That is my suggestion.

Chair Roessler: Okay. So are you actually saying that that motion would come up before the Board at the meeting next week?

Mr. Katz: Yes, but I would -- I mean, that's what I would recommend.

Chair Roessler: Okay.

Mr. Katz: Again, I don't think the Board needs to spend another session at another Board meeting to finish its work related to this.

ABRWH December meeting plans/other follow-up

Chair Roessler: Okay. Basically say that if NIOSH and SC&A can resolve the issues, that it's really a Site Profile situation.

Mr. Katz: Well, it's not -- I mean, you are, you are closing out a Site Profile matter anyway, a Site Profile review anyway, so it's all Site Profile.

But again, I'm just saying I think the Board can say we are done with this, we have reviewed it, you know, we're satisfied with historic profiles so long as, you know, NIOSH and SC&A work out this last technical matter, they will run it by the Work Group, but the Board can act and say we are done with the Site Profile review as a Board at this meeting if you want to.

If you are uncomfortable with that, that's fine, but I don't think it's worth another meeting.

Chair Roessler: Well, I was comfortable with it before the last meeting, but then so many questions came up, and it was recommended that we continue discussion.

Mr. Katz: Yes.

Chair Roessler: I would be comfortable with presenting it in this manner at this time but I would like to hear from the other Work Group members.

Mr. Katz: Right, me too.

Member Field: Right. This is Bill. I think these issues, while complicated, are resolvable just by getting together and coming to some agreement that would be claimant-favorable.

I mean, some of it is just an error in the bias, and then the geometry issues can be worked out, and I don't know about which table to use, I'm not sure why that second table was generated, and the appropriateness of using the updated table versus the initial one, you know, it's strange.

I think that may be the biggest contention for 20 years, but I think these other issues can be worked out between NIOSH and SC&A.

Mr. Katz: So Bill, are you comfortable with the route that I proposed, that the Board sort of close this out at this meeting?

Member Field: I think that makes, it makes a lot of sense. In fact I think the Work Group maybe being involved may muddy the waters versus if we just let them handle it themselves.

Dr. Neton: Ted, this is Jim. I want to make sure what you are saying though, because I think there may be some confusion.

You are not saying that the Work Group closes this issue, you are saying the Work Group presents it to the Board, that the Board should not review this any further, the Full Board, the Work Group would still be in the loop and be responsible or involved in closing out this final issue?

Member Field: Right.

Mr. Katz: Yes. I'm saying that if you run it by the Work Group in case there is anything that gets knotty at the end, but, yes, that's what I am saying, Jim, and that's what I think Bill is agreeing to.

Member Field: I think that's the way to go. It makes a lot of sense.

Chair Roessler: Was that Brad who just commented?

Mr. Katz: No, that was Bill.

Member Clawson: Oh, I've listened to everything, the talk. I understand what you are trying to get to, Ted, and you are right, you know, this is ultimately what we are saying is that we think that this is a Site Profile issue, SC&A and NIOSH should come to a resolution with it and we'll play a part in it, we'll be in the loop of it and everything else like that, but I don't see that we have to meet again to be able to take care of this.

I think that we'll just stay in the loop with NIOSH and SC&A with the correction of this last one, but I am

good with proceeding forward as you said, Ted.

Mr. Katz: Okay, thank you.

(Simultaneous speaking)

Member Field: I think the bigger issue is that table, and switching to a different use of the table from what has been done historically and that affecting previous calculations that have been done, I think to me that's the bigger issue.

I think these other issues, as far as the geometry and using the correct bias calculation, I think those are fairly easily resolved, and what I am hearing is that, and correct me if I am wrong, it sounds like NIOSH is on board with looking at those and coming to make a good resolution to those.

Mr. Katz: Jim?

Dr. Neton: Yes, this is Jim, I agree. I think we are on board with the two changes, looking at the geometry factor, and I think we agree that the bias factor issue between revisions needs to be addressed.

The table issue, I am not sure where we are. I don't know historically how this would affect anything, if anything at all, but we need to look at it in the larger context.

And you're right, Bill Field, this may be a harder issue to resolve than those other two.

Member Field: Right, right, even though the differences are smaller, yes.

Mr. Katz: So, Gen, so if you -- Gen, if you are in agreement, too, then you would have a motion from the Work Group to present, so you don't need a motion at the Board level.

Chair Roessler: Okay. So we have a motion from the Work Group, but I think we still, I think the Board still has a motion on the table.

Mr. Katz: Okay. So whatever, you would be recommending that you take the motion off the table and act on it, yes.

Chair Roessler: Yes. And that the Work Group recommends taking the motion off the table and that we will resolve this within the Work Group.

Mr. Katz: Correct.

Chair Roessler: Okay. And I agree with you, Ted. I think we don't want to get into all the scientific and technical details on this with the Board or we will never finish the meeting.

Mr. Katz: You'll kill the Board. You'll kill the Board with that.

Chair Roessler: I know. It almost killed the Work Group, I think. But, okay, now I am going to have limited time between now and next week and I could -- What I think we are proposing is to go through the nine issues, show that the eight are closed fairly quickly, we can do that with a slide presentation I think.

And on the eighth one though I think I'll need a little bit of help from somebody, maybe somebody from NIOSH can, Jim or Tom and Joe can help me put something together for that one.

Mr. Katz: So when you say the eighth one you mean the external dose from the residual floor contamination?

Chair Roessler: Would you say that again, I didn't quite hear you?

Mr. Katz: Which do you mean by the eighth one, do you mean --

Chair Roessler: Okay. When --

(Simultaneous speaking)

Dr. Neton: Well, the MCNP.

Mr. Katz: Oh, okay. Okay, not the --

(Simultaneous speaking)

Chair Roessler: This whole fuel pellet thing is --

Mr. Katz: Yes, yes, okay, I got you.

Chair Roessler: Yes, I was --

(Simultaneous speaking)

Dr. Anigstein: The Finding Number 6.

Mr. Katz: Yes, right, understood.

Chair Roessler: Yes.

Mr. Katz: Okay.

(Simultaneous speaking)

Chair Roessler: -- and then the one that is not closed addresses these three findings on this last fuel pellet issue.

Mr. Katz: Yes. So we can get someone from NIOSH maybe to give Gen sort of a simple slide, couple slides, whatever, to address this last matter in a very sort of 10,000-foot level?

Dr. Neton: Yes. This is Jim. I think we can do that, like a path forward sort of slide for this Finding 6.

Mr. Katz: Yes. Yes, and just --

Chair Roessler: If you could put it in something that I could put on PowerPoint, then I can put the other, I can summarize the other issues.

Now I will not be at the meeting personally, I will be on the telephone, but I think we can handle that okay.

Mr. Katz: Yes, we can.

Dr. Neton: We'll more than likely put it in a

PowerPoint format, because that's the easiest for us.

Chair Roessler: Yes, it's easiest for me, too.

Dr. Neton: What about the other issues though, who is going to summarize those?

Mr. Katz: Gen is.

Chair Roessler: I can do that, or if Tom wants to help me, that would be okay, too.

Mr. Tomes: I can do that, yes.

Chair Roessler: Okay. Why don't we --

Dr. Neton: We may as well just list them, yes.

Chair Roessler: Just list them briefly and we can present that. Yes, Tom, if you can do that, and Jim, you can give me the one on the fuel pellet --

Dr. Neton: Well, I think I'll let Tom do that, too, since he --

(Simultaneous speaking)

Mr. Katz: I mean this will help logistically --

Chair Roessler: Well, Tom and I have worked on this before, so I am sure we can work it out.

Dr. Neton: Yes. No, I think we can do that.

Chair Roessler: And we can talk, you know, offline we can talk about timing and so on.

Dr. Neton: Yes. I'm going to be out of the office between now and the Monday before the Board meeting, so I will make sure someone else is available to, you know, review it and get it out the door.

Mr. Katz: Yes. So Tom, if you would just copy me when you send things to Gen, send the draft to Gen. And Gen and Tom, just let me know me when it's final, because I'll need to get that out.

It will probably be pretty late for getting it out to the Board members and get it to Glenda Leary to post. Someone will have to -- Someone from -- Glenda will have to put it in proper form to get it posted in time, because that will be very late.

So if you, again, would keep me in the loop and make sure I get the final, then whenever that comes in, I will get that distributed and posted.

Chair Roessler: Well we don't really have much time because --

Mr. Katz: We don't.

Chair Roessler: -- for you to do that, we need to probably finalize something before the weekend.

Mr. Katz: Yes, definitely.

Dr. Neton: Yes. And tomorrow is right now a government holiday by the way.

Chair Roessler: Okay.

Mr. Katz: Yes, yes, for President Bush, yes.

Mr. Tomes: Gen, this is Tom. I have one question just to help me get started on this. For the nine issues we want basically a bulleted, or a list of all the issues and just in a very brief summary of how they were resolved --

Mr. Katz: Yes.

Mr. Tomes: -- and then for this MCNP issue you just want maybe a couple slides to give a little bit more details on that?

Chair Roessler: That sounds good, yes.

Mr. Katz: Yes.

Chair Roessler: On the eight issues that are closed I think the main thing is to say that they are closed.

Mr. Tomes: Okay.

Mr. Katz: Oh, yes, you need to summarize them just a little bit, Tom, so that it makes sense what was the issue and how it was resolved.

Mr. Tomes: Okay. It will be very brief on those, yes.

Mr. Katz: Yes, because Gen will need to give that much detail for the Board at least.

Chair Roessler: Yes.

Mr. Katz: Yes.

Chair Roessler: So if I could get something I would say by Friday, I've got Friday open where I can go over this, and then we try and turn around and get something to Ted.

Mr. Tomes: I can do that, yes.

Chair Roessler: Okay. Okay.

Mr. Katz: That's the plan. Right, great.

Chair Roessler: So have we reached the end of our meeting today, or is there any other discussion and questions or advice?

Mr. Katz: No. I think we're finished, and you have a plan and you will present from on the phone, which will work fine.

Chair Roessler: Okay.

Mr. Katz: We should be good. We have plenty of time for this presentation at the Board meeting, so it will be good.

Mr. Traub: Yes, this is Rick Traub. I've got a question for Dr. Anigstein on the point detectors.

Dr. Anigstein: Yes?

Mr. Traub: What was the exclusion zone that you used?

Dr. Anigstein: Zero.

Mr. Traub: Okay. Thank you.

Dr. Anigstein: That was recommended by Dr. Hendricks.

Mr. Katz: Okay. So thank you, everybody. Gen, if you are ready, I think --

Chair Roessler: I am ready. You can close --

(Simultaneous speaking)

Member Field: Can I just say thanks for that wonderful presentation today. I know it was very detailed, but I think it was very helpful, so I really thank you for that presentation.

Chair Roessler: Yes, Bob, you are a good instructor.

Dr. Anigstein: Thank you.

Mr. Katz: Yes, you are good --

(Simultaneous speaking)

Member Clawson: I don't understand what you said, but it was still good instruction and it was meaningful, but it's all good, and I appreciate it, too, Bob.

I appreciate NIOSH's and everybody's input to help all of us understand it better too.

Dr. Anigstein: Yes.

Adjourn

Mr. Katz: Okay. So with that I think thanks, everybody, and we are adjourned and I will see some of you next week and I will hear the rest of you on the phone.

Chair Roessler: Thank you.

(Whereupon, the above-entitled matter went off the record at 11:54 a.m.)