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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TBD-6000/6001 WORK GROUP

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WEDNESDAY,
OCTOBER 14, 2009

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The Work Group convened in the Zurich Meeting Room at the Cincinnati Airport Marriott Hotel, 2395 Progress Drive, Hebron, Kentucky, at 9:30 a.m., Paul Ziemer, Chairman, presiding.

PRESENT:

PAUL L. ZIEMER, Chairman
JOSIE BEACH
MARK GRIFFON*
WANDA I. MUNN
JOHN W. POSTON

ALSO PRESENT:

THEODORE KATZ, Acting Designated Federal Official
NANCY ADAMS, NIOSH contractor
DAVID ALLEN, OCAS
BILL THURBER, SC&A*
BOB ANIGSTEIN, SC&A
MURIEL BURRELL*
JOHN DUTKO*
LARRY ELLIOTT, OCAS
EMILY HOWELL, HHS
JOHN MAURO, SC&A
DAN McKEEL, Co-Petitioner*
JIM NETON, OCAS
JOHN RAMSPOTT*

*Present via telephone

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

(9:41 a.m.)

MR. KATZ: Good morning, everyone on the phone. We are sorry for the hold up. This is the Advisory Board on Radiation Worker Health. This is the TBD-6000/6001 Appendix BB Work Group and we have been trying to sort out document questions, as well as getting technology ready for presentations.

But we are going to begin now as usual, starting with roll call with Board Members in the room. And please, everyone, we are discussing, as part of the discussion today, GSI. So, individuals should speak to their conflict if they have a conflict as well.

CHAIRMAN ZIEMER: This is Paul Ziemer, Work Group Chair, not conflicted.

MEMBER MUNN: Wanda Munn, member of the Board, not conflicted.

MEMBER BEACH: Josie Beach, Board Member, not conflicted.

MEMBER POSTON: John Poston, Board Member, not conflicted.

MR. KATZ: And Board Member on the phone?

MEMBER GRIFFON: Mark Griffon, member of the Board and not conflicted.

MR. KATZ: Okay. NIOSH/ORAU team in the room?

MR. ELLIOTT: Larry Elliott, Director of NIOSH's Office of Compensation Analysis and support, not conflicted.

DR. NETON: Jim Neton, Office of Compensation Analysis and Support, not conflicted.

MR. ALLEN: Dave Allen, Office of Compensation Analysis and Support, not conflicted.

MR. KATZ: On the line, NIOSH/ORAU team?

(No response.)

MR. KATZ: Okay. In the room, SC&A?

DR. MAURO: John Mauro, SC&A, not conflicted.

DR. ANIGSTEIN: Bob Anigstein, SC&A, not conflicted.

MR. KATZ: SC&A on the line?

MR. THURBER: Bill Thurber, SC&A, not conflicted.

MR. KATZ: Welcome, Phil.

MR. THURBER: Bill.

MR. KATZ: Oh, Bill. Sorry.

MR. THURBER: No problem.

MR. KATZ: Okay, anyone else SC&A?

(No response.)

MR. KATZ: Okay, then federal employees or contractors in the room?

MS. HOWELL: Emily Howell, HHS.

MR. KATZ: And on the line?

MS. ADAMS: Nancy Adams, NIOSH contractor, not conflicted.

MR. KATZ: Okay. No one from DOL or DOE?

(No response.)

MR. KATZ: Okay. And then members, we've got everyone in the room? Yes. Members of the public, petitioners and others, representatives, staff of representatives and Congress on the line who want to identify themselves.

DR. McKEEL: This is Dan McKeel. I am the co-petitioner for GSI and its SEC.

MS. BURRELL: And I am Muriel Burrell. I worked at GSI.

MR. KATZ: Can you repeat your name, please?

MS. BURRELL: Muriel, M-U-R-I-E-L, Burrell, B as in boy, U-R-R-E-L-L.

MR. KATZ: Welcome, Muriel.

MS. BURRELL: Thanks.

MR. RAMSPOTT: John Ramspott, General Steel.

MR. KATZ: Welcome, John.

MR. DUTKO: John Dutko, General Steel.

MR. KATZ: John Dutko?

MR. DUTKO: Yes, sir.

MR. KATZ: Thank you. Welcome, John.

MR. DUTKO: Thank you, sir.

MR. KATZ: Any others?

(No response.)

MR. KATZ: Okay, then let me just remind everyone on the line to please mute your phones, except when you are addressing the group here. And if you don't have a mute button, *6. Press star and six. And then when you want to take it off of mute, just press star and six again. And if you need to leave the call for a brief period, please do not put the call on hold. Hang up and dial back in when you are ready to rejoin us.

Much thanks. And Dr. Ziemer, it is your show.

CHAIRMAN ZIEMER: Okay, thank you, Ted. And I will officially call the meeting to order. The agenda has been distributed to the Work Group and to the staff and to the

petitioners. I have some hard copies here in the room if anyone needs a hard copy.

DR. MAURO: I will take one.

CHAIRMAN ZIEMER: Okay, John.

Okay. I just have a few introductory remarks to make and I just want to review the agenda. There really are three sort of main parts to things that we are going to deal with today.

First of all, we want to update the TBD Findings Matrix. And I think that will not take a great deal of time but we do have some more recent input from NIOSH on that matrix so we want to get updated on that.

Then we will focus on General Steel Industries, which is included in Appendix BB to the TBD-6000/6001 document. And there we have two parts. We have the matrix which was generated as a result of the review of Appendix BB, which some think of as sort of a site profile. And then we also have a recent document, which is a review of the

evaluation report of the petition from the General Steel petitioners. And to some extent, there are issues that cross the lines between both of those. So some of those will be common issues both to the Appendix BB itself, as well as to the Petition Evaluation Report.

But nonetheless, we do have an issues matrix for the Appendix BB evaluation that was made by SC&A and we have issues there that have been in the resolution process. And then we have the recent review by SC&A of NIOSH Evaluation Report of the petition and there are issues there which will require resolution as we move forward, as well.

In addition to those documents, Work Group members, I believe, have all received a number of documents from the petitioners, mostly from Dr. McKeel and then some additional documents from the site expert, Mr. Ramspott. And so I think all of us have those documents as well and we will

also afford the petitioner an opportunity to make some general statements for the record, as well as input on these various issues.

Now, I recognize that we have a wealth of documents that we are reviewing. We have a fair number of issues that we need to grapple with. We will try to be as efficient as we can and make as much progress as we can today. But as I assessed the various documents and read many documents in recent weeks and looked at some of the complexities of these issues, it appears to me that we may not be able to resolve everything today. I guess I would be surprised if we can, although I certainly don't want to discourage it. But we may need additional information and input as we proceed.

And so I am expecting that this Work Group will need to meet again in the near future, perhaps in the next six weeks or so, perhaps I am thinking now in November and we will talk later about the path forward and

scheduling but we do need to stay on task and try to deal with all of the issues that are before us in these matters, both with respect to the TBD-6000, which is a more general document, as well as the focus on Appendix BB.

Then also we need to be cognizant of the fact that there are other appendices that we will need to deal with later as well. We certainly won't be dealing with them now but they will be on the horizon.

So with those general remarks, I want to begin with an update on the TBD-6000 findings matrix and the status of those issues.

Now, I do need to check to see whether the petitioners have a copy at least of the original matrix. And I am going to ask, Dan, are you on the line?

DR. McKEEL: Yes, sir, I am on the line.

CHAIRMAN ZIEMER: I know that you requested current copies of the matrices. And

Josie sent the cleared copy of the Appendix BB Matrix just a little bit ago. Did you receive that yet?

DR. McKEEL: Well, actually, I am about ten feet away from the computer. I can get that.

CHAIRMAN ZIEMER: Oh, okay.

DR. McKEEL: I have an early version of the Appendix BB Matrix with the SC&A findings but not the NIOSH responses. And as of yet, I don't have a copy of the TBD-6000.

CHAIRMAN ZIEMER: And the problem that we have had here at the table this morning, I will just tell you, is that none of us seems to have a cleared version here with us of that that we can send to you.

DR. McKEEL: Okay.

CHAIRMAN ZIEMER: So we will do our best to make sure that the issues are articulated in terms of the responses. And then we may have to send you the cleared

version after the fact. I apologize for that but it's just the way it turned out here.

DR. McKEEL: That's fine.

CHAIRMAN ZIEMER: Yes.

DR. McKEEL: Thank you.

CHAIRMAN ZIEMER: So, let's turn to the matrix, first of all, and just for the --

MEMBER GRIFFON: Paul? Paul, can you tell me which matrix, the exact file name, so I can make sure I have the right one?

CHAIRMAN ZIEMER: Yes, hang on. I am pulling mine out here, if one of the other Work Group members has it. John, do you have the matrix that Mark would have?

Okay, it would be dated March 6th or March 9, 2009, Issue Resolution Matrix for SC&A Findings on TBD-6000. That matrix has the SC&A original findings. It has the NIOSH responses. And these go back to November, I believe.

DR. MAURO: Yes.

CHAIRMAN ZIEMER: I will let John Mauro give you the history.

DR. MAURO: The history of it is, when SC&A completed its review of TBD-6000, we issued the matrix on November 11, 2008. And that is what is on the bottom of each page. Then we had some meetings. NIOSH prepared a response to each of those findings. And then SC&A responded and the last set, and it is in this matrix I am looking at. And the date in which all of this is captured is dated right on the top of the page, SC&A response to NIOSH response added March 9, 2009. This is, if you folks don't have an electronic version of it, we certainly can get it because I have a copy of it. It is on my system. So but this is the latest version. And it is from here, this is our stepping stone, so to speak.

CHAIRMAN ZIEMER: But that is not a cleared version.

DR. MAURO: And it is not a cleared version. And the first action -- in

fact we should discuss this a bit. There is new material.

In theory, for items four and five, David Allen has distributed responses.

CHAIRMAN ZIEMER: And those responses were cleared.

DR. MAURO: And those responses were cleared. And I have with me SC&A's response to those responses no one has seen that has to be added to this.

CHAIRMAN ZIEMER: Right.

DR. MAURO: So what I am getting at is perhaps the best path forward is, let's process this, update it, and then clear the whole thing and move it out so that everyone -- a new baseline and everyone will have a new version of this that is right up-to-date, including Dr. McKeel. That might be the simplest way to go, rather than have iterative versions going out.

CHAIRMAN ZIEMER: We can -- because that has intermediate responses that

occurred late last year and early this year.

DR. MAURO: Yes.

CHAIRMAN ZIEMER: And I guess it must not have ever been submitted to --

DR. MAURO: It probably was never submitted for PA clearance. That is correct. I suspect that.

I could ask Nancy to get on the line but I just spoke with her --

CHAIRMAN ZIEMER: Well, --

DR. MAURO: -- and she said no. She does not have it.

CHAIRMAN ZIEMER: Okay. Well, we need to expedite it.

DR. MAURO: So we would have to clear this stuff.

CHAIRMAN ZIEMER: Whatever we do today, we need to get it to the petitioners as rapidly as we can as well, so that they have -- although this is not part of the -- this is separate but it is tied in so closely with Appendix BB.

DR. MAURO: It would be very good for everyone to be current on both documents, yes.

MR. KATZ: Mark, have you located the document?

MEMBER GRIFFON: Yes, I have the matrix, yes.

MR. KATZ: Great.

DR. MAURO: Great. I was concerned that somehow it wasn't distributed. But it was, except it wasn't cleared.

CHAIRMAN ZIEMER: Right.

MEMBER MUNN: And the date of distribution again was?

DR. MAURO: Well, this is it.

CHAIRMAN ZIEMER: I believe it was in March.

DR. MAURO: March 9, 2009 is the last version of that.

CHAIRMAN ZIEMER: Okay, so first of all let's pick up the current NIOSH responses. Actually, let me just review

something which I have sort of just prepared. And I am going to hand Emily a copy of this because I think I can use this for discussion. It is just something that I prepared to help with the meeting to summarize the issues and who was going to provide what.

And I don't think there is any names in here other than the authors of reports which have been used throughout other documents. There is two reports mentioned in here. And the first issue on the matrix, what arose out of our last meeting was the question of whether or not recasting is considered when -- let's see.

The question of whether or not recasting is considered was the issue and the fact that that would result in certain progeny, namely, thorium-234 and Pa-234 rising to the surface of the casting. This issue is in abeyance because NIOSH was to evaluate that and revise. And I think they had agreed to add a section to TBD-6000 to address that and

it also identified the Puzier reference.

And Dave, the response to that you have done, but there is not a cleared version of that, I believe, or is there now?

MR. ALLEN: I am not clear on whether anything is cleared or not so I don't know. Like we just talked, we gave our response. SC&A gave a reply to that. And as best as we can tell, at least the final thing is not cleared and I am not sure if the NIOSH part was ever cleared or not.

CHAIRMAN ZIEMER: Well, the tasking -- well, I don't want to call it tasking, but the agreed-to path at the last meeting was that NIOSH would evaluate and revise and add a section to TBD-6000. I don't believe that has occurred yet.

MR. ALLEN: Right. That's true.

CHAIRMAN ZIEMER: So it remains in abeyance. That is something that NIOSH has agreed to do, is my understanding, to add that issue or add that as a revision to the TBD-

6000. Was that your understanding?

DR. NETON: Yes.

CHAIRMAN ZIEMER: And that remains to be done. So there is a revision to TBD-6000 that is to arise to address that issue of the progeny that arise during that process.

MR. ELLIOTT: Do you have a sense of when that will occur, Dave? Or can you speak about other activities that are compounding that or have to be attended to along with that? What is going on with this?

MR. ALLEN: Well, I did want to clear one thing up because I am not -- reading the original SC&A review of TBD-6000 along with the replies that are here, everybody agrees, we agree and I think SC&A agree with that, the TBD would benefit from a discussion of that. Nothing in anything so far has said that the numbers look like they should change, as far as the beta dose from this. And from what I have looked at, it looks like they are really accounted for from other remelt areas,

what kind of beta dose you get compared to what you get, what is assigned in TBD-6000.

I am not clear if that is what was intended from SC&A, if they really thought the language needed to be revised or if they felt the numbers were not correct.

DR. MAURO: No, we felt that the numbers are not correct. And what I am saying is that I believe the radiation yields in the vicinity of ingots reflect the classic numbers of 200 mr per hour at contact, 2 mr per hour at foot, which is the correct numbers for a slab of natural uranium.

However, parts of the report indicates there are circumstances that have occurred in the past where the thorium-234 somehow finds its way toward the surface and there is this crust that is on the outside now. And as a result, they have seen beta fields and gamma fields from bremsstrahlung that were substantially elevated above the numbers I just mentioned by a factor of ten or

greater.

Now, our position is that we are not necessarily saying that all of these AWE facilities that are covered by TBD-6000 necessarily deal with that material but there is, I think it was a 24- or 34-day half-life of the thorium-234, which -- 24 -- which would indicate that -- well you could envision circumstances where an ingot would show up at an AWE facility that may not be very aged, okay, and as a result, could still contain some crust, where the unsupported thorium-234 may still be contributing to an elevated radiation field in the vicinity of the ingot. And to the extent at which that could occur, it could substantially increase the external exposure, both beta and gamma, that a worker might experience.

So I guess what I am asking you is that that discussion needs to be had in TBD-6000. Right now, 6000 is silent on that particular subject. The degree to which it

has a substantial effect on your external radiation fields in the vicinity of uranium is very much going to depend on the type of uranium the person is handling. If it is uranium that has already been skinned of its crust, then of course it is not a problem. If its uranium that is many months old, it is not going to be a problem. Or if, in general, ingots or dingots are not sent to a particular facility, then it wouldn't have this crust.

And finally, there is even some discussion of how real this phenomenon really is. For example, there is some discussion where it is widely believed that it covers the entire ingot. In other cases, there is some evidence that no, no, no, it is more in the top, the top crop. And there is some other discussion where it is inside the inner surface of the bomb, the casing, more there.

And so all we are really pointing out is that there is an issue here where, depending on the outcome, could have an effect

on the numbers in TBD-6000.

DR. ANIGSTEIN: It is a little late for that from a direct second-hand experience, rather than a fourth- or fifth-hand account. And that was working -- we had an old contract years back with Manufacturing Sciences Corporation, which was a DOE contractor at Rocky Flats, and they were doing vacuum casting of uranium ingots. And we were out, I and another colleague from SC&A, were out there talking to them and discussing -- we were supposed to do the radiation assessment for them. And they described that the uranium would be put into this mold and vacuum induction, with induction heating under vacuum. And then they would open up the bottom and the uranium would drain, I think, from the bottom into this mold.

So in that instance, the uranium itself left behind they called it a skull, a sort of slag. And there sort of was coating on the whole inner surface not just on the

top. They called it -- it was hot. It was hot because it was all very concentrated thorium-234. So in that instance, it was removed from this ingot but it remained. The top of it still had it.

CHAIRMAN ZIEMER: Still had it.

DR. ANIGSTEIN: And they had to sort it out. It was called a hot tub to sort it out.

There could have been other instances where it wasn't drained through the bottom where it would remain on the entire ingot.

So the theory there was that during the casting it did migrate to the surface, not just to the top but to the surface surrounding the uranium. And conceivably, if they had used a different technique, they could have just removed the uranium. If they allowed the uranium to solidify there, they would have had the crust all around.

It is a real thing. It doesn't mean that it happens in each and every process, due to differences.

CHAIRMAN ZIEMER: Well, I think that is understood. And just reviewing this issue, after the original finding, NIOSH agreed that the TBD would benefit from a discussion of this matter. So that was agreed on.

And SC&A basically said it appears that NIOSH and SC&A are in agreement on this issue. Now, whether or not the numbers are affected wasn't discussed here. They may or may not be. But at this point, the issue was, consider this parameter. And NIOSH has agreed to do that and they are looking into that. And so that remains in abeyance until the TBD is revised and we would have an opportunity to look at what that revision would be.

So the matter would be discussed and then NIOSH would have to determine the extent or the conditions under which the

values would change. In some cases it may be significant. In other cases, it may be an, oh, never mind, depending on the situation such as you described, how it is generated and what they do with it as the process continues.

So I think it will remain in abeyance until the revision occurs but everyone agrees that that issue has to be discussed in some detail.

And what did we say on the time table or did we establish one?

MR. ALLEN: Well, that was why I was trying to make sure.

CHAIRMAN ZIEMER: We need clarification.

MR. ALLEN: I need clarification because from our preliminary evaluation on it, it wouldn't really affect the numbers. The numbers of TBD are --

CHAIRMAN ZIEMER: Well the point is, you need to discuss that and document that.

DR. MAURO: By the way, right now, you have been looking into this matter and you are finding that this 200 mr per hour, this 2 mr per hour surface, are holding up well, notwithstanding the crust? I mean, is that what you are --

MR. ALLEN: The beta skin dose numbers and the TBD are holding up well to what we are seeing from remelt operations. And because of that -- and there is other outstanding issues -- my intent was not to revise TBD-6000 until these other issues are further down the road.

CHAIRMAN ZIEMER: So you have one revision but --

MR. ALLEN: Right.

CHAIRMAN ZIEMER: But it might be useful to have a White Paper so that --

MR. ALLEN: That is why I wanted a clarification.

CHAIRMAN ZIEMER: -- you can say, okay this is what is going to be in the

revision.

MR. ALLEN: Right.

CHAIRMAN ZIEMER: That would be helpful.

Okay, I am just making a note and I see others are. So a White Paper on what the revision will cover.

And I assume that will give us some idea of what you are finding on those values.

MEMBER BEACH: So we can expect that before our next meeting?

CHAIRMAN ZIEMER: It depends on how soon we meet, I am sure.

MEMBER BEACH: Well you said about six weeks.

CHAIRMAN ZIEMER: I am thinking about six weeks or so. We will talk about it at the end of this meeting. And we have many other issues so that is not going to be the showstopper. You know, if that is not ready. I mean, we are going to have to deal with

other things. And actually, to some extent, work on petitions becomes a priority. We have got to deal with the petition itself, although this becomes part of it.

DR. MAURO: Yes, I would like to add that this, as Dr. McKeel pointed out in some of his material, this is a cross-over issue. It has relevance to Appendix BB.

CHAIRMAN ZIEMER: Right.

DR. MAURO: Also, Dr. McKeel may have received a Puzier report. I know there was -- okay, good. So everybody is on the same page.

CHAIRMAN ZIEMER: Right.

DR. McKEEL: This is Dan McKeel. I do have one comment about Puzier.

CHAIRMAN ZIEMER: Yes.

DR. McKEEL: Besides the fact that DOE went out of its way to accommodate getting that report released, but it is in very small type, very difficult to read. It is a poor copy.

And what would help me is if somebody who knows where the thorium-234 references are by page, that would help me a great deal.

CHAIRMAN ZIEMER: Yes, I think we can track that down because in fact Bob may have that information right now. I think Bob, can you --

DR. ANIGSTEIN: It is if you go by the typewritten page numbers on the bottom, you find it on page 25 and 26. There is also a second pagination handwritten in the upper right-hand corner. And those page numbers are 41 and 42.

DR. McKEEL: Thank you.

CHAIRMAN ZIEMER: So pages 25 and 26 and 41 and 42?

DR. ANIGSTEIN: No, or 41. They are the same. It is 25 and 26 on the bottom, 41 or 42 on the top.

CHAIRMAN ZIEMER: I got you.

DR. McKEEL: Thanks so much.

CHAIRMAN ZIEMER: Issue two. NIOSH had agreed with the finding that the beta dose should be included but they contended that the contribution to personnel dose was small. And the issue was also placed in abeyance and the tasking was that NIOSH was to address beta dose.

MR. ALLEN: Yes.

DR. MAURO: I would like to add that we did do the calculations in our report and we found that the beta dose contribution from surface contamination to skin, testes, and breasts are not insignificant.

So we may have a bit of a disagreement here and it is important that we get it on the table. We did do some numbers and we found the numbers were substantial.

DR. ANIGSTEIN: I think that NIOSH's point was that if the same worker was exposed to a slab of metal and to a contaminated floor surface --

DR. MAURO: Got you.

DR. ANIGSTEIN: -- the slab of metal would be the dominant.

DR. MAURO: Okay.

DR. ANIGSTEIN: But the point that we made was that there may be circumstances where there is no metal around, just dust on the floor. And in those cases, that should be considered.

CHAIRMAN ZIEMER: Well, where this issue was at our last -- before the last discussion was that SC&A agreed with NIOSH regarding the relative magnitude of the exposure --

DR. MAURO: Within that context.

CHAIRMAN ZIEMER: -- but in that context. Whereas if it is small compared to the others unless it is the only thing you are considering.

But the last note in the matrix was that it appeared that NIOSH and SC&A are in agreement but the issue is in abeyance until the revision where apparently NIOSH

would discuss it in the revision and point out this very thing, I believe, is what was agreed to. So that becomes part of the revision.

DR. MAURO: Yes.

CHAIRMAN ZIEMER: It would seem to me that we don't necessarily need a White Paper on that in advance if we understand that that is what -- it is just going to be clarified in the revision.

MR. ALLEN: It will be a new set of numbers. But I mean, it is beta numbers from surface contamination.

CHAIRMAN ZIEMER: Right.

MR. ALLEN: I don't think there will be a lot of disagreement.

CHAIRMAN ZIEMER: Right, just that it's discussed.

DR. MAURO: Well because we have put our numbers in. And when you do your numbers, you know --

MR. ALLEN: If any of my numbers are significantly different --

CHAIRMAN ZIEMER: Then we have a different problem.

Okay, issue three. At the last meeting, NIOSH was tracking down the origin of the 232 value and they were to provide an update on that, issue three.

MR. ALLEN: Unfortunately, the update is the author reviewed some information and cannot find that now. He doesn't know where it came from. There were very small numbers that he added in there but he is not quite sure where they came from. I don't know how to close this out.

CHAIRMAN ZIEMER: So how do we know that those numbers are -- is there any independent verification?

MR. ALLEN: I think SC&A, I am putting words in your mouth here, but I think you basically said, you know, the other numbers look good but this morning we had no idea where it even came from.

DR. MAURO: We had no idea where

it came from. We don't think the thorium should be there.

MR. ALLEN: And they don't really disagree. It was a tiny number.

DR. ANIGSTEIN: There was an experiment with a mixed oxide fuel at Fernald, which would eventually have worked its way back to the DOE supply pool.

DR. MAURO: Thorium-232.

DR. ANIGSTEIN: Yes, it was a mix. They were trying to have mixed uranium and thorium as a reactor fuel that was fermenting with it. And that is how thorium got into the uranium supply, at least there, and it may have gotten recycled back.

DR. MAURO: Okay. I hadn't heard that before.

MR. ALLEN: I don't think that was ever reprocessed.

MEMBER MUNN: Why would they reprocess?

MR. ALLEN: I mean, the idea was a

thorium breeder chain.

MEMBER MUNN: Well it seems unlikely they would reprocess that channel.

MR. DUTKO: They did.

MEMBER MUNN: They did?

MEMBER POSTON: Yes, the first core for Indian Point 1 was a thorium uranium mixture. The reactor was made by Babcock and Wilcox and the fuel was reprocessed at West Valley.

CHAIRMAN ZIEMER: Was that kind of unique, though, John?

MEMBER POSTON: The only core that I know of. They had to rework it for Babcock and Wilcox.

DR. McKEEL: Dr. Ziemer?

CHAIRMAN ZIEMER: Yes, Dan.

DR. McKEEL: This is Dan McKeel.

CHAIRMAN ZIEMER: Yes, Dan.

DR. McKEEL: I believe we have sent to the Board a page and I can't remember, there are two tables in this document, Tables

1 and 2, and it is a document about Weldon Spring. I think it is called the newest U.S. uranium plant, something like that. But anyway, they have a table in there where they have constituents of some of the uraniums that they processed. And one of the tables does show a very low, it is less than one percent, you know, some fraction of that, of thorium-232. So that is another place that we have seen it. And that context was, of course, Weldon Spring supplied some of the uranium to GSI.

CHAIRMAN ZIEMER: Yes.

DR. McKEEL: I am sure we can find that again and send it to you if that would be of interest but that is in our material.

CHAIRMAN ZIEMER: Okay. Again, that was just a trace then.

DR. McKEEL: Yes, but it is there.

CHAIRMAN ZIEMER: Okay. I am wondering if that is something worth looking at. I tend to vaguely remember that. If we

can pick that out, we might even be able to do that during the break or something.

DR. NETON: Yes, we could easily compare the numbers.

CHAIRMAN ZIEMER: So we will take a look at that. And Dan, we are going to try to find that also during the break. I think I have got all the documents --

DR. McKEEL: Okay.

CHAIRMAN ZIEMER: -- that you had provided, if I can sort through them, and if we are going to pick that out today. Otherwise we can hold this in abeyance and look at it again at the next meeting.

I don't think it is going to end up being a significant issue but we want to make sure we put it to rest properly.

MR. RAMSPOTT: Dr. Ziemer?

CHAIRMAN ZIEMER: Yes.

MR. RAMSPOTT: This is John Ramspott. I did forward that document to SC&A as well.

CHAIRMAN ZIEMER: Yes.

MR. RAMSPOTT: And the one point I made with it is we are not just talking about thorium. We are talking about the thorium that is then activated by the betatron. There is two steps in that and they are various articles about betatron activation of thorium on the internet.

CHAIRMAN ZIEMER: That is right.

MR. RAMSPOTT: Thorium is not just by itself. It then has another step.

CHAIRMAN ZIEMER: Right.

MR. RAMSPOTT: It would be different than most of the other plants that handled the --

CHAIRMAN ZIEMER: Right. In this context here, in TBD-6000, it is simply the presence of the thorium in the uranium. The case you are talking about would be specific to Appendix BB issues.

MR. RAMSPOTT: You are totally correct. Yes, sir.

CHAIRMAN ZIEMER: Exactly. Thank you for that, reminding us of that.

Then issue four, which was airborne uranium dust concentrations. At the last meeting what I had jotted down is that NIOSH did not understand the funding and actually that shows up in the matrix here as well. It says the comment is not clear. And then there is a reply by SC&A but the action item at the last meeting was that NIOSH was going to review the Adley report, compared to the Harris-Kingsley report and the Simonds Saw data and validate the Adley value, which was a GSD of 5 as being adequate and generate a White Paper. And Dave has done that.

And that White Paper -- and I think that was cleared. So everyone should have a copy of that White Paper. And Dave, do you want to comment on that just to summarize it?

MR. ALLEN: Well, I guess it is best just to summarize it. It was a review of

the data in Adley. For issue four, it was air sample data, I believe is what we were looking at. And I reviewed what was in Adley and what was at the Simonds Saw Steel plant and compared that to what was in TBD-6000. And there is not a lot or did I get the wrong issue up here on the screen?

I put a table right off the map there that kind of tries to compare them apples to apples. One of the bigger issues was the units were completely different from --

CHAIRMAN ZIEMER: Right.

MR. ALLEN: -- to the other. A lot of conversion going on so I tried to put them on similar units and just do a straight comparison. And still to me, TBD-6000 looks like it is in-line with that. And I think John said SC&A hasn't replied.

CHAIRMAN ZIEMER: John, we don't have any official comments but you had --

DR. MAURO: Yes, we did some work.

I have restricted -- Bill Thurber, Bill are you on the line?

MR. THURBER: Yes, I am.

DR. MAURO: Bill did the work over the weekend, prepared a brief response, which I envisioned would go in the matrix, right underneath your new material, if your folks would like it and maintain copies of it. This is our response.

I think the bottom line is, the bottom line we agree. Bill could explain what he did to convince ourselves that in fact yes, it looks like the Adley report is compatible with the Kingsley and Harris report.

CHAIRMAN ZIEMER: I think that would probably be fine. And then we can get this cleared also for the petitioners in a very reasonable time. But is it okay, Emily, to distribute this here, right, and discuss the bottom line on it?

MS. HOWELL: Yes.

CHAIRMAN ZIEMER: Okay. And then

--

DR. MAURO: Bill, was there anything that you wanted to just, were there any exceptions or any aspects where you felt that there may be some differences that needed to be discussed or are you pretty comfortable with where we are on this?

MR. THURBER: I'm pretty comfortable.

NIOSH indicated that there weren't any distributions in Adley. And actually there is quite a bit of raw data in there. And if you look at the raw data, it is not clear how Adley came up with their average exposures for the various job descriptions. But if you go to their raw data and use it rather than what they say are the averages, you come out with slightly higher numbers.

But, as David Allen said, the numbers in TBD-6000 are higher than those in Adley. And even if you look at the adjusted Adley numbers, they are still in line with

TBD-6000. So we are content with the fact that Adley has been looked at in the context of TBD-6000 and doesn't change the TBD-6000 conclusions.

CHAIRMAN ZIEMER: Okay, thank you, Bill. Let's see. We need to get a copy of this to Mark. You can send him an un-cleared copy.

MEMBER GRIFFON: I have -- are you talking to me? I have the White Paper.

CHAIRMAN ZIEMER: No, not the White Paper.

MEMBER GRIFFON: Oh.

CHAIRMAN ZIEMER: Here at the meeting, John has distributed their response, which basically says that they agree with the NIOSH analysis and it is a two-pager. It is really a page and a third or so. And we will try to get this cleared right away -- and also your copy -- out for the petitioners. But John gave us the bottom line there and Bill amplified what was done.

But it appears to me that at this point, we can close this item. Let me ask the Work Group members here. Dr. Poston, was each one --

Mark, do you want to see the SC&A review before we close this?

MEMBER GRIFFON: You can send it along but I am pretty comfortable with it as it is. So, I agree. I think we can close it.

DR. MAURO: Bill, if it is handy, could you email your report? I don't know if I sent it out to everybody. No. If you can email a copy of this to everyone, this way you have an electronic version, including Mark, that would be helpful. This way you have it. Because all I did was hand out hard copies. I brought it with me this morning.

MR. THURBER: I'm not sure I have the list, John.

DR. MAURO: Okay, we will take care of it. Don't worry about it. In fact, we will process this.

CHAIRMAN ZIEMER: Okay. We will get it out here probably sometime today through Nancy or something like that.

Okay, very good. So by consensus, we will agree that we can close issue four.

Issue five, there was disagreement between NIOSH and SC&A on how to determine surface contamination. I had a note here NIOSH linked to surface contamination to airborne regardless of particle size. NIOSH assumed sediment buildup. SC&A believed that surface is what is important and they referenced the Adley report and some collection plates and so on.

And NIOSH was to provide a White Paper which would review the Adley report. And that has been done. And that White Paper was distributed. And Dave, again, you want to summarize for us there?

MR. ALLEN: Yes, it is kind of, with Adley like I said, units are different. And for their purpose with the report, it was

a little difficult to pull the information that we are looking for from it.

They did do settling rates. They did it as a matter of the amount of uranium milligrams per square foot per day, set plates out for 158 days in the winter in the metal melt building, I think what it was called, the Melt Building. And they changed those after 158 days and replaced them with new plates for another 117 days. And that way, they were looking at winter when the doors were routinely, normally closed versus spring when the doors were routinely left open, I think is what they said in Adley.

So just dividing the amount of uranium, the square footage at the plate and the number of days they got a settling rate of uranium.

Unfortunately, we were using a settling rate in meters per second. They are using a settling rate in milligrams per square foot per day. So we have to correlate some

air sample values to make these two match up.

So again, I was trying to use the time-weighted averages in Adley for those. It was very difficult to try to correlate those air samples with the settling plates because the time-weighted average was four people who moved from one job to another, whereas the settling plates were stationary.

And I think I listed all of that in the White Paper. I attempted to anyway. So that was a difficult comparison. But in the end, what I found in the White Paper, the settling rate itself, the 0.00075 seems to be a reasonable number even towards the high end. That has to be applied for a particular period of time and that part in TBD-6000 does not seem to be a good number. It should be a little higher than that is what I came up with in the White Paper.

I don't know if John wants to --

DR. MAURO: Again, Bill was kind enough to work on this over the weekend. I

have a restricted version of a hard copy that no one else has seen. I would like to distribute it. And Bill could describe what we did to evaluate the White Paper that was distributed by David. Again, I will give the bottom line. It sounds like we have got a resolved issue.

And I would like to add one more thing before -- but I do want Bill to go over this because we did some work on this. The most interesting thing that came out of this is something I had in my mind -- we had in our mind an idea that when you are working with uranium and you are milling it and grinding it and rolling it, you are generating aerosols and dust in the air but you also generate large flakes. And I was always concerned, and this goes back to so many cases, where the way in which NIOSH was approaching the problem was well, do you know what your dust loading is in the air? Well assume it is all about 5-micron AMAD and we know the velocity, the terminal

settling velocity is .00075 meters per second. We agree with that and they have let it fall for some time period. There is some variability in how you do that. Sometimes you assume it falls seven days, sometimes you assume it falls a year.

But in any event, what I am getting at is we were always concerned with the idea that you estimate activity on surfaces based on this deposition process, where we felt that well no, the surfaces don't get contaminated. I mean, they get contaminated that way but the way they really get contaminated is from this grinding and flaking and these big pieces coming down. But what happened was when we looked at the Adley data, son-of-a-gun, that is the way in which it happens.

So, Bill, I want you to please go through what you did --

MR. POLO: Ten minutes to nine.

DR. MAURO: Pardon me? Is that

Bill?

MR. THURBER: No.

DR. MAURO: What I am getting at is this particular issue which I have sort of been cranky about for a long time, I think it might just have gone away across the board. That is, the way in which you do it, this velocity, .00075 coming down, works because the plate analysis when you go backwards and do all the calculation and looking at what accumulated on the plates, and then you use this deposition thing, it worked. I was quite frankly expecting the plates to be loaded up with a lot more than what would be there if only settling was occurring. But son-of-a-gun, what is there is calculated, is right on target. In fact, if anything, the .00075 seems to be a little high.

So anyway, but Bill, please, there was a couple of aspects of the work where you did have some observations and maybe want to develop the story a little further but this is

an important issue because it not only affects this particular TBD-6000 but it must affect 100 cases that we reviewed in the past, where one of our findings was this. And I think this is going to be very helpful in resolving a lot of issues. So I think it is important that we look at this a little bit. And Bill, please go ahead and describe the work you did.

MR. THURBER: Okay. What Adley did is as David mentioned, they set a bunch of plates out in the winter and after 158 days they took the samples from the plates and determined how much uranium was there and basically assumed that the deposition was linear over that period of time.

They did the same thing in the spring for 117 days, the difference being in the spring, the doors were open so conceptually you had more air blowing around and disturbing what had settled and so forth.

We looked at the alternate assumption that said we don't know whether

this stuff really accumulated linearly for 117 days or 158 days but rather if during that time it had reached some kind of an equilibrium situation -- who is talking?

MR. KATZ: Bill, can you just hold one second?

Whoever else is on the telephone, would you please mute your phone, who is speaking right now?

Excuse me. Excuse me. There are people talking on this line who should not be talking. Please put your phones on mute. If you don't have a mute button, you can use *6 to mute your phone.

Zaida? Zaida, are you on the line?

(No response.)

MR. KATZ: Nancy, are you on the line? Nancy Adams or Zaida Burgos?

MS. ADAMS: Ted, Nancy is here.

MR. KATZ: Nancy, can you get a hold of Zaida and please, whatever line that

is, they are having a conversation, they don't seem to be able to hear us. Can you cut that line then?

MS. ADAMS: Yes, it seems like a member of the public.

MR. KATZ: It is but --

MS. ADAMS: I will call Zaida.

MR. KATZ: Thank you.

MR. POLO: There is a woman lawyer out there.

MEMBER MUNN: Yes, there are several.

MR. DUTKO: Is that Joe Polo?

MR. POLO: Yes.

MR. DUTKO: Joe, shut up!

MR. KATZ: Okay. John, whoever you are speaking to, if you just, Joe Polo or whoever that is, if you would use *6, you will mute your phone and then we won't have to listen to your conversation so that the Work Group can do its work. Thank you. *6 or a mute button.

Okay, Bill.

MR. THURBER: Okay. Anyways, we considered an alternate hypothesis which said that during the deposition period, at some point during the deposition period, that an equilibrium had been achieved between suspension and/or deposition and re-suspension. The one number that you know for sure from the Adley results is the number of milligrams of uranium that are deposited per square foot. You don't know exactly how many days over which that occurred, but you do know that number. That is a number that is very certain.

So, we looked at this alternate approach where instead of assuming that the deposition was linear, that sometime during the deposition period, equilibrium had been reached. And what we found by making that assumption was that again the numbers were a little different than those suggested by NIOSH but in the same ballpark. That either way you

look at it, that the numbers were reasonable.

Now there were a couple of things that we didn't understand in the NIOSH report, probably because the description was a little bit truncated. But there were some points made in the discussion of contamination levels that weren't clear to us. As David mentioned, the calculated deposition velocities, based on the Adley data, were actually lower than the .00075 meters per second number that has been regularly used. And if the deposition velocity was indeed lower, we would have expected that the contamination levels calculated with Adley were lower and NIOSH suggested that the opposite effect was true, which we didn't understand but that is something that can be sorted out on the side, as far as I am concerned.

The main point is that looking at the deposition results in two different ways, we come up with numbers that are within reasonable expectations.

CHAIRMAN ZIEMER: Thank you, Bill. Dave, did you have any comments on that last part?

MR. ALLEN: Well I might not have understood but to try -- I think you have already kind of answered that question, if I understood it. You are basically saying you didn't understand how the settling rate could be higher in Adley but the contamination levels would be lower.

MR. THURBER: No, it is the other way. You calculated settling rate, settling velocities from Adley and got numbers of .00023 or .00022 or something, which is lower than the .00075, but you say in the contamination levels section, the median value for the TBD-6000-derived contamination levels was 3.8 times lower than the contamination levels derived from Adley. And I didn't understand that statement.

MR. ALLEN: Yes, that --

MR. THURBER: The fact that the

settling velocity was lower from the Adley data.

MR. ALLEN: Yes, the simple fact that if you are going to use the settling velocity, you have to apply some duration to it. And it basically comes down to we had a slightly -- we are using a slightly higher settling rate than you would get from Adley but we are not applying it for a long enough time in TBD-6000. The seven days should be longer, basically 3.8 if I remember right, or something longer, even is we use our higher settling rate.

Does that clear it up?

MR. THURBER: Well I guess what you are saying is that you have introduced deposition time into this estimate which wasn't clear from what you had written. That is all.

MR. ALLEN: Okay. Yes, that is exactly it.

MR. DUTKO: Dr. Ziemer?

CHAIRMAN ZIEMER: Yes.

MR. DUTKO: Can I point something out, sir?

CHAIRMAN ZIEMER: Yes.

MR. DUTKO: I just wanted to mention the fact that we handled this uranium, we chained it up. We set it up on shooting tables. We had to set up film directly behind the ingot. We had to handle the ingots by hand. What in fact is the thorium factor with this handling the ingots as we had to, sir? Thank you.

CHAIRMAN ZIEMER: Yes, that actually would be a different question than we are dealing with right here but we will keep that in the back of our minds and we can deal with it probably when we are into the GSI issues directly.

This particular issue is a general issue in the what is called TBD-6000, which is the general document that applies to all the AWE facilities of this type. And we are

talking here more specifically about surface contamination in these facilities. So the issue you raise will be a separate one.

DR. MAURO: Just I would like to boil it down. Because we didn't look at the Adley work, we were concerned that maybe there may be some important data there to take into consideration. And our main concern was airborne dust loading to do an inhalation activity and direct radiation exposure from residual radioactivity on the ground.

CHAIRMAN ZIEMER: Right.

DR. MAURO: All right. And what you did do was look at the Adley data and show that yes, in fact there was. It reaffirms that the Harrison-Kingsley that you used upon which to base all of your numbers, rings true with the Adley data, which gives a lot of assurance because you are coming from two different directions, two independent sets of work, and the numbers are coming out in about the same place.

CHAIRMAN ZIEMER: Yes, thank you.

Again, we want to make sure that Mark gets a copy of the SC&A response here, as well and then as soon as it is cleared, to get the copies out to Dr. McKeel and his colleagues.

It would appear that this particular issue can be closed. Mark, do you have any questions or comments or do you want to see the document on this one as well?

MEMBER GRIFFON: On this one, I wouldn't mind seeing SC&A's document. I am actually in the middle of looking at some of the numbers itself. But it was quick to conclude for me.

MR. THURBER: Mark, this is Bill Thurber. I could email to you the documents right now, if you would give me your email address. If that would help.

MEMBER GRIFFON: Yes, that is fine. You don't have it from -- it is [identifying information redacted] at,

[identifying information redacted] --

MR. THURBER: [identifying information redacted] at [identifying information redacted].

MEMBER GRIFFON: Right.

MR. THURBER: Okay. I will take care of it in the next minute or two.

CHAIRMAN ZIEMER: Yes, and you are going to give electronic copies to all of the Work Group members in any event. Right, Bill.

MR. THURBER: Yes, I will be happy to, but I will need those email addresses from somebody.

CHAIRMAN ZIEMER: Let's just hold off action on this for the moment.

MR. THURBER: Yes.

CHAIRMAN ZIEMER: Okay, any further questions on this particular issue?

(No response.)

CHAIRMAN ZIEMER: Then I would just point out that issue six had been transferred. I don't know if I sent you the

memo yet, Wanda, but you are on this group as well. This was transferred to the Procedures Review Subcommittee, issue six.

MEMBER MUNN: I am so pleased.

CHAIRMAN ZIEMER: You had been getting rid of some but we want to keep the hopper full.

But now that you have an official transfer letter, I can use that to transfer this to you officially.

MEMBER MUNN: It will be approved tomorrow. That will be fine.

CHAIRMAN ZIEMER: Right. And then I point out that, at the last meeting, we closed issue seven. However, John Mauro asked for an opportunity to comment on issue seven again, even though it is closed, you are going to let the door ajar a little bit and I agreed to let John comment on that.

DR. MAURO: And I appreciate that accommodation.

When we last spoke about this, we

came to the meeting and we -- it is actually the ingestion, inadvertent ingestion -- and we came to meeting under the impression that the effect of the full inadvertent ingestion rate by workers in these facilities was 0.5 milligrams per day. That is, and in fact, you may even recall Bob brought a little vial with what 0.5 milligrams looks like and you could barely see it.

Now, Jim correctly pointed out, he said, no, no, no. We don't really do that. We have this, and it is a long story but it boils down to, whatever the air concentration is, milligrams per cubic meter, you multiply that number by 0.2 and you get milligrams per day ingested. And so if you have a hundred milligrams per cubic meter of dust --

MR. ELLIOTT: That can't be.

DR. MAURO: Let me finish and then you can say it.

MR. ELLIOTT: That's pretty high.

DR. MAURO: -- you can get 20,

depending on what you add.

So at the time, we were talking about some pretty high numbers. We were talking about high milligrams per cubic meter and you end up with pretty high ingestion rates. But and so as a result of that, we were wrong. It isn't just an automatic 0.5. In other words, we walked into the meeting saying it is always 0.5.

But it turns out though that after having an opportunity to sort of caucus and think about it a little bit, we realized that the reality is in most of these sites, the dust loadings are nowhere near 100 milligrams. They are closer to one. And then if you multiply that by you know, your 0.2, now you are getting back down to those really small numbers again.

And so I just wanted to bring that up to the Work Group that under most circumstances, when you are implementing this OTIB-0009 procedures where you are using what

I call the 0.2 rule, you are going to come up with milligrams per day, in at least the case of uranium, that are going to be really, really small. And there is a certain incongruity between that number, let's say it turns out to be 0.5 milligrams per day, and what is widely used as a default value by EPA and the Nuclear Regulatory Commission and NCRP. If they talk in terms of 50 milligrams a day or 100 milligrams per day.

Now, Jim correctly points out that when you go back to the literature behind that, you find out that, well, you know, that literature and the science upon which it is based is kind of weak. And we accept that, too.

So we are sort of in a bit of a strange place now. The 0.5 milligram per day number that you would get very often using the 0.2 rule, intuitively doesn't seem to be right because it is so much smaller than what is reported or recommended by other agencies.

Then we physically looked at it and said, my goodness, if you are in a dusty environment, it has got to be more than this.

So all I wanted to say is that we are troubled that if when you are doing a dose reconstruction for a worker and you are assigning some ingestion and it turns out that ingestion, especially if it is a dusty environment like an AWE facility -- and you end up with a 0.5 milligram per day ingestion rate, it just doesn't seem like you are really giving the benefit of the doubt to that worker with that number.

If you were coming in something in the order of tens of milligrams per day, it seems to ring more true. And I guess that is -- unless Bob you want to add anything -- that is where we come out on this.

CHAIRMAN ZIEMER: Are we talking about the actual mass of the --

DR. MAURO: Mass.

CHAIRMAN ZIEMER: -- material.

DR. MAURO: Yes.

CHAIRMAN ZIEMER: Not the mass of a nuclide.

DR. NETON: That is my issue, if I could comment on it.

DR. MAURO: Okay, good.

DR. NETON: Everything you have said so far is true. But I always believed that the amount that you ingest is directly tied to the amount of surface contamination that is on the ground, which is tied to the air concentration.

So I cannot see a scenario where the air concentration approaches zero, close to zero -- I can't see assigning a ten milligram uranium mass intake when it is distributed maybe amongst some inert matrix, and that is where the issue comes in.

I don't disagree that a normal person may ingest 20, 50, 100 milligrams per day of material, dirt, dust, whatever. But when you spread that uranium among the inert

matrix, then it is quite conceivable you can ingest 20 milligrams of material but only ingest 0.5 milligrams of uranium. I am not saying that you only ingest 0.5 milligrams of total material in the day. And that is, I think, our --

CHAIRMAN ZIEMER: You almost never have a pure -- I say almost never because I know of cases where accidents have occurred where something has become airborne. In fact, I had one where the investigator -- an aerosol was generated right in his breathing zone. And he ingested virtually pure nuclide. The mass was not very much but the activity was terrific.

DR. NETON: Let's say this material were plutonium. Very high specific activity, very little mass. You have the same activity on the ground, are you going to say ten milligram intake of plutonium is just as well? So give it the same exact air concentrations, plutonium versus uranium, with

the same particle size. How are you going to give a person exactly ten milligrams each for the same amount of activity? That doesn't --

DR. ANIGSTEIN: Yes.

DR. MAURO: Okay.

DR. ANIGSTEIN: First of all, from my experience, I have worked extensively with EPA and NRC, I don't think it should be based on pure uranium. I think it should be based on total amount of matter ingested. And then on a case-by-case basis, it should be said, okay, here we have like, for instance, at Blockson when we did it, I maybe presented this one on several iterations, but in principle, they said okay. They rolled uranium on the weekends. They rolled steel during the week. So the contamination was a mixture of steel dust and uranium dust. And then there was a fraction assigned.

So, that kind of an approach would make sense where you assign some recognized amount of ingestion and then you apportion

that ingestion to whatever else, you know, using some site specific estimates, here is steel, here is soil, here is whatever other substance forms a surface layer of, say, the upper millimeter or whatever you want to assign to the surface layer and then you have a concentration. I think pure uranium, unless it is a uranium fabricating facility which would have nothing but uranium, I think pure uranium probably is too conservative but I think that the total amount -- and the other problem I have is this OTIB-0009 is highly speculative. It is not based on data. Whereas, here we have at least a published report that is the policy of another government agency. And that should be given some precedence over something that is sort of ad hoc, made up. This has been, there was at one time an effort made by three agencies to come up with a rule, with some guidelines on recycling of metals from nuclear facilities. And there were three separate groups of

contractors. One was working for EPA, which is us, one is working for NRC, which was SAIC, another one was working for DOE, which was ANL. And we had some disagreement but we came to a consensus and the consensus was we weren't talking about milligrams per day. We were talking about milligrams per hour of total --

DR. NETON: Inert material.

DR. ANIGSTEIN: -- material, of contaminated material.

DR. NETON: There is a difference, Bob, though.

DR. ANIGSTEIN: Pardon?

DR. NETON: There is a difference.

DR. ANIGSTEIN: But I mean, the same approach.

DR. NETON: Okay. Many of these facilities that we have, especially these small, what I call mom-and-pop, AWEs process uranium for very short durations of time. They aren't like the, what was the one where

the -- Bethlehem Steel, where we had steel production and then uranium. There was one thing on top and mixing. And I think we all agreed that that model was probably the most appropriate application there. Well, you have a facility that works for two or three days and distributes some uranium and you know the air concentration, there is going to be essentially a surface settling.

And I think it makes the most sense to the take the predicted surface concentration times some factor of the -- and you know the value, square meters per day that a person would ingest of that material, which is in the RESRAD-BUILD and there is distributions that we have calculated. And we have done that calculation and compared OTIB-0009 to the RESRAD-BUILD calculations and we are right on.

DR. MAURO: For the 0.5 milligrams --

DR. NETON: No, no, no.

DR. MAURO: -- distributions.

DR. NETON: Based on air concentration --

DR. MAURO: No, no. He uses two approaches.

DR. NETON: Right.

DR. MAURO: And one is the 0.5 and one is the 50.

DR. NETON: Well, it has to do actually with the amount of square --

DR. MAURO: The material.

DR. NETON: -- area of material ingested per day. And they did sort of a sanity analysis and the amount ingested per day in the workplace using the higher value, they felt was inappropriate. And we agreed with them. We agreed with that analysis.

DR. MAURO: Well, in the end, I think that we are closing the gap and I agree. I see where you are coming from now. So, you are not disputing that -- listen, 50 milligrams per day may very well be what

people might ingest in a very dirty environment. But that 50 milligrams is not pure uranium.

Now my concern is that, at a lot of these AWE facilities where, let's say that is what they do, they roll, grind, that is what they do -- and it is well established that there was dust on the ground, on the floor, dust they could see in the air associated with the grinding and rolling operations. So the material that was distributed was uranium.

Now, under those circumstances, I would say the 0.5 if not going to hold up very well because you are dealing primarily -- yes, the stuff that is on the --

DR. NETON: You have to go back to -- under the surface concentration that we would predict would be on the surface, available for ingestion. That is where we --

DR. MAURO: Yes.

DR. NETON: It is intuitive to me

that the higher the air concentration, the greater the chance for ingestion because as you just saw in the Adley analysis, our settling rate is about right, if not a little high.

DR. MAURO: I'm with you.

DR. NETON: And so we take the air concentration, settle it down, and then have a person ingest a unit area.

DR. MAURO: That was the part that I was just troubled with, this business of well, we are going to assume a certain amount. Ten percent with something that is on your hand and then some fraction. That whole sequence of calculations to go from what is on the ground to what you ingest was --

DR. NETON: Well, for OTIB-0009, I mean, look at RESRAD-BUILD and they actually, there is a very good empirical analysis that was done of all the factors involved and there is a range. We can apply a uniform distribution of that range. In fact, I think

I looked at the upper end of that range against OTIB-0009 and it played out about right.

DR. MAURO: But he admits, you admit -- listen, let's go with the 0.5 case. Because it seems to me that it would be unusual for it to be this very dirty surface. Yes, it was 0.5 milligram per day.

In other words, there were two categories. The high, very dirty place and the clean place.

DR. NETON: Well, I don't know if it was dirty or clean. It had to do with the square meters of ingested material per day. It is all related to the meters squared per hour that a person ingests of the surface contamination. We have to go back and look at that. It is not a dirty versus a clean environment. It is like how much could a person really ingest in one day? Could you ingest -- I think it came down to you ingest about a postage-stamp size of --

DR. MAURO: Whatever is there.

DR. NETON: -- your work space every hour or something like that. Whatever is on that surface contamination level, --

DR. MAURO: But see, I am going back to what Bob had pointed out earlier about the amount of material that a person ingests, in terms of milligrams per day, they were actually talking the milligrams per hours, this is a steel mill now. We are looking at a steel mill.

So right now, you are working in a dirty environment and there is stuff on surfaces. I don't care if it's uranium or it is steel. If it is a dirty environment, you are going to be ingesting fairly large quantities.

Now the outcome of your calculation for an old AWE facility which is handling primarily uranium, where there is a lot of uranium on surfaces and you walk away with a note that says 0.5 milligrams per day,

we are going to have a problem with that.

DR. NETON: But again, our model is tied to the amount that is on the surface contamination.

DR. ANIGSTEIN: What about the case --

CHAIRMAN ZIEMER: You are not going to get 0.5 milligrams per day, unless it is fairly --

DR. NETON: If it is a fairly low surface contamination value, you will get a fairly low ingestion rate because you are not ingesting much uranium. You are ingesting a lot of inert material with it.

MEMBER POSTON: If you inhale it or ingest it, you are going to expectorate with stuff. Right?

DR. NETON: That is another point. And quite frankly, those ingestion models that the EPA and others rely on, as far as I can tell, do not account for the amount that is swallowed from inhalation. I think they

are tied, personally.

MEMBER POSTON: Just think if we --

CHAIRMAN ZIEMER: You mean the stuff that is trapped and cleared and swallowed.

MEMBER POSTON: If it is oral and inhalation, you are going to expectorate.

DR. NETON: What I am saying, Bob, is those analyses measured the fecal output of people and determined the amount that was ingested and they did not account for the amount that they could have inhaled and ingested subsequently via the lungs.

CHAIRMAN ZIEMER: Okay.

DR. NETON: So I believe that they are biased high. I can't prove it, but they certainly don't account for it.

DR. MAURO: And I concur with that.

DR. NETON: And that is fine.

CHAIRMAN ZIEMER: We are going to

take a break. Fifteen minutes. It is 11:00. We will take a break until about 11:15 and then we will resume.

(Whereupon, the above-entitled matter went off the record at 11:01 a.m. and resumed at 11:17 a.m.)

MR. KATZ: Okay, we are back from a break. Let me just check with someone on the line to make certain we have you. Mark?

MEMBER GRIFFON: Yes, I am here, Ted.

MR. KATZ: Okay, great.

CHAIRMAN ZIEMER: Okay. We are ready to deal with Appendix BB, which is General Steel Industries and the Issue Matrix there and also recognize that some of the issues involved here also spill over onto the SEC Petition Evaluation Report as well. So, to some extent we may get into those issues as well.

Dan McKeel has asked to make a statement to us. And Dan, are you on the line

now?

DR. McKEEL: Yes, sir, I am.

CHAIRMAN ZIEMER: We would be pleased to have you make your initial statement here, Dan.

DR. McKEEL: All right. Thank you very much, Dr. Ziemer. Can you all hear me all right?

CHAIRMAN ZIEMER: Yes, we hear you very well here.

DR. McKEEL: Very good. I wanted to primarily speak about the most recent documents from SC&A on its review of the NIOSH SEC 105 petition. And I think those findings are so important that they really override many other considerations and they include comments about Appendix BB. So they will pretty much encompass my thoughts on both of those important documents.

The first finding is their issue seven which has to do with dose reconstructions not based on based on best

available science. And in that finding, SC&A documented, and this is quoting from their paper, has documented a number of scientific errors in Appendix BB. Most noted is a 20-fold error in calculating the dose from irradiated uranium, which we found in the computer files used by NIOSH, although this error increases the dose rate and is, therefore, claimant-favorable, it is not scientifically correct.

And I think the very important comment is that the calculated values are, therefore, not acceptable for use in dose reconstructions.

The second comment is on issue eight, incomplete model use for exposure assessments. And SC&A's finding there, and I quote, is that, other indications were that the NIOSH model is incomplete, as given by Buker et al in 2008.

In section 7.3.4.1 under the heading Neutron Dose is the statement, a study

is in place to determine the photon-to-neutron ratio. That would be a NIOSH study. As we found in our audit of Case B, NIOSH has neglected the neutron dose in performing dose reconstructions. And I would like to add that I sent four separate requests to OCAS trying to get a copy of this photon-to-neutron study and was unable to do so. And I was finally told that that data was incorporated in the White Paper that NIOSH issued in November of 2008 and in the SC&A comments to it. And as you will see later on, apparently SC&A is not aware of that fact. So I asked for the pages of that White Paper that had the relevant photon-to-neutron study data. And I got no reply about that.

Under the heading Neutron Dose on page 36 of SC&A's review is the statement again that a study is in place to determine the photon-to-neutron ratio. And there the comment by SC&A was we have to reserve further comments on the neutron dose assessment until

we have had a chance to review the aforementioned study.

The third comment I have relates to issue eight. And again, that is the incomplete model used for exposure assessments and I think this is a very powerful statement. Given the undetermined status of the model, we find that the dose reconstructions performed by NIOSH to date, do not meet the standard of scientific accuracy. And of course, we all recognize that they are the words that are a necessary determination to award an SEC.

The fourth comment I have is about SC&A's issue number three: lack of documentation. And the conclusion of that finding I want to highlight is that consequently, it does not appear to be possible to determine the exposure of workers to uranium from January 1st, 1953, the assumed start of uranium handling operations to March 1, 1958.

And furthermore, my comment to that was that part of the source characterization at GSI would include not only the cobalt-60 sources, which there are two of, but also the iridium-192 source, the 250 kVp x-ray unit, and perhaps as was discussed in TBD-6000, the thorium-234 that is in the top crop and sides and top and bottom, as a matter of fact we believe, of the raw un-machined dingots and ingots that were sent over from Mallinckrodt to GSI for x-ray examination.

And then SC&A also confirms that finding and says on page 30 that, finally, no mention is made of the potential exposures to other radiation sources during the pre-'64 period, such as the 250 kVp x-ray machine and cobalt-60 and perhaps iridium-192 sources. I wanted to highlight that.

The finding number four and issue relates to film badge dosimetry dependence on photon energies and exposure geometry. And the major finding there was SC&A observes

after a long set of deliberations about this, that the film badge records are, at best, an approximate measure of the radiation doses received by their wearers.

Later on page 29, SC&A comments on several incidents that involved sealed sources and has a note there about a particular incident that we believe refers to the highest dose recorded at GSI. This was a dose received by a worker when he, we believe, was unable to replace a cobalt-60 sealed source and left it open for 16 hours. And that comment should be noted as well.

And I think after I finish, perhaps later in the discussion, John Ramspott may be able to fill in details if that particular incident still is an issue.

On page 3 -- 31 of the SC&A review is this comment. Another issue is the energy dependence of the film badge dosimetry. The exposure conditions at GSI were different from those in most other facilities. Before

relying on the film badges to validate its model of worker exposures, NIOSH should characterize the spectrum of the photons incident on the film badge, including angular corrections and compare it to the spectrum of the radiation source used to calibrate the badges.

Only by means of such a comparison can the film badge readings be meaningfully translated into radiation doses. Even then, the dose registered by the film badge would be meaningful only if the radiation field were consistent with the anterior-posterior exposure geometry.

And my comment is that I believe at the November 10th, 2008 Work Group meeting, Dr. Neton from NIOSH was going to look into several aspects that were not finalized by then, including the isotope sources and the film sensitivity, the dental film sensitivity used at GSI in the Landauer badges to 24 and 25 MeV betatron energies. And I think we

still need to have that assessment, as SC&A seems to indicate.

My sixth point relates to issue number five, the lack of validation of models of radiation exposure of betatron operators. And I would just comment that, as we all know, SC&A developed a model. NIOSH developed a model. And in the White Paper in November '08, both of those model external doses were compared to the film badge readings.

SC&A's finding was, in short, neither the film badge data nor the model exposures can be used to establish an upper bound to the external exposures of betatron operators that is claimant-favorable and scientifically correct. That is the end of that quote.

The next to the last point is on page 32 of the SC&A report. And that relates to Section 7.2.4, internal dose reconstruction feasibility conclusion. And in that, SC&A states the following: NIOSH concludes that

the methods described in Battelle-TBD-6000 and Battelle-TBD-6000 Appendix BB provide reasonable approaches to conservatively bound internal doses for all members of the class under evaluation. That is NIOSH's statement. SC&A says, we disagree with this conclusion for reasons discussed in sections 4.13 and 5.16.

And finally, I would like to draw attention to the quote on page 38 of 50 that is 5.24 in the SC&A report and relates to Section 7.6 of NIOSH's SEC Evaluation and that is titled Summary of Feasibility Findings for Petition SEC 00105.

SC&A says this: we agree that with a few exceptions Allen and Glover in 2007 do provide guidance to enable health physicists to perform dose reconstructions. And of course Allen and Glover 2007 is Appendix BB. The exceptions are vague instructions for assessing intakes of uranium dust via the ingestion pathway and ambiguity in assigning

workers who may have performed radiography using sealed sources outside the betatron buildings, the radiation exposures prescribed for betatron operators or those prescribed for the general worker population.

These issues aside, we find that the guidance provided by Allen and Glover is neither claimant-favorable nor scientifically valid.

And to the petitioner and I believe the workers and site experts that I represent, those eight items are really fully sufficient and compelling for the TBD-6000 Work Group to recommend to the full Board, hopefully even as early at the October 20-22 upcoming meeting in New York to reverse NIOSH's recommendation to deny SEC 105 based on Appendix BB and the SEC Evaluation Report assertions that it is feasible for NIOSH to do accurate dose reconstructions.

So that is my final finding comment. I just wanted to add one footnote --

and there are some other footnotes in the written version of this that I mailed to everybody this morning -- and that was that, in the SC&A report Attachment A, which has to do with Dr. Anigstein's interview with the petitioner, the primary petitioner, it says that the primary petitioner had not responded to Dr. Anigstein by the time of his report.

And I did talk to the petitioner and she said, and sent me the email confirming this, that she did reply to Dr. Anigstein. And it was distributed to members of the Work Group, to SC&A and NIOSH on July 7, 2009. That reply is very interesting and I would urge you all to please read it because it has a different tenor to it and some additional facts about herself and her relatives that were GSI claimants. And I think that's important: to keep the record accurate.

So, that is the end of my comments and I am extremely appreciative that you all let me address you this morning on these

ideas. Thank you very much.

CHAIRMAN ZIEMER: Okay, thank you, Dan. And I think Bob is going to comment on your last comment right now. I think he did in fact subsequently receive that.

DR. ANIGSTEIN: Right.

CHAIRMAN ZIEMER: Tell us what the status is of that.

DR. ANIGSTEIN: If Dr. McKeel would note on the top of the interview report, Attachment 1 is dated June 24th. And I submitted the -- that was the date on which I initially wrote this.

CHAIRMAN ZIEMER: This report.

DR. ANIGSTEIN: I originally wrote the report. Now I don't have the date here where I distributed it, but I think it was at least one week later. It was early in July that I sent this out to the Work Group. And my point was that at that time, they said she has not responded as of this date.

I fully acknowledge that I did get

the response later emailed to me and I forwarded that response to the members of the Work Group and to NIOSH staff involved with Appendix BB. And as a matter of fact, I will comment on that later on because there is an agenda item where I am asked to report specifically on my interviews. So I will comment on that.

CHAIRMAN ZIEMER: Right. And initially that was a separate item on the first draft agenda. But then, since you had incorporated -- then that is fine and it is still on this agenda but it appears as part of the SC&A document here because your reports on those interviews were incorporated into the document.

Originally when I made the agenda, I didn't realize those reports were going to be in the document so had called that out as a separate item.

DR. ANIGSTEIN: Yes and no, because there was another interview that was

not strictly part of the SEC that I conducted and sent a report on.

CHAIRMAN ZIEMER: It was not in here.

DR. ANIGSTEIN: It is not in here.

CHAIRMAN ZIEMER: Right. Right. Yes and thank you, Dan, for that input. Actually, we will be discussing the SC&A report specifically as part of item five.

I do want to back up a little bit here first and take a look at the original Appendix BB Issues Matrix and make sure we are updated on that. And just some carry-over items which were directly related to the original matrix, although they all have implications also on the petition as well.

First of all, to see if there is any additional update from SC&A on the film badge review. Is there anything since our last meeting that we need to be updated on? And --

DR. ANIGSTEIN: Yes.

CHAIRMAN ZIEMER: -- I guess I will lump in there, both for SC&A and maybe for NIOSH as well, the third item which has to do with the so-called Picker x-ray issues. I don't know if SC&A looked at that at all but NIOSH was going to look at that.

DR. ANIGSTEIN: We looked at it to some extent.

CHAIRMAN ZIEMER: Okay. But anyway, so update us on that and then I am going to report briefly or remind you of the one document that I generated reviewing those high dose values, which that was distributed after our last meeting.

Okay, Bob, go ahead. We have a PowerPoint presentation. And are these slides that we can later share with --

DR. ANIGSTEIN: Yes, these have been, at the last -- 15 minutes before my taxi was due, I saw Emily's email clearing --

CHAIRMAN ZIEMER: So these have been cleared and we can --

DR. ANIGSTEIN: But I have not distributed them.

CHAIRMAN ZIEMER: No but we can get electronic copies distributed both to the Work Group and the petitioners very soon.

DR. ANIGSTEIN: Yes.

CHAIRMAN ZIEMER: Okay. So we have a series of PowerPoints and Bob is going to discuss those. And Dr. McKeel, we'll get you copies of these. Work Group members don't have copies yet either.

DR. McKEEL: Thank you very much.

CHAIRMAN ZIEMER: If the electronics fire up here, we will be able to --

DR. ANIGSTEIN: Okay, so I am just going to -- this is a complete history of the film badge measure issue.

I distributed a preliminary version which wasn't cleared and so there was some material on yours and back here, and also on a later, my next presentation of some

material that I added later is now in use. So, the two are not consistent.

Okay, so our first review, I was working from a CD and I tried printing. And some of the results were not clear, particularly in 1954.

COURT REPORTER: Sir, I need you to keep your voice up.

DR. ANIGSTEIN: Pardon me?

COURT REPORTER: At the end of your sentences, you trail off. I need you to keep your voice up.

DR. ANIGSTEIN: Okay.

Then there was a Work Group meeting about November 10th I think or something like that. And immediately after the meeting, or when I requested or commented on the fact that some of the data was not legible, I was sent a much better copy, a hard copy of 1964. So I was able to read those and then the later one through '65 and later, we are able to decipher. So I would say it was

100 percent.

In the end, I had 100 percent coverage of every weekly report from January '64 through June '66. The January '64, by implication, went back to mid-November 1963. There were seven previous weeks which were not covered but where I did not see the actual report but we could infer because they would give cumulative doses and in no case was there a dose where all cases that all the readings were minimal.

So if it was a total during this period, a total of 88 workers, NIOSH reported 89, but it turned out there was one worker that was added after the fact.

COURT REPORTER: Sir, please keep your voice up.

DR. ANIGSTEIN: Pardon?

COURT REPORTER: You need to keep your voice up.

DR. ANIGSTEIN: Oh, okay.

COURT REPORTER: You trail off at

the end of the sentence.

DR. ANIGSTEIN: It is just the microphone placement.

COURT REPORTER: I will just say that you trail off at the end of your sentences and that is what I was --

DR. ANIGSTEIN: Okay. Okay, thank you. I will try to remember that.

So, of these as it is said, there were 66 workers during this two and a half year period, every reading was kept. There were 13 total readings where the reading was seven millirem and then there were ten readings -- sorry, 13 readings equal to ten millirem and ten readings greater than ten millirem. There was some question for the film badges of that period whether ten millirem was really a good number.

So then based on material that was sent by Dr. McKeel, communicated to the Work Group, Dr. Ziemer has asked that we look at it further because Dr. McKeel was under the

impression there was some very high dose readings and I had not seen those high original review. And I confirmed week by week and confirmed that there were no such very high readings.

And then by accident, I was looking at the later data to investigate the report by another worker who said he had had an accident with a cobalt-60 source. And I knew his name. I was going to look him up and see what kind of readings were reported on his film badge. And in the process of doing that, I found yes, there were some very high readings. I found that out by simply skimming every six months down to every six weeks from 1966 through 1973. But by looking at every six months it would tell me if there were some high readings and then I was able to go back and trace the actual week.

MEMBER POSTON: What does high mean?

DR. ANIGSTEIN: Emily?

MEMBER POSTON: I'm not asking you for a name. I am asking for a --

DR. ANIGSTEIN: No, I know. I know. I was told I can't mention numbers.

MS. HOWELL: I didn't hear the question.

MEMBER POSTON: I want to know what high means. High is qualitative.

MS. HOWELL: That is fine.

DR. ANIGSTEIN: I can mention numbers?

MEMBER MUNN: You can say how high is high.

DR. ANIGSTEIN: We had one dose that was recorded at 38,500 millirem. Another one that was 19,000 something.

Okay. What happened there was these would have immediately caught attention. These were higher than the annual limits at the time. So these would have most likely been communicated immediately. The badges were typically processed up to a month later.

So these, you know, in retrospective probability analysis, we said undoubtedly these would have been -- those readings would have most likely been communicated to the radiation -- the person assigned radiation officer who also was known to be the supervisor at the time.

These took place in 1969 and in 1970. There were two such cases. In the first such case what we found was the notation DS on the film badge report. First there was the weekly report for all the workers that covered that week. Then there was a second page with just for that one worker same dose but it said DS. And we confirmed with Joe Zlotnicki who is an SC&A associate who formerly worked for Landauer, he said DS means does subtractant. And he said most likely, they would have some correspondence.

He communicated with Landauer and found inside with variability of all of the correspondence which showed in the first case

the worker had written a memo to the supervisor, a very simple typewritten memo, saying during the week of, the week corresponding to that high reading, I wore so and so's, you know, Smith, to give you a name, Smith's badge and I dropped it in the betatron room and I retrieved it later.

Then that memo was attached to a memo from the supervisor/radiation officer to Landauer requesting that that dose be subtracted. And in fact, the dose -- this took place over a month or two; it took a while for the letter to get written, for Landauer to act. And once Landauer acted and issued that second report with the DS on it or subsequent for the rest of the time this worker worked at GSI or at least was part of a film badge program, all of his cumulative doses were at a minimum. So that dose had been removed from his record.

The second case would be 19-plus rem dose. The worker himself wrote the letter

to Landauer saying that he had, during that week or during a particular day, it was on Friday he dropped his badge in the shooting room and retrieved it the following Monday, from my memory.

And he requested, and as documentation for this, he said he worked with three other workers and gave their names and badge numbers. And he said at all times that he was in the shooting room, at least one of those three were with him and all of their badges showed no reading. Therefore, he uses that as evidence that his badge in fact was not exposed while he was wearing it.

And again, Landauer issued another dose report with a DS and subsequent to that all of that person's badges, all of that hazard report had cumulative, I think in this case he already had a 40 millirem accumulated dose so in the future, it reverted back to 40.

There was a third one of approximately seven rem where there were no

comments and no redactions. Now all of this took place in the '69 -- in the post-AEC period. So strictly speaking, it is not relevant. But it is relevant only if you say well, GSI continued with the same supervisor, the same radiation sources, meaning the betatrons and whatever, isotope sources and x-ray machines that they had. There is no indication they got new machines or new sources. So it could be argued, therefore, that this was representative of what could have happened in the earlier time, even though there were no such high badge readings during -- the highest badge reading was in excess of two rem during the covered period.

So, basically then, the later report, later documents for this one, this April 2, 2009 report, detailed chronology on this day the letter was sent, on this day the redaction, the dose subtraction took place. And it was very plausible chronology that it would have taken that many days for this to

have taken place and then --

COURT REPORTER: Sir, I will ask you one more time. Please keep your voice up at the end of your sentences.

DR. ANIGSTEIN: Okay. Finally as requested on April 17th, I produced redacted copies of all of this correspondence so that it could be shared with members of the public who requested it. And this consisted of the two letters. One letter from the radiation officer, accompanied by the memo of the worker to the radiation officer. The second letter from the worker himself and then copies of the corrected dosimetry report. So all of that is publicly available.

The only other items that I have which were -- the question had arisen about whether there were metal filters in those badges. And there is a photograph that can be furnished at SC&A's request by Landauer. And this is from the historical collection. One of the badges that they talked about the

little red badges. And if you look here and here are evidence of these metal discs that were placed over the film as filter. And there were three so maybe I guess there is a third one back here.

And the purpose of these, of course, was to give some idea of the quality of the radiation. And in one case, there was even a notation on the dose, the H, which means high energy.

CHAIRMAN ZIEMER: Well, plus the cut-out represents the open window part as well. So that is a third energy determiner.

MEMBER POSTON: Actually, there would be four.

CHAIRMAN ZIEMER: I used Landauer badges and there were typically three metals plus the plastic. And the left one probably was not a metal filter here. It is probably just plastic. So we had open window, plastic, and three different metals.

MEMBER POSTON: So there are four

filters over it.

CHAIRMAN ZIEMER: Yes.

DR. ANIGSTEIN: Right. The plastic, I would guess, would take out the betas.

CHAIRMAN ZIEMER: Yes.

DR. ANIGSTEIN: Yes, because there was a space. In the report there was a column for beta and it was always black.

CHAIRMAN ZIEMER: Right. Your open window you get beta plus gamma.

DR. ANIGSTEIN: Yes.

CHAIRMAN ZIEMER: The other, less would be gammas or x-rays. And you could do some energy determinations from the filters.

DR. ANIGSTEIN: And the next page, this is taken from an -- ORAU has a museum, I haven't visited it in a long time, of historical radiation devices. And on their website, excerpts from their website, it shows exactly the same Landauer badge. And it comments they have three circular metal

filters.

So okay, that is the end of the film badge story.

CHAIRMAN ZIEMER: So what we insert here, on those, one of the questions that was raised by the petitioners was whether or not those memos that went into Landauer and the removal of the subtracting of the value, whether those corresponded to people whose badges were on the list.

DR. ANIGSTEIN: Now the one issue where there was a little discrepancy is the worker, and this was, I mean, I have the report but this is from my memory --

CHAIRMAN ZIEMER: Well, let me get it because it is in my report. And that is, there were two things. One is, on the one high exposure, the worker whose name corresponded to the number on the list had written or another worker had written, there were two individuals, that he had used that other person's badge and had dropped it in

there.

DR. ANIGSTEIN: Right.

CHAIRMAN ZIEMER: And the names agreed with names on the list.

DR. ANIGSTEIN: There was one discrepancy. There was a discrepancy and that was that that worker said I used Smith's badge. He himself was not issued the badge until over a month later or six weeks later, was the first time that his name appeared.

CHAIRMAN ZIEMER: His name appeared in January. This was --

DR. ANIGSTEIN: Actually, I found it in December.

CHAIRMAN ZIEMER: Okay, you found it in December. I know I saw it on the January badge.

DR. ANIGSTEIN: That was in the report.

CHAIRMAN ZIEMER: He certainly showed up later on the list.

DR. ANIGSTEIN: Yes.

CHAIRMAN ZIEMER: So he was an individual there.

DR. ANIGSTEIN: But he was not badged --

CHAIRMAN ZIEMER: At that time.

DR. ANIGSTEIN: -- at that time.

CHAIRMAN ZIEMER: And apparently had used this other person's badge or at least that is what he was claiming.

DR. ANIGSTEIN: Yes. I did notice that at times there were unassigned badges. That badge lists were composed of badge numbers with names and then there were frequently numbers in the badge report with no names.

Now I can't comment any further on that. Whether that worker could have been told, take one of these temporary badges, unassigned badges that we have, because in discussing this again with Zlotnicki, he said well, the number was only attached to the badge report once GSI told them we have

assigned badge number 50 to worker such-and-such.

And they might very well, if they were given, I am just speculating, if they were given these, why would they have been given extra badges, and I would speculate well if somebody shows up, they are not going to say well you can't work until we send your name in to Landauer and they issue you a badge. Yes, you start working now and here is the badge. And later on when we get around to it, we will tell Landauer that you are the person wearing that badge.

So I am just speculating, he may have been told to pick up the badge that is unassigned and instead, he picked up an assigned one.

CHAIRMAN ZIEMER: Well in any event --

DR. ANIGSTEIN: It is plausible, whether it is true or not.

CHAIRMAN ZIEMER: -- we confirmed

that those were people who were on the list.

DR. ANIGSTEIN: Yes, there was a real person who had not been issued a badge.

CHAIRMAN ZIEMER: On the other case, also the individual, all of the individuals named, including the ones with minimals that he referred to, all showed up on the list of workers.

DR. ANIGSTEIN: And they were current.

CHAIRMAN ZIEMER: Right. And I found one discrepancy in the number and I included this in the report. There was one digit in the badge number that I couldn't tell whether it was a three or an eight. The copy was very fuzzy.

DR. ANIGSTEIN: I think I confirmed that it was probably an eight.

CHAIRMAN ZIEMER: Well in any event, --

DR. ANIGSTEIN: We magnified it.

CHAIRMAN ZIEMER: -- I thought it

looked like a three when the number was listed on the list as an eight.

DR. ANIGSTEIN: Well my impression was that it probably was an eight.

CHAIRMAN ZIEMER: Yes, in any event, the only other question that some may have is whether or not workers were made to do this. There was some implication I think that there was an implication at least, and I don't know if anyone was actually asserting this, that these workers may have been told that this had to be subtracted. I don't know that to be the case.

DR. McKEEL: Dr. Ziemer, this is Dan McKeel. May I --

CHAIRMAN ZIEMER: We have this written documentation. Dan, do you have a comment on that?

DR. McKEEL: Yes, sir. I would like to just -- John Ramspott has done extensive -- more investigation of this but I have two comments.

One is when I wrote Landauer and received my set of data from them in January 2007, their employee wrote me a letter which stated, highlighted, that there were two workers that had received above-the-limit doses in the reports that she was sending to me.

And so all I can say is perhaps she overlooked those DS notations that Dr. Anigstein apparently has in his dataset. But at least the official Landauer letter to me conveying those data did not contain any information about doses having been retracted.

And then the other thing to comment is of course we know the names of the people who had the 38 rem and the 19 rem doses. And moreover, we have talked to everybody alive in their families. Now neither of those two workers are alive. They are both deceased. And we have claimed all along that the Privacy Act certainly does not cover deceased persons and, in fact, as proof

that the HHS OGC office apparently agrees with that idea sometimes but not others, in the SEC Evaluation Report by SC&A, they in fact revealed the name of John Ramspott's wife who is deceased, while they redact John's name, itself.

So anyway, I would like Mr. Ramspott to fill the Board and everybody in on what we have found but I will give you the headline first. The headline first is that one of the workers who by all reasoning that we can do without knowing the names on you all's letters and memos, the second worker that Dr. Anigstein mentions denies that he ever wrote such a letter to Landauer and in fact has no knowledge of him having that high dose reading. So that is number one.

The first one, the person with the highest dose; we have talked to all [identifying information redacted] of his [identifying information redacted] who were told about this incident by their father, the

person that we have named on this, and I am going to let John fill in the story. We believe that the story told is true. We believe that the highest dose reading actually was incurred by the gentleman whose name that dose is assigned to.

So John, are you on and could you fill in the Board on what we found, please?

MR. RAMSPOTT: I am on the line and I am going to ask Terry Dutko, are you on the line as well?

MR. DUTKO: Yes, sir.

MR. RAMSPOTT: The reason I am asking if Terry is on the line is that Terry and I actually interviewed live, in person, about two and a half months ago, the isotope supervisor foreman who actually reported the incident that took place that we believe resulted in the highest badge reading. We do know the names. Actually, Terry tracked down this foreman, the isotope foreman for the gentleman whose name ends in P. You will -- I

know who I am talking about.

But I do have to follow up on Dr. McKeel's one comment. We had to go through a lot of cloak-and-dagger and hit-and-miss to find these people and I really was surprised to see the redaction of deceased names apply sometimes to us and not to others. You know, my wife, Christine, has no problem, I am sure, with her name being in this report. As a matter of fact, I know she is smiling down on us because we are trying to remedy this for all the workers and her father happened to be one of them. But to use her name, redact mine, then play a lot of cat-and-mouse where we can't get names, seems like there is two sets of standards to me, and I think that should be noted.

But I am going to move into the meat of the situation and one comment that, before I let Terry start to explain some of this because he was a worker who was there. You guys like first-hand information. He was

there. He was a worker. I just happened to be sitting in on this interview. And Terry and I both swear to the fact that we sat there. As a matter of fact, the gentleman we interviewed, I have a nice smiling picture of him in a 1964 magazine with him noted as an isotope operator and a picture of him that morning Terry and I met with him. And he does happen to have a GSI dosimetry pencil in his pocket, which he showed us as well. So there definitely were other sets of detection devices used at GSI, which we don't seem to have any records for.

The one big factor that I am going to bring out, I hope, in my own personal opinion, this should show the amount of -- I am going to use a nice word like deceit because the story starts to change a lot when you talk the man who was a foreman there. This incident, as Dr. Anigstein noted in the letter he received, was from the betatron room. Well it couldn't be further from the

truth, unless there is two such accidents with the same man, at the same place, at the same time, with the same high badge reading because this gentleman was very, very specific to tell us that this whole incident took place in 6 Building in the

small isotope NDT testing area, totally opposite direction from the plant. And of course, we think this will lend credence to why the isotope sources must be considered. Actually by law all radiation must be included in dose reconstructions. It is the law. It seems to have been overlooked.

And in this case here, this Building number 6 also happened to house her other supervisors at GSI, anywhere from 200 to 300 unbadged, I am going to repeat that, unbadged workers when the supposed accident took place. So, Terry, can you fill us in on the details as we heard them from Mr. last name starting in D? Would you, please?

MR. DUTKO: Yes, we met with this

gentleman early in August. We stated that this individual who he was supervisor over supposedly dropped the film badge, supposedly in the shooting area of number 6 Building. For some odd reason, I don't know why, went home off the job, signed the report in the log sheet when he left as to there being a hot isotope in the shooting room.

[identifying information redacted], supervisor, came in 16 hours later, saw this report. Joe Polo happened to be there. I talked with Joe Polo and Joe Polo verified that the pit was left hot. This gentleman had gone home. He expected to be fired.

Now when this gentleman went home -- and I talked to this gentleman's son not too long ago, his son claimed that when he came home he was very upset and crying that he had a bad exposure. He had a bad exposure occur at work. He expected to be fired.

One thing I know for sure without

question, without speculation: any time anyone was brought in employment into the betatron, they were the top Magnaflux operator. Magnaflux was a starting job. They did not enter the betatron without an assigned film badge. At no time, especially not six months or six weeks or two months later. They had temporary badges if needed. These temporary badges were always recorded and assigned if needed.

This gentleman supposedly took a film badge of the reported incident of somebody else's, dropped it in a shooting room, when all in all this incident occurred in 6 Building. It was a contrived incident made up by management as a cover-up to this film badge incident. I know the gentleman's name. Not only that, another exposure incident I talked personally, the fellow from work I worked with, he had a seven rem exposure and didn't even know it. He was never even told of it but it was on his film

badge records.

Now it is this kind of, well, how would you call it, injustice that we found out personally there is no doubt in my mind something happened to this gentleman. I know not what but I think he had a serious accident. It had to be covered up and that is exactly what it looks like because that is what this gentleman basically told us.

DR. McKEEL: Terry, this is Dan McKeel. Can you also tell about the involvement of St. Louis Testing in this? Because that is further corroboration of what happened.

CHAIRMAN ZIEMER: Before you do that, let me ask a question. This is Ziemer.

DR. McKEEL: Sure.

CHAIRMAN ZIEMER: Did I understand you to say that he did actually leave the area but left his badge in there? In other words --

MR. DUTKO: This is what I was

told by this gentleman. He left. He accidentally dropped his film badge in the shooting room and not know it.

CHAIRMAN ZIEMER: But not in the betatron room.

MR. DUTKO: No, this was in number 6 Building, shooting room, sir.

CHAIRMAN ZIEMER: So that was what?

MR. DUTKO: Number 6 Building cobalt.

CHAIRMAN ZIEMER: That is the cobalt source?

DR. ANIGSTEIN: That was a small cobalt source.

CHAIRMAN ZIEMER: Yes, but what I am sort of asking is you are not asserting that the value on the badge then represented his exposure, since the badge was left in the shooting room overnight, apparently.

MR. DUTKO: Sir, I think it was there for 16 hours because [identifying

information redacted] was called in by [identifying information redacted] --

CHAIRMAN ZIEMER: Yes, I have got you --

MR. DUTKO: -- at the suggestion of Joe Polo.

CHAIRMAN ZIEMER: But the individual was not in there during that period.

MR. DUTKO: Right. They called him --

CHAIRMAN ZIEMER: Okay.

MR. DUTKO: But whether this man had an exposure, I can't say, sir. I can't say. But there was something that happened, something that happened in this closure completely away from the betatron --

CHAIRMAN ZIEMER: Got you.

MR. DUTKO: -- where they contrived this letter that somebody dropped not even their own film badge. And sir, as long as I worked there, nothing like this ever

happened, --

CHAIRMAN ZIEMER: Yes.

MR. DUTKO: -- as far as somebody not having an assigned film badge, by liability alone, when they walked into that betatron. You could take that to the bank.

CHAIRMAN ZIEMER: Okay, thank you. Go ahead.

One comment from Bob here.

DR. ANIGSTEIN: I would like to make two responses. One is Dr. McKeel's observation or Dr. McKeel's report or the letter that he got from Landauer, that is completely consistent with the dose subtraction because each of these two initial reports, the 38-plus rem and the 19-plus rem, happened towards the end. One was October 30 and one was in November.

So what Dr. McKeel was given or what the lady from Landauer was looking at was the year-end report. And in fact, the year-end report, the December 31st report, were

these workers for two different years, 1969 and 1970, would, in fact, have contained those doses. They were subtracted in January or February in those two cases, of the following year.

So she was giving correct information but it was not complete. Unknowingly incomplete information.

DR. McKEEL: But Dr. Anigstein, I did get the end of year badges through 1973. So, Emily, apparently, I presume, looked at those badge readings, too. She may have just missed the reports with the DS but --

DR. ANIGSTEIN: Yes.

DR. McKEEL: -- we discussed --

DR. ANIGSTEIN: I can certify that after the DS every badge reading for that individual was M in one case and 40 millirem in the other case. So what she was looking at, she looks at a 1969 year-end report and says, okay Smith had the high reading over the limit. She did not look at later years. I

mean, this was having dealt indirectly through my colleagues. They don't have the manpower. They don't have the resources for that. They charge by the hour and Dr. McKeel submitted the statement where, you know, that he was charged so and so much.

If she had done this sort of exhaustive search that I did, it would have taken many more hours and they would have had to charge them. Besides, Landauer is not in business to supply this information.

CHAIRMAN ZIEMER: Well, in any event, the records show both.

DR. ANIGSTEIN: Yes. So what she said was entirely correct but not complete.

CHAIRMAN ZIEMER: Okay.

DR. ANIGSTEIN: I also did, after having talked to Terry Dutko, who called me a few days ago and gave me the account that he just gave, I just out of curiosity and assuming, we really don't know what the strength of that source was but someone had

said it was a microcurie and others said it was a curie. I said, well just hypothetically, let's assume it was a 250 millicurie source and what was the exposure rate and one foot away from that source, just an arbitrary value, and it turns out that it would have taken ten hours at one foot away to have accumulated 38-rem. Rems are not quite the same but --

CHAIRMAN ZIEMER: Close enough.

DR. ANIGSTEIN: A two percent difference.

So that story -- and since we don't know how close the badge was to the source and we don't know the actual strength of that source. So the story of it, it was there for 16 hours and got that kind of exposure is quite possible.

CHAIRMAN ZIEMER: Do you have additional comment, John or Terry?

MR. RAMSPOTT: Dr. Ziemer, it is John Ramspott.

DR. McKEEL: I have a comment, too, please.

CHAIRMAN ZIEMER: Go ahead, John and then Dan.

DR. McKEEL: Okay.

MR. RAMSPOTT: I think the point that I am actually trying to make -- and I definitely appreciate that verification that 16 hours is viable. But the whole fact that this is a contrived story about happening in the betatron vaults is what I understood --

CHAIRMAN ZIEMER: Yes, I understood that point, John.

MR. RAMSPOTT: The fact that it didn't happen there?

CHAIRMAN ZIEMER: Yes.

MR. RAMSPOTT: It happened at the opposite end of the plant?

CHAIRMAN ZIEMER: Yes.

DR. McKEEL: Calls into question, into total question about the validity of any badge information or any letters. And I am

sure that Landauer got something from GSI. I am not questioning them by any means.

CHAIRMAN ZIEMER: No, and indeed that is what I looked at, what was in the Landauer records. So those do exist.

MR. RAMSPOTT: Yes, actually and I believe it but it is the old bad data in, bad data out.

CHAIRMAN ZIEMER: Yes, I understand your point.

MR. RAMSPOTT: I think the question, the badges I don't believe can be used for anything. I think this is indicative of what went on at GSI. I might add that the isotope foreman said the reason they did this little concoction was because they didn't want the whole place interviewed or inspected by the Atomic Energy Commission for any violations. That is the quote from the gentleman. Is that correct, Terry?

MR. DUTKO: Yes, sir.

CHAIRMAN ZIEMER: Yes, thank you,

John, for that additional input. Dan, you had a comment also?

DR. McKEEL: Yes, for everybody. My take on what is the important carry-away message here is actually something that Dr. Anigstein said earlier and that is that the high badge reading, even if it was incurred from this open source on a badge that the gentleman whose name is assigned to that high badge reading left the facility, what everybody needs to understand is there is incontrovertible evidence now from the supervisor D and from the head person at St. Louis Testing that the source was left open, out of its shield and container for 16 hours and there were 300 men working around that open source in that building in a concrete block structure that Dr. Anigstein's report and others have said, since it was built out of cinder blocks, was basically transparent to those gamma photons.

And so the carry-home message is

that there was an open source for 16 hours at that facility that could have exposed 300 unbadged workers and nobody has accounted for that dose and that is the really important thing. That this was not, as Dr. Anigstein's report carefully delineates, this was not the only accident/incident that occurred with isotopes at General Steel Industries. And so we may never know what that worker did, whether he was wearing the badge and took it home but all indications are if that badge was left in the 6 Building open, that that was another major exposure source for the people working there.

CHAIRMAN ZIEMER: Do we know procedurally when they used those sources procedurally, did they have a rope-off area? They must have restricted personnel during the exposure times normally. Right?

DR. McKEEL: No. No, they didn't have any --

MR. DUTKO: Yes, they did. May I

make a comment, sir?

CHAIRMAN ZIEMER: Yes.

MR. DUTKO: I talked to the supervisor over at Isotopes. And he told me it was a common practice to take the cobalt source out in the plants, not the shooting room at 6 Building but out in the actual plant, rope off an area one and a half times more than needed and set up the shot. But he said what was very risky about the situation, a lot of the times the operators would leave the exposed shot going, run some film or get a cup of coffee, or whatever. And that is what he always considered very risky. They had cases of people walking through the tape and into the isotopes.

MR. RAMSPOTT: Dr. Ziemer?

CHAIRMAN ZIEMER: Yes.

MR. RAMSPOTT: John Ramspott again.

CHAIRMAN ZIEMER: Yes, John.

MR. RAMSPOTT: Terry may have misunderstood the first part of that question.

Does that old cinder block building -- that had no rope around it. Is that correct, Terry?

MR. DUTKO: Yes, that is correct.

CHAIRMAN ZIEMER: I understand that and indeed in many cases where that kind of work is done, the users rely on distance and, hence, roping off areas because you can indeed simply by inverse-square law, protect your other workers.

Now, if workers are wandering through the area, that is another issue of concern, of course. But I understand the point you are making.

DR. McKEEL: Dr. Ziemer, the workers told us that cinder block building --

CHAIRMAN ZIEMER: Yes.

DR. McKEEL: -- it would have been right next to it. The only thing that was on there, obviously the radiation symbols. We got mixed stories whether they were ever on there, maybe at a later date. But as far as

roping the cinder block, these guys worked right up next to it. It was the rest of the plant, including 10 Building, was pretty infamous. That is where they actually transported the cobalt into another testing area that has never even been discussed yet, that this foreman shared with us. And that is actually where the infamous plumb-bob cobalt source got stolen from; not from 6 Building but from 10 Building, which is right adjacent to the new betatron building. And that building was occupied by probably 800 people.

CHAIRMAN ZIEMER: I got you.

DR. McKEEL: Thank you.

CHAIRMAN ZIEMER: Okay.

DR. ANIGSTEIN: I can actually add here --

CHAIRMAN ZIEMER: We will get a comment here and then we are going to take our lunch break.

DR. ANIGSTEIN: I can answer that account from what I was told during the

meeting with the workers in Collinsville and that was, if I remember correctly, not in the transcript but just in the summary, there is hopefully a summary of what went on for two and a half hours.

And on the one hand, [identifying information redacted] was testing the, I think it was the founder of St. Louis Testing who attended our meeting said that they were called in -- there were few other contractor who was called in to do radiography with all his own sources. And his practice was, he would set it up outdoors and he would have one of his men always there. He set up 12-hour shifts and they would rope off. They would go around with a survey meter and find the distance of two mr per hour and rope that off.

So it sounds like when GSI was doing their own, see, they looked to this gentleman for guidance. He was more knowledgeable. He also was responsible for calibrating the machinery. But he probably

followed the same practice of the safety factor of another, 50 percent of this one.

I do want to mention, by the way, that the incident of the source which I thought was the 6 Building anyway, being left, yes, the source in the 6 Building is, in fact, my incident number four in finding number one. So we did manage to account for that but we did not know to relate that to the 38-rem region.

CHAIRMAN ZIEMER: Okay, thank you. Folks, quick comment?

MR. DUTKO: Yes, sir. I just wanted to comment, sir, that at number 6 Building cobalt shooting room was right next to the foundry walkway. Very close proximity to major traffic, sir.

CHAIRMAN ZIEMER: Okay. We are going to take our lunch break here. It will be an hour. We will reconvene at 1:30 and we will continue from this point and also get into the discussion of the Petition Evaluation

Report and the review by SC&A, as well as the general concepts of bounding the doses at GSI.

So we will be back at 1:30 folks.

(Whereupon, the matter went off the record at 12:26 p.m. and resumed at 1:30 p.m.)

A-F-T-E-R-N-O-O-N S-E-S-S-I-O-N

(1:30 p.m.)

CHAIRMAN ZIEMER: Okay, we are ready to resume our deliberations. I want to confirm that Board Member Mark Griffon -- Mark, are you on the line?

(No response.)

CHAIRMAN ZIEMER: Okay, I don't hear Mark but maybe he will let us know when he gets back.

Let's see if the petitioner is on the line. Dan McKeel? Hello, Dan?

MR. KATZ: Dan?

(No response.)

CHAIRMAN ZIEMER: Any of the other -- John Ramspott, are you on the line?

MR. RAMSPOTT: I'm on, Doctor,

thank you.

CHAIRMAN ZIEMER: Okay, we seem to have lost Dr. McKeel but I assume he will be back momentarily.

MR. RAMSPOTT: I'm sure he will.

CHAIRMAN ZIEMER: Okay. We are going to just continue a little bit with our Appendix BB Issues Matrix, particularly the film badge area. One of the items on the agenda had to do with the possibility of there being additional film badge records that might be at the Landauer site, and more specifically old records from Picker X-Ray and NIOSH was going to look into that and we will just ask for a status report from Dr. Neton. What do we know about the possibility of additional film badge records from Picker X-Ray via Landauer?

DR. NETON: Yes, this will be great. We contacted Landauer and they do have information from Picker in their possession. Unfortunately, the count coding system is

different now than it was before so they couldn't make any direct correlation between General Steel and Picker.

So now they are going back and doing a customer index for all the Picker information they have as well as customer index for the Landauer customers for those early years that we are interested in. And we have a purchase order in play that they are working under to provide.

CHAIRMAN ZIEMER: Did your purchase order stipulate any timetable or do we have a rough idea from Landauer what this is going to take?

My understanding is those early records are not in really -- they might have been microfiche records, somewhat difficult to read.

DR. NETON: Correct.

CHAIRMAN ZIEMER: Do you have any feel for what or did you stipulate any timetable in your purchase order?

DR. NETON: I don't know. I mean, I can get back to you on that.

CHAIRMAN ZIEMER: I am just wondering if it is something we would expect in the near future. Just sort of keep us updated if you find out something.

DR. NETON: I will check into it.

CHAIRMAN ZIEMER: Just let us know, you know, if it is going to be many months or if it is going to be a couple of weeks or whatever. It may be a long shot, but at least you are pursuing it.

I also had written on the agenda here, petitioner input on the high-dose cobalt sealed source incident in Building 6. I think that is the incident that we have just discussed and so I think we have covered that.

I put on here general discussion relating to bounding of doses at General Steel Industries. And this perhaps is just as well covered as part of the SEC petition. So perhaps we will just move into the SEC

Petition.

Dr. Neton, does that make sense to you as well?

DR. NETON: Yes.

CHAIRMAN ZIEMER: Because you have to talk about bounding doses in that regard. And I simply put this in here in part because there was concerns raised by the petitioner that particularly with respect to, I think the original Appendix BB review, that didn't specifically call out all the sources that we know were present and some implication that perhaps they weren't considered in the bounding. So we want to make sure that there is an understanding that the bounding is such that it would include both the betatrons and the other isotropic sources, as well as the uranium and the other components there. And that can be covered, I think, in the SEC petition evaluation report as well as the SC&A review of that report.

Now the petition evaluation report

we have had for a bit of time. The evaluation or the review by SC&A we all just received. Some of the items in that were highlighted already by Dr. McKeel this morning but we have not formally looked at that review. And I think it would be important for us to look at that petition or the evaluation report review by SC&A. That report, in turn, I would expect should generate some sort of a matrix of issues that need to be explored and --

DR. ANIGSTEIN: Do we have the matrix?

CHAIRMAN ZIEMER: Oh, yes. But not everybody has that matrix yet. The petitioners have not seen it. I know you have generated a matrix within the past couple of days following the report and I don't think it is available yet in cleared form to the petitioners, or is it?

DR. McKEEL: Dr. Ziemer, this is Dan McKeel. I do have a copy of the Issue Resolution Matrix, the SC&A Findings.

CHAIRMAN ZIEMER: For the petition evaluation -- for the review of the evaluation report?

DR. McKEEL: Yes.

DR. MAURO: That must have been very recent.

CHAIRMAN ZIEMER: I have not seen the cleared copy yet so it must have been. Did you get that in the last day or two, then?

DR. McKEEL: Yes.

CHAIRMAN ZIEMER: Okay.

DR. McKEEL: There are no NIOSH responses to it.

CHAIRMAN ZIEMER: No, there would not be any NIOSH responses.

DR. McKEEL: Okay. That is what I have got.

CHAIRMAN ZIEMER: It was generated within the last couple of days, I would think.

DR. MAURO: It is the clearance on it that would have been generated.

CHAIRMAN ZIEMER: Yes, the

clearance on it, right. Because the report itself has not been cleared that long, let alone the Matrix.

DR. MAURO: Both the report and the Matrix were cleared all at the same time and relatively recently.

CHAIRMAN ZIEMER: Okay. So, the petitioners do have the Matrix as well. So that is good.

In any event, we will go back and go through these items and get a feel for what the issues are from SC&A's point of view. NIOSH has not had an opportunity formally to respond to all of these but you may have some comments.

DR. NETON: We did provide some preliminary comments and SC&A has actually already responded back.

CHAIRMAN ZIEMER: Oh, it is moving rapidly. But are those comments on the -- they are not. Are they on the Matrix yet?

DR. ANIGSTEIN: We have a triple

set of SC&A findings which Dr. McKeel had quoted from extensively earlier. But we have the SC&A findings that Dr. McKeel has and quoted from, the cleared version. Then NIOSH responded to each of our findings and then just this past weekend, I think five of the ten findings there was an SC&A reply to the NIOSH responses. And that was circulated to the Board and to NIOSH but has not yet been -- I submitted it for clearance but it has not been cleared.

CHAIRMAN ZIEMER: Okay.

MS. HOWELL: I have returned everything I have received.

DR. ANIGSTEIN: Oh?

MEMBER MUNN: Everything Emily has had, she has returned.

DR. ANIGSTEIN: Okay, somehow --

MR. KATZ: But I think you just produced this on Friday.

MS. HOWELL: And I did it.

DR. ANIGSTEIN: Okay then I may

not have seen it.

CHAIRMAN ZIEMER: I don't think I have seen it.

MEMBER BEACH: I've read that. I just don't know what I did with it.

CHAIRMAN ZIEMER: The cleared version?

MR. KATZ: Not the cleared version.

MEMBER BEACH: I don't know if it was cleared. I tend not to pay attention.

MR. KATZ: Josie would have gotten the version on Friday. The report was cleared by Emily.

MEMBER MUNN: It is dated the 14th.

DR. ANIGSTEIN: Anyway, this is --

CHAIRMAN ZIEMER: Well, we will get the cleared version up. Dan, does the version you have have those responses on it?

DR. McKEEL: No, sir. The only thing on mine is the original SC&A findings

and that is what I reported on this morning.

CHAIRMAN ZIEMER: Right, okay.

DR. McKEEL: There are no other NIOSH or SC&A responses.

CHAIRMAN ZIEMER: Well those are all very recent when apparently that final clearance came out. So we will get those out right away.

DR. ANIGSTEIN: I will get those out as soon as I can.

DR. McKEEL: Thank you.

CHAIRMAN ZIEMER: Okay, go ahead, Bob.

DR. ANIGSTEIN: Okay, well I just want to step through the issues first. Ignore the screen for the moment. You can shut it down.

CHAIRMAN ZIEMER: You can move your computer over and lock it up.

DR. ANIGSTEIN: Not to be a distraction.

CHAIRMAN ZIEMER: Okay, it is

going off.

DR. ANIGSTEIN: Okay. So I am just reading. So issue number one, which I think is the overriding issue, consists of the lack of monitoring data from 1953 through 1963. And I don't think I need to belabor this. I cite four incidents that were reported by workers, one of whom taking the cobalt-60 source that was described as appearing to be a plumb-bob. [identifying information redacted] has described that he thought it was a fishing sinker and was going to use it for that purpose. At any rate, that had to be retrieved.

They did, I mean, it was found. Its absence was noted. They searched the plant and naturally -- walking around with a survey meter. They thought that maybe it had gotten into the castings, it had gotten thrown in with the scrap metal that formed the casting. And finally, they did an aerial. They had an airplane going around the

neighborhood and they found it. Either in the guy's house, he had thrown it out. The accounts differ but everybody agrees that there was such a source, it was taken, and the last informal conversation I had was that he actually did have radiation burns, which is not surprising because he put it in his pocket. So that was one incident.

The second incident, there were two incidents where someone was actually inside a casting while it was being radiographed. They said the betatron went on. The alarms went off, lights flashed and the guy just didn't notice or wasn't paying attention. One case was inside of an army tank and he was just blocked off.

And there were two such incidents over the years. Neither of these were radiation workers. Neither of these were licensed betatron operators so they were probably never issued badges. There was no recording of their exposures.

Then the fourth incident was the one that was discussed earlier of the so-called small pill that was stuck in the open position and the one account that we were given at the meeting I had in Collinsville was the order of the St. Louis Testing whose job it was among other things to calibrate the meters, all the survey meters, was called in because the meter had pegged. I mean, that is the way he gave the account.

They called him in because the meter pegged. He came in with his own meter and found that there was, in fact, a source left open. And I asked, well what was the scale of the meter. And he said he assumes it was on the highest scale, which was five r per hour, which would cause rate. We would call into question whether, in fact, there was a 250 millicurie source.

No one seems to know what the center of that source was. They simply referred to it as the small pill. They don't

know when it was acquired. If it was in fact 5 r per hour and it was at any sizeable distance, most likely, it would have been stronger than 250 millicuries.

Incidentally, I did try -- we did try -- I should say we because several people were involved in trying to get any records for the licenses. The Illinois -- I forget the exact name but they were Illinois Department of Safety.

CHAIRMAN ZIEMER: Department of Nuclear Safety.

DR. ANIGSTEIN: The state department that takes care of radiation control had no records. They referred us to the NRC district, which was District Three, the one that encompasses Illinois. They have no records. They said, call Washington.

I talked to several people at NRC whom I knew personally in Washington and I finally ended up with the Public Document Room and they said well, we have the film. You can

file a FOIA request. The way they described it, all of those records have been turned over to NARA, the National Archive Repository, something like that.

And they said the normal practice there is after 30 years, the records are destroyed. That is the standard practice. Some records, obviously, they keep longer like the U.S. Constitution but that is their practice. And they also told me that a FOIA request had been filed in 2006 by Dr. McKeel. And he was told that there were no records. At that time they did a complete investigation and were told that there were no records. I did not ask them to repeat this investigation.

So in fact, every -- oh, and furthermore, there was a company, I can't think of the name right now, that was in the business at that time -- still is -- of furnishing such industrial sources and again, Mr. Zlotnicki who works for SC&A had a contact. He seemed to have a wide range of

contacts. He contacted them to try to find out whether they had any records for General Steel Industries or General Steel Castings and the answer was they could not find anything. So I think every conceivable avenue has been exhausted to get information on those sources.

Anyway, that is kind of a long-winded answer on issue one. If I may just summarize, NIOSH response was that the incidents mentioned of specific events from years ago based on recent memories of operators. And then to jump to their conclusion, NIOSH accommodates no incidents in the individual dose reconstruction. And the reply to that is there were thousands of workers there. I went over all the interview reports. There were approximately 40 workers, 40 different individuals who showed up at one or more meetings. There were, like, five different meetings. There were four meetings that were organized by the Union and Dr. McKeel and Mr. Ramspott and then one that was

organized by SC&A so there were five meetings total. There were 40 different workers or I counted a widow as being one of the workers, and compared this to the several thousand GSI workers. So there was no -- this is a sample. I mean, yes, their account gave a sample of what happened. I don't think we can say that this was, that there were no other incidents. These were four incidents and as long as these four incidents -- we know about these incidents, we know who was the exposed worker that can be accounted for.

It may very well be that there were others or other incidents that were not known to these people or not remembered by these people. And then the lack of monitoring data, that cannot be ruled out.

CHAIRMAN ZIEMER: Well okay, do you want to discuss this?

DR. NETON: Yes.

DR. ANIGSTEIN: Oh, okay.

CHAIRMAN ZIEMER: Let's discuss

them as we go. Jim?

DR. NETON: A couple of things. Refresh my memory. The four incidents were all in a time frame where there is no monitoring data. Is that right?

DR. ANIGSTEIN: No some of them were before, during, and after. No, they were all -- no. There were some before and some after -- some during. There was no after because the monitoring continued until they shut down. But they involved, at least two of them involved unmonitored workers.

CHAIRMAN ZIEMER: The person in the tank was an unmonitored worker.

DR. ANIGSTEIN: Yes, exactly.

CHAIRMAN ZIEMER: There may have been monitoring but the worker was not a betatron worker.

DR. ANIGSTEIN: Yes, he was in there making some measurements with a tape measure.

CHAIRMAN ZIEMER: The person who

took home the source mistakenly was not a radiation worker.

DR. ANIGSTEIN: That is correct.

CHAIRMAN ZIEMER: The third one --

DR. ANIGSTEIN: Was also in one of the castings.

CHAIRMAN ZIEMER: What was the third one?

DR. ANIGSTEIN: The third one whose name we have that has been redacted --

CHAIRMAN ZIEMER: It was a betatron incident.

DR. ANIGSTEIN: Yes. Actually, I miscounted.

CHAIRMAN ZIEMER: The fourth one was the unsecured cobalt source that we talked about.

DR. ANIGSTEIN: There were two incidents of someone being inside a casting.

CHAIRMAN ZIEMER: Oh, okay.

DR. ANIGSTEIN: One was identified full name. One was identified only by his

first name.

CHAIRMAN ZIEMER: Okay.

DR. ANIGSTEIN: And neither of them were radiation workers.

CHAIRMAN ZIEMER: The third one was a betatron operator was involved in an incident.

DR. ANIGSTEIN: No other knowledge --

CHAIRMAN ZIEMER: -- of what that means. We don't know. Okay.

DR. ANIGSTEIN: We don't know. He signed an affidavit. He has died since then.

CHAIRMAN ZIEMER: Okay.

DR. ANIGSTEIN: And he just said there was an accident involving the betatron, too. And it happened to be -- he was a radiation worker and his name appears on the badge records earlier -- I mean, later. But it happened the week before Landauer records started.

CHAIRMAN ZIEMER: So, as I

understand it, SC&A's concern here is that these are four incidents we know about. Might there have been others that we don't know about that somehow have to be taken into consideration in the bounding process? Is that --

DR. MAURO: Yes. The way we look at it is there a long period of time, '53 to '64 where, right now, we don't have film badge records. What we heard is a story that these incidents do occur occasionally and there is reason to believe that there could very well have been additional incidents like that in that ten-year time period.

CHAIRMAN ZIEMER: Right.

DR. MAURO: What do you do to reconstruct a person's --

CHAIRMAN ZIEMER: The incidents we know about, you certainly can reconstruct.

DR. NETON: And in fact, I think we have done that at least in one instance.

CHAIRMAN ZIEMER: If they put a

source in their pocket or are exposed.

DR. MAURO: Sure.

DR. NETON: So if it is brought in the dose reconstruction interview, which we had at least in one case we have done that, and we certainly will handle that under standard practice.

What concerns me here though is that it is not so much that we don't have badges; I am hearing now that there are incidents to unmonitored workers that, even if we had heroic efforts to go and find dosimetry data, there are questions being raised about these incidents that we couldn't reconstruct anything.

So does that make the whole issue --

DR. MAURO: Confounding.

DR. NETON: Yes, confounding it even more. So we find a lot of -- say Picker X-Ray comes up with a cache of records from Landauer, then the allegations are still on

tape. Allegation is probably not the right word, but the assertions are that there were workers who were exposed that weren't monitored and then we are back to square one, I guess.

That is my concern right now.

DR. MAURO: I think that is a legitimate concern. I mean, we have that concern also.

DR. ANIGSTEIN: And probably the number was small because the initial Landauer film badge record that we have is only 18 workers.

DR. NETON: Right and that is my next question is how --

DR. ANIGSTEIN: And it grew to as many as 73.

DR. NETON: How frequent were these radiography operations in this period versus the frequency in which they were practiced during the betatron era where we have records? It seems to me that the usage

of those devices was much less frequent in the earlier years than it was in the current. And Dave, you might know something about that.

DR. ANIGSTEIN: The first betatron you have to remember was built in '52, early '52.

MR. ALLEN: Right. We do have from the meetings that you are talking about, the transcripts from there, there was a guy that was the supervisor at the time. He mentioned that prior to, I believe he said prior to '63, it was fairly slow, a few guys working type of thing and everything changed in '63 and that was one of the reasons they brought the new betatron over and they started to do 100 percent instead of an actual sampling of a quality control type of work.

And I think that Mr. Dutko has even stated that '63 --

CHAIRMAN ZIEMER: Well prior to the betatrons, do we know what they had? Were these cobalt sources in use at that time?

DR. ANIGSTEIN: No.

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

CHAIRMAN ZIEMER: Yes, Dan.

DR. McKEEL: We do know about several of the isotope sources. As best we can understand from the workers, the large, possibly 80-curie, source of cobalt-60 was acquired somewhere around 1963, you know, in the era where the Landauer film badge program started.

The iridium source, according to one of the isotope workers who was there from the beginning was in use in the early '50s and then he left GSI and came back in 1956. It was still there. So the iridium-192 source was used in those early years, particularly in Building 6 on the railroad trucks. And that is what the small cobalt source was also used primarily for x-ray inspection of railroad trucks. And that was in use between those two, the iridium source and that small source

were used continually for a long time, probably through the 1950s and the 1960s, plus they were also used in other parts of the plant as has been put on the record this morning.

So, those other sources were used in the '50s.

MR. RAMSPOTT: Dr. Ziemer?

CHAIRMAN ZIEMER: Yes?

MR. RAMSPOTT: This is John Ramspott.

CHAIRMAN ZIEMER: Yes, John?

MR. RAMSPOTT: In reference to a comment, I think it was Dave Allen was making, about one of the supervisors saying the betatron was used less frequently, the gentleman that made that statement did not become the betatron manager until 1963. So his knowledge before that would be limited, at best. If you look at his name, he definitely will tell you he started as a manager in '63.

Now the other thing that we know,

there was only one betatron so it definitely did get used heavily. Their main product was different at the time. It was tank turrets, and tank hulls, and some submarine parts.

So the betatron was actually used quite heavily and even by NIOSH's own document, if you look at the uranium going over from Mallinckrodt, the purchase orders that you have from 1964 actually going backwards to '58, you will see -- and after '64 I think there was 12 hours of use for Mallinckrodt. Prior to that there was 437 hours of uranium work alone being done at the betatron, that is why they were sending it there. And with the newer information that we know now as to how they were using the betatron to actually shoot the corners of the ingots to figure out the depth of the crust, you could do four times as many ingots in the same time frame as originally indicated by Appendix BB.

So the amount of uranium going

over, the way it was actually used is considerably more. So the use of the betatron in the early days is heavier than I think they indicate.

CHAIRMAN ZIEMER: Okay, thank you.

Now, the actual use of the betatron, NIOSH has a methodology for bounding that. But I think the issue we are asking about now is this issue of prevalence of possible incidents where non-monitored workers might have been exposed. I am trying to get a feel for -- I mean, this question has arisen in other facilities. What is an approach that has been used in other facilities? And I am just talking in general because one can always postulate almost anywhere that something might have occurred that we all know about.

So you know, there are sources and somebody might have wandered in. How do we handle them? These incidents that we know about by themselves rise to a level where the people themselves identify them. In fact, it

is pretty rare to have something of this nature that goes unnoticed. So it is back between zero and one of these that one would say, well, are there things, for example -- was the practice such that when the source is out, guys are taking breaks and people are wandering through. Is that a regular thing or is that unusual and we would know about it? Or how do we handle this?

Give us some thoughts on that, Jim. I don't know the answer to that. I am speculating here about what one would do. You could bound it in some regard by taking a worst case and assigning everybody but that doesn't make sense. You don't have 24 -- you don't have an incident every day 24/7 for ten years.

DR. NETON: That was sort of our response to that finding was that these are sort of well known, well remembered events in these peoples' minds. I mean, so the fact that they are not saying there were hundreds

of these things and here is a few examples, but these are sort of well emblazoned in their memories leads one to think possibly that these were sort of isolated things and we would probably know about, maybe not every single one but it wasn't a very frequent occurrence.

The other thing that comes to mind here is that these iridium and cobalt sources that were used early on, I've forgotten the doses that we are assigning to the betatron.

DR. MAURO: Six. Six rems.

DR. NETON: Six rem, that is going to be pretty much everyone, right? I don't think we are really triaging those doses to speak of.

DR. MAURO: Well, I think you break it up between --

CHAIRMAN ZIEMER: Well, everyone, there were two groups, weren't there?

DR. ANIGSTEIN: But not workers. Basically, we are assigning those doses to

everyone who, as it happened, would have been badged or who was repairing the castings right after the radiography.

DR. NETON: Right but if you took a person who was a radiographer and it seems to me if they were assigned a 6 rem betatron, one could establish that that would more than likely bound their exposure as a radiographer. There are historical analyses done that go back in time. And I forget this guy, [identifying information redacted], I think, did this for EPA. He went back and developed distributions of workers going back into the '50s. Radiographers are consistently among the higher-exposed class of workers. But there are values that are in those tables. I wouldn't be surprised if these betatron doses would bound the doses of the radiographers in that time frame.

DR. MAURO: I would agree that the 6 rem per year or the 13 rem that -- We came up with a different number.

DR. NETON: Yes, whatever.

DR. MAURO: Whatever number you pick certainly is a high dose. But now the idea that -- and I would also argue that the vast majority of the workers that worked there, whether they worked on the betatron or they worked with sources, and even if there were some incidents with the sources, may not have experienced that.

I am troubled by -- that it is almost, well, the six probably covers all ills. Now this is really almost like a philosophical question. I mean, is that okay? Is it okay to say, listen, we have got a number and intuitively, our sensibility is that well, even if these incidents did occur and maybe even occurred often, once a month or once every three months, or whatever it was, the six probably covers it. I mean, this is a tough call. And as a health physicist, I would say yes, you are probably right but so would ten. In other words, you could pick

just about any big number and say it likely covers these kinds of transients. There may have been an occasional one, perhaps a 38 rem was a real one. The guy that went home with the one in his pocket. So I mean, there may have been others that could have occurred.

But I am looking at it more from the point of view and this becomes -- if you assign some number that everyone agrees is a big number, 6 rem a year is a big number or 13 rem a year, and then say, well, that is going to cover a lot of ills, the fact that we don't have data for those 13 years. And somebody asked me, John, do you think that it is likely assigning that to everybody, not just the betatron workers but everybody? You know, we are just going to give that to everybody. Would you feel that that would probably be claimant-favorable? And I would say, sure.

But the question I guess is richer than that. And by that I mean, it seems to be too easy a solution. Well, we will just

assign everybody this big dose. And how big is good enough then?

DR. NETON: I think there is more to it than that, John. I mean, we have the dosimetry data at 60-whatever plus for the betatron. So that is well modeled and well -- I think we differ on exactly what that number is.

DR. MAURO: But that is not the issue.

DR. NETON: We agree. So we have a dosimetry data that encompasses not only the betatron activity but also the radiographers because they weren't just monitoring the betatron operators in the '60s. They were monitoring radiographers.

So we know what these workers' exposures were and, in general, they were very low with a few exceptions.

DR. MAURO: Right.

DR. NETON: And then also the same process going back in time.

DR. MAURO: Right.

DR. NETON: No differences. Not only the same sources, probably less intense sources because, as we heard from Dr. McKeel, the large cobalt source didn't come into play until --

DR. MAURO: Until later.

DR. NETON: -- '63.

DR. MAURO: Yes.

DR. NETON: So it certainly is based on facts, which is not made up information, it is just going back in time and saying well, there are gaps in the previous era but we know that it is no worse than what we know in the '60s.

DR. MAURO: I would agree. I would say that a reasonable person would agree it is unlikely that very many people could have gotten more than six rem a year in that time period. And I would agree with that. But you know, is that -- and now we have left the realm of, what I would say, the degree to

which analysis helps us. In other words, and the facts before us help us.

MR. ELLIOTT: Well, that is an interesting word you use, and it is a really interesting point you are raising, John. The law says we are to provide reasonable estimates. Reasonable dose estimates. The law does not say anything about claimant-favorability. That comes into being, it says, benefit of doubt and we translate that into claimant-favorability aspects in how we do our work.

So you know, where does the line of reasonability depart and it become unreasonable?

DR. MAURO: When I was thinking about this, I said to myself, we know one thing for sure, no one died of acute radiation exposure. So we know that no one probably got more than a couple of hundred rem in one shot. So we can stop there.

So one could argue that, well, we

will assign 200 rem to everybody. So I don't want to --

DR. NETON: Let's go back to Bethlehem Steel. How would you juxtapose what we did at Bethlehem Steel up against this and how was that very different in that approach, which is a one-size-fits-all model?

DR. MAURO: And why I am comfortable with Bethlehem Steel is that what you did is you went back to measure data. We are talking dust loadings now. I guess that is what you are referring to or the external exposure.

External exposure you went with the worst possible situation.

DR. NETON: What I am talking about is assigning everybody the same high dose. Everyone at Bethlehem Steel, 300 workers, or 400, whatever cases we had, all received 500 MAC air --

DR. MAURO: Right.

DR. NETON: -- for two years of

operation, whether they were secretaries, cafeteria workers, or parking lot workers. That is not very different than what we are proposing to do here.

DR. ANIGSTEIN: I beg your pardon. It is.

DR. MAURO: Yes, good.

DR. ANIGSTEIN: According to Appendix BB and that has been followed, and I just reviewed a case where this was applied, only workers, only the radiation workers and the workers working on the castings immediately after radiography were assigned the betatron operator's dose. Everyone else was assigned a dose of 0.72 millirem per hour for their entire work year, which comes to about, if you assume 2400 hours, which the attendant VP assumes, it comes to about 1.7 rem.

So right away, there is a dichotomy there, and so these workers who would have had these accidental exposures that

did not fit that category. They would have been in the non-radiation worker category in terms of dose reconstruction.

DR. NETON: Well, now we are getting back into the incident issues, which is different than what John was arguing. John was arguing about the validity of our model, in general, not based on facts.

DR. MAURO: I would like to make a distinction between the setting that we dealt with at Bethlehem Steel and the setting that we are dealing with here. It is important.

At Bethlehem Steel, there were inherent boundaries to where you can go. And the boundaries are pretty straightforward. From an external point of view, it really was virtually impossible for a person to get more than 2 millirem per hour at one foot away and you gave them that. You gave everybody that. You can't get more than that. And they were there all the time. And that is a boundary in external.

So as far as I am concerned, you gave a plausible upper bound, external. Internal, you gave a dust loading that was so high that, if it was higher, then you couldn't even stay in the room. And there was some evidence that in fact on some occasions it did get that high. This was the Simonds Saw early data. And so you had physical limitations on -- it really can't be higher than that. And there was reason to believe there were occasions when it might it have even gotten that high. And you assigned that value to everyone that was working in 1949, 1951.

In other words, so you went down a road where you did, in fact, find a plausible upper bound that we found and even uses some surrogate data. So we came down favorably on that.

Now, how does that circumstance apply here? I am saying that there was mechanistically a reason why you could place the upper bound where you did at Bethlehem

Steel. You don't have a mechanistic method here to place a plausible upper bound on the exposures that unmonitored workers might have experienced in that ten-year period.

CHAIRMAN ZIEMER: Are we talking mainly about isotopic exposures?

DR. MAURO: Yes.

CHAIRMAN ZIEMER: Well --

DR. NETON: Those are radiographers.

DR. MAURO: Those are the radiographers.

CHAIRMAN ZIEMER: But, for example, unmonitored workers wandering through the zone. I mean, that has what has been -- I think you can model that. If we are talking, for example, about the half-curie source --

DR. MAURO: We don't know the size of the curie source.

DR. ANIGSTEIN: No, we don't know the size of it. We really have only the vaguest -- I mean, we said it was under a

curie. We were told it was a quarter of curie. Nobody knows.

DR. MAURO: Listen. What I would argue is, if we had a handle on the size of the curies and could come up with plausible circumstances that would place an upper bound on all workers for that ten-year period, then we would be in the realm of the way we dealt with the problem on Bethlehem Steel but I don't think that is where we are.

CHAIRMAN ZIEMER: Because I think you can model people wandering through a zone. I mean, unless somebody is going to go down and sit and eat their lunch next to the source for 30 minutes or something which you can also model, but people wandering through a zone, I agree it makes a difference if it is 80 curies or a half a millicurie or whatever you are talking about. So that --

MEMBER POSTON: Well, he just said it was under, they were told it was under a curie.

CHAIRMAN ZIEMER: I know.

DR. ANIGSTEIN: That was one account. These people were not, you know, were not experts on radiation. They received some training --

CHAIRMAN ZIEMER: Well, but part of that is the amount of time it is out is very related to the size of that source. If you are doing radiography with an 80-curie source versus a millicurie, it is very different how it gets -- whether you have to leave it.

So, I would say sort of generically, I think you can model that. I mean, you have limits on how much exposure you can give a film and still use it. So --

DR. MAURO: But we heard stories where the sources were left out. They would go get a cup of coffee.

CHAIRMAN ZIEMER: Well, okay but I am saying that if it is an 80-curie source and you are going out and getting a cup of coffee,

you are going to have usable films.

DR. ANIGSTEIN: The 80-curie source seemed to consistently -- the quote-unquote 80 curie source, they consistently said was used in the betatron building only. And it was kept in the chem lab, somewhere in the basement. It had a special wheel, a heavy shielded wheel device for transporting it.

So that seems to be consistent but nobody could tell me when it was. Dr. McKeel said 1963. I did not -- I mean, I believe I have talked to all of the same people he talked to. They really didn't know. My feeling is that it was earlier.

CHAIRMAN ZIEMER: Well, I think what we have at the moment, let me, we have the nature of the concern. We have some sort of early thoughts on how one might address this. We have some unknowns here. What I would like to do because we are not going to solve this one today --

MR. ALLEN: Can I add one --

CHAIRMAN ZIEMER: Maybe we are not, unless David is. David has been waiting. And then we want to move through the others so we have a feel for the nature of the issue and maybe get a feel for what the next steps would be. Dave?

MR. ALLEN: I think hopefully Mr. Dutko is still on the line. I think he can probably shed some light on this.

CHAIRMAN ZIEMER: You mean the activity of the source or the --

MR. ALLEN: Well, I think we -- on some information. If Mr. Dutko is still on the line, please correct me if I am wrong, but I believe you and a couple of other operators have said for the time frame you were there, anytime you were working with the sources in Building 6, you wore your film badge as well as a pencil dosimeter.

MR. DUTKO: Yes, sir, that is true. We have later information from people I have contacted that said that the sources were

stored in number 5 Building in a fenced-off cage with radiographic warning signs but it was in 5 Building that the sources were stored.

MR. ALLEN: Stored but when they were actually exposed and used, they would still -- when you were there, not earlier -- but when you were there, they would have been in 6 Building in that cinder block room?

MR. DUTKO: That was only one place, sir. They actually used the cobalt sources all through the plant for different situations. Again, I repeat, they would flag off one and a half times the area needed and set up the shot.

MR. ALLEN: Okay, I misunderstood you earlier. I thought you were saying that was prior to you getting there that that was happening.

MR. DUTKO: Even when I was there, sir, they used the cobalt sources out in the -- besides 6 Building. They used both places,

6 Building and out in the plant.

MEMBER MUNN: I think he is saying they were stored in one building, used --

MR. DUTKO: They were stored in 5 Building, ma'am.

CHAIRMAN ZIEMER: Right, okay. Thank you.

MR. ALLEN: And one last question here. The small sources we are talking about, do you know, were they still there when the monitoring began? Because I was under the impression they were still there.

MR. DUTKO: What was that question, sir? I didn't understand.

MR. ALLEN: The small cobalt source and any of the other small sources you would have used out in Building 6 and everywhere else, the ones that were there in the early years, were they still there when you were working there or would you know?

CHAIRMAN ZIEMER: John, are you there yet? Did we lose him?

MR. KATZ: John?

DR. McKEEL: Terry Dutko, are you on the line?

MR. KATZ: Terry.

DR. McKEEL: This is Dan McKeel. My understanding is that Terry and all of the men that we are talking to all said who were there, primarily in the later years through '73, said the small source in Building 6 was in use, in daily use.

CHAIRMAN ZIEMER: Through that time period, Dan?

DR. McKEEL: Yes, through that time period. Right.

MR. ALLEN: That was how I was remembering it but I wanted to --

DR. McKEEL: I think that is correct.

CHAIRMAN ZIEMER: What do we know about the starting date on the small sources? Can you remind me? Did those go back into the '50s?

DR. ANIGSTEIN: Definitely.

DR. McKEEL: Well, the iridium-192 was during the '50s. And my understanding was the small cobalt source, whatever the size was, still unknown, was used in the 1950s as well.

They made railroad cars. That was the primary thing that company did from the beginning almost.

DR. ANIGSTEIN: It is agreed. The General Steel Castings, it was called then, acquired the St. Louis Car Company in 1960. Before that, they made the beds for -- it was like a baseplate for locomotives. That was the original reason the company was founded.

CHAIRMAN ZIEMER: Okay. Well okay, we sort of have a feel for the issue on issue one and the concerns and so on. Let's go ahead and identify, go ahead with issue two, Bob, and lay that out for us.

DR. ANIGSTEIN: Right.

MEMBER MUNN: May I ask --

CHAIRMAN ZIEMER: Oh, questions, first?

MEMBER MUNN: One last question.

CHAIRMAN ZIEMER: Let's see if Mark -- Mark, did you come back on the line yet? Mark Griffon?

(No response.)

CHAIRMAN ZIEMER: Apparently not. Okay.

MEMBER MUNN: I don't think so.

CHAIRMAN ZIEMER: Wanda?

MEMBER GRIFFON: I'm on, Paul, actually.

CHAIRMAN ZIEMER: Oh, Mark is on. Okay, thank you, Mark.

MEMBER GRIFFON: On my cell phone, but I am on.

CHAIRMAN ZIEMER: Okay.

MEMBER MUNN: I just wanted to ask Bob again before we leave this business of the incidents, the five incidents that you know about, someone asked me --

DR. ANIGSTEIN: I keep correcting myself. There were four incidents during the unmonitored period and one later.

MEMBER MUNN: That's -- okay. That is what I wanted to make sure we understood.

DR. ANIGSTEIN: Yes.

MEMBER MUNN: Four during the unmonitored period.

DR. ANIGSTEIN: Right.

MEMBER MUNN: So those are the ones that we are focusing on with respect to unknowns.

DR. ANIGSTEIN: Yes.

MEMBER MUNN: Okay.

MR. DUTKO: Dr. Ziemer?

CHAIRMAN ZIEMER: Yes.

MR. DUTKO: I'm sorry. I lost you, sir.

CHAIRMAN ZIEMER: Oh, Dave had asked you a question about the years that the smaller sources were in use.

MR. DUTKO: Well, the smaller sources were in use from the start, about '52, '53, sir.

CHAIRMAN ZIEMER: Okay.

MR. DUTKO: They used them on railway work in 6 Building quite a bit in the early days. They used them on tanks, tank hulls and tank turrets, of course, and different type of work, under frames. But they were, the sources were in use in the early days.

CHAIRMAN ZIEMER: Thank you.

DR. NETON: What about past 1960, though?

MR. DUTKO: Past 1960?

DR. NETON: Yes.

MR. DUTKO: There was 6 Building work still going on. Of course, the betatron. I assisted an operator in a large curie cobalt source in the new betatron one time. They brought a large cobalt source in to x-ray nuclear channel heads.

CHAIRMAN ZIEMER: Okay, thank you.

MR. DUTKO: This was done in the new beta.

CHAIRMAN ZIEMER: Okay.

MR. DUTKO: By a fellow named [identifying information redacted]. [identifying information redacted], who was an isotope man.

CHAIRMAN ZIEMER: Thank you. Let's go ahead, Bob with Issue 2.

DR. ANIGSTEIN: Issue 2 continues, and is probably a continuation of Issue 1, and that is the incomplete monitoring of workers during the Landauer -- let me just shorten that and call it the Landauer era. And that we have -- there were times where they weren't monitored. For instance, they had to leave their badges behind when they left the building. For instance, to use the restroom. The restroom was just outside the new betatron building and depending on the orientation of the beam, now the significant

exposure is something like 50 mr per hour and that would not have been captured. So albeit not a huge exposure, but you know, it is there.

So, and then some of the same men would have alternated as layout men, where they would have to mull over this casting and mark the placements where the films showed defects. And during that time, they didn't wear their badges because the were outside the betatron room and apparently there was a concern on the part of the management that if they wore their badges, they might become damaged from various, you know, physically.

So, all of their exposures would not have been captured. That is my second point.

CHAIRMAN ZIEMER: Okay. Let's discuss that for a moment. And as I read the evaluation report, it appeared to me that NIOSH had modeled the restroom values, using an occupancy factor.

MR. ALLEN: Yes, actually --

CHAIRMAN ZIEMER: Am I right or was that --

MR. ALLEN: Yes, but there was an error there that came to light afterwards. It is actually -- SC&A modeled restroom doses with two-shot scenarios. One was flipping the head.

CHAIRMAN ZIEMER: Oh, okay. Flipping the head, so to speak?

MR. ALLEN: No pun intended. But in the ER report, we pointed out that it occurred after this one supervisor left and that was after the covered period. As it turns out, it was after he left that department, not after he left the site and there was a little over a year or two that this could have been happening --

CHAIRMAN ZIEMER: During the covered period.

MR. ALLEN: And so yes, we have got to look into that a little deeper. But

actually I like relying on Mr. Dutko there. And he was an operator in the new betatron.

CHAIRMAN ZIEMER: It sounded like he had a new assignment that went elsewhere in the company but was still employed.

MR. ALLEN: Yes, that was the error I made.

DR. ANIGSTEIN: I spoke to him.

CHAIRMAN ZIEMER: Bob, I think, confirmed that, right?

DR. ANIGSTEIN: Yes.

MR. ALLEN: And, Mr. Dutko, sorry to keep bugging you but you have always been a good source of information and I think you are the one that originally brought up this idea of flipping the head on the betatron. And I know you have made the statement that if it occurred once, it occurred too often. You weren't real happy with it and I don't blame you.

MR. DUTKO: That is correct, sir. It was first introduced by [identifying

information redacted]. He was the replacement boss for [identifying information redacted]. He was, I believe, from Los Alamos at the time. He introduced this move that we had no knowledge of whatsoever and I guarantee you when the betatron head was inverted, it would violate its own set limits. The far right limit would limit you to the northwest in rotation and the far left limit would limit you to the northeast in rotation. But even shooting on the tracks, the far northwest limit would put you with the cone shooting slightly down toward the ribbon door, down the railroad tracks to the ribbon door. That would allow that much rotation, slightly northwest.

MR. ALLEN: Okay and as far as inverting the head, do you have any feel, you were if I am not mistaken, you were primarily in the new betatron building.

MR. DUTKO: I was in both betatron buildings, sir.

MR. ALLEN: Okay and was that a routine occurrence or once a month?

MR. DUTKO: Routine? Well, I would not call it routine but again I say it was a move I was never happy with. When ordered to do so, I questioned it. And well, I was told to mind my own business and to do what I was told. It was a move I was not happy with, I felt was dangerous. And again, the order was by the head of the department.

It was nothing more than a time-saving move. That is all it was. We were limited to zones shooting toward the control room in all instances by the limits. And this man introduced this but none of us had any knowledge of it. That was our first knowledge it could be performed in such a manner.

CHAIRMAN ZIEMER: All right. Is this the configuration that had the potential of exposing someone on the roof?

MR. ALLEN: No, that would be pretty much any configuration.

CHAIRMAN ZIEMER: Any configuration.

MR. ALLEN: This was more -- again, Mr. Dutko can correct me if I am wrong but the machine had limit switches on that prevented it from pointing towards the control room.

CHAIRMAN ZIEMER: Right.

MR. DUTKO: Yes, sir, it did. Its normal limits again. The control room was on the north.

CHAIRMAN ZIEMER: So this would allow it to point toward the control room?

MR. ALLEN: There was -- basically, this [identifying information redacted] introduced a procedure that would allow them to essentially defeat those limits.

MR. DUTKO: That is exactly right, sir.

MR. ALLEN: And again, I know that you were upset about it enough to where the impression I got -- it wasn't very frequently

but I don't think I ever got a --

MR. DUTKO: I wouldn't say very frequently but they would use it as a timesaving mode whenever they chose. We had nothing to say about it, sir.

I knew it was questionable. Anybody with any common sense knew it was questionable. But when you get an order by the department head to do it to save casting moves and time, well you did what you were told.

MR. RAMSPOTT: Dr. Ziemer, this is John Ramspott.

CHAIRMAN ZIEMER: Yes.

MR. RAMSPOTT: Just for clarification for everyone, there was a misunderstanding earlier about flipping the head of the betatron in order to expand the shooting parameters. That was misunderstood or mixed up with also shooting castings sitting on the railroad tracks versus in the actual center of the shooting vault.

CHAIRMAN ZIEMER: Yes.

MR. RAMSPOTT: And I think that got mixed up because -- and Terry Dutko can correct me if I am wrong -- but Terry, wasn't shooting on the railroad tracks themselves, which is shooting out of the vault towards the opposite end of the shooting area, was that very consistent? Was that a regular process?

MR. DUTKO: Again, it was a time-saving move. If they had a hot casting, they knew our rotation perimeters. They would set up the casting where we could set up the betatron due west, roughly and traverse it over to the tracks.

MR. RAMSPOTT: That is a big difference, Dave. That is shooting towards that 10 ribbon door, too.

MR. DUTKO: You did not have to rotate the betatron head or invert it to shoot on the tracks.

MR. RAMSPOTT: That was my point.

MR. DUTKO: This was a selling

point by the betatron maker that you could shoot a casting on the track in place if the casting was placed properly. Not all shots, not all quadrants could be gotten on the tracks but in the case of one, two, three, four shots due west, that is what they would do.

MR. RAMSPOTT: Terry, which is the most frequently used process, shooting on the railroad tracks or flipping the head?

MR. DUTKO: I would say shooting on the railroad tracks, John, because it was a selling point of the betatron. It was used on an as-needed basis on a foreman's call.

If a foreman had a hot casting and he would bring it in, we would shoot it on the car and out again it would go.

MR. RAMSPOTT: Thank you.

CHAIRMAN ZIEMER: Let me ask a question here, at this point, of NIOSH. When you do your modeling and you can model people who worked, for example, outside the building,

or used the restroom and so on, did you assume a certain number or a frequency of the flipping of a certain -- well, you didn't do the flipping because you thought it was after the period, but let's say a certain frequency of pointing toward, I guess it would be pointing toward the ribbon door at that point versus a frequency of pointing, say, toward the west wall?

MR. ALLEN: Well, Mr. Ramspott, I think we had a misconception there too as far as what was flipping the head versus pointing at that west wall.

CHAIRMAN ZIEMER: I got you.

MR. RAMSPOTT: I might add that restroom is towards that west wall. Is it not, Terry?

CHAIRMAN ZIEMER: Well, the restroom, the diagram we are looking at one here, John.

MR. RAMSPOTT: Yes.

CHAIRMAN ZIEMER: It looks like

the restroom is kind of at an angle between the north and the west wall and sort of adjacent to the ribbon door, just down a ways from it.

MR. DUTKO: It is about northwest.

CHAIRMAN ZIEMER: Yes.

MR. ALLEN: Okay.

MR. DUTKO: Mr. Ziemer?

CHAIRMAN ZIEMER: Yes.

MR. DUTKO: If you can visualize a casting with the north quadrants of shots left on the corner of it, that is when they would invert the betatron to pick up that north quadrant of shots without rotating the casting.

CHAIRMAN ZIEMER: I see, okay. Yes.

DR. ANIGSTEIN: If I can comment, this is a briefing that was given back in May of 2008, luckily I have it here. But, I think it was distributed and it describes in the original, in the SC&A 2008 proposal

summarizing it. And the calculations that were done here showing for instance the dose rate to the restroom. It is not test result. That was simply moving. Here is a betatron. It is pointing directly at a steel casting which is centered on the railroad tracks. You don't see the railroad tracks here.

CHAIRMAN ZIEMER: Yes, I understand.

DR. ANIGSTEIN: And so this is pointing at the railroad tracks. The casting is still there. And what you are getting there is -- remember, you can actually draw a straight line. You can see that the line from the betatron target to the restroom bypasses the shield wall. There is some thin metal wall here. It is not open air but it does not show up. This is the actual MCMP model but it is based on the ORNL diagrams from the two reports.

So unlike the betatron-1, it was completely surrounded, except for the

entrance, by huge heavy shield walls. The betatron-2 was not.

CHAIRMAN ZIEMER: Yes, I understand.

DR. ANIGSTEIN: One was, for whatever it is worth, one was actually built by the Army Corps of Engineers --

CHAIRMAN ZIEMER: Right.

DR. ANIGSTEIN: -- and this one was built by a civilian contractor working for GSI.

Now if you added -- so here we have 22 millirem per hour in the restroom.

CHAIRMAN ZIEMER: Right.

DR. ANIGSTEIN: Near the corner of the restroom here. Now, but this is with the betatron being parallel for the proposed listing of the phone, like parallel to the south wall, aiming straight at the west wall.

CHAIRMAN ZIEMER: At the west wall.

DR. ANIGSTEIN: In the direction

of the west wall.

Now if you then turn the betatron beam, let's say you wanted to have a casting somehow going here and the betatron beam is at an angle, it could be much worse. So even though this is line of site, the betatron beam is not isotropic, it is very heavily focused in the center and which you are getting just like the penumbra, the very stray edge of the beam. If it was to be otherwise direct hit, things could be much higher, even if it was not that common.

The thing I also want to point out is I think there is a misconception, perhaps if I recall on NIOSH response, well, there was an SC&A model. There is not an SC&A model. The reports are very careful. I mean, I thought I made clear in the report but it may have gotten lost in the words that this is simply examples of exposure scenarios not modeled by NIOSH which gave higher doses. We do not claim -- we claim that these are

accurate. For that particular scenario, our calculations are as accurate as we know how to make them. However, we do not claim that these were limiting scenarios because, unlike NIOSH used the ATILLA code because it is much quicker to run and it allows you to get many, many locations, running MCMP X as we did, a typical one takes 24 hours. And we are talking about at that time, it was the best machine available to us, it was a 2.7 gigahertz machine, and I know, factor one.

CHAIRMAN ZIEMER: But these are dose rates, not integrated doses.

DR. ANIGSTEIN: No, these are rates.

CHAIRMAN ZIEMER: These are dose rates.

DR. ANIGSTEIN: These are hourly rates.

CHAIRMAN ZIEMER: And the bounding process, you basically are doing what I would consider to be an integrated dose over say a

year for someone at some location.

DR. ANIGSTEIN: Yes. We did that also. We take the integrated dose for the radiography but we did not do an integrated dose for people outside the radiography area. The radiographers are not affected by this. They are here behind the shield.

CHAIRMAN ZIEMER: No, I understand.

DR. ANIGSTEIN: They do get a little scattered radiation going through the light shield these are cinder block walls. But they most likely would not have been on the side of the betatron when they were in here.

So they were reasonable and they actually had survey meters, which they used. And they never recorded the --

CHAIRMAN ZIEMER: Well, let me make an analogy here. And I will do it in terms of shielding design. If you are designing a shield, say you are designing this

shield and you have exactly that configuration, one of the things you do is determine what is going to be the annual dose to someone in that restroom? And to do that, you have to make some reasonable assumptions. What percent of the time is the beam in that direction?

DR. ANIGSTEIN: Yes.

CHAIRMAN ZIEMER: What percent is the restroom occupied?

DR. ANIGSTEIN: Yes.

CHAIRMAN ZIEMER: And you do it in a sort of generic way. It is a kind of bounding.

DR. ANIGSTEIN: Yes.

CHAIRMAN ZIEMER: All I am saying is in principle, that can be bounding.

DR. ANIGSTEIN: Yes.

CHAIRMAN ZIEMER: Now, there may be some issues with the assumptions made in terms of occupancy factors and the time that the beam is on for a shot and the percent of

the time that it is pointed in some direction.

DR. ANIGSTEIN: There is a problem. The occupancy factor we can probably say is, you know, is unlikely to be more than an hour a day.

CHAIRMAN ZIEMER: Well, I am just saying in principle you can do that. There may be some problems with coming up with the right assumptions.

DR. ANIGSTEIN: Yes.

CHAIRMAN ZIEMER: And so in the bounding case that we are doing here, you make, I mean, for normal shielding design, there are accepted occupancy factors --

DR. ANIGSTEIN: Yes.

CHAIRMAN ZIEMER: -- for bathrooms. For control rooms.

DR. ANIGSTEIN: Yes.

CHAIRMAN ZIEMER: For all of those things. So you know, there are some sort of underlying principles that can be used. But I am trying to get a feel for two things. One

is, once we know things about when the flipping occurred and other things, can it be bounded? And number two, are there other, are there incidents of the type you described that sort of exceed those bounds to the extent that we have not really bounded it correctly? I mean, the bounding, if done for this program, I would think would have to include the kind of things we do in shielding design but also consider the workplace issues that the petitioners have described which sometimes -- and you always, you often have this in real life, is where people defeat the system. The flipping of the thing is defeating of the system. They basically defeated interlocks and bypassed the designed safety features of the system.

DR. ANIGSTEIN: Right.

CHAIRMAN ZIEMER: And although that is unfortunate that that was done, and that never shows up when you are designing things a priori because you think everybody is

going to follow the rules, but since that was done then you have to account for that.

But it seems to me in principle it could be accounted for. What is your feeling on that, Jim?

DR. NETON: I tend to agree with you. I mean, we might have to go back to the drawing board and fix a few issues here but I think it could be modeled based on certain assumptions, occupancy factors, and such. Because the theme is pretty well characterized. I think we might have some fundamental differences about the characteristics of the beam itself.

CHAIRMAN ZIEMER: The beam should be normally characterized in terms of the energy, the targets, and the beam size.

DR. ANIGSTEIN: We were able to actually characterize the beams in the first principle --

CHAIRMAN ZIEMER: Right.

DR. ANIGSTEIN: -- microbeams

would actually be the electrons --

CHAIRMAN ZIEMER: Right, and you can do that not only for the photons but the numbers of neutrons generated, all of that. Right.

DR. MAURO: When all is said and done, there are certain classes of problems that we believe are tractable. That is, we may disagree on occupancy times and lots of -- such as how long does a person stay in a bathroom, but they are tractable. And at some point in the process, we could come to some consensus on what is a reasonable set of assumptions. And thereby place a plausible upper bound. I think that is what we are talking about on that.

CHAIRMAN ZIEMER: Yes.

DR. MAURO: And then there is another class of problem, and this is the other side where we have some difficulty saying whether it is tractable or not.

And you know, when you boil it all

down, I think that this ten-year period where you don't have available tools at this time, film badge data, I feel that falls under the category that may be very difficult to track. I am not saying it is not tractable because I understand your position. I am saying that falls on the side of the fence where I say we have got a problem.

All the things we are talking about here, I believe they are tractable. I think that reasonable people could come to some judgment regarding how we place a plausible upper bound on all of these different scenarios, whether it is the guy on the roof or the folks in the bathroom, what assumptions you want to make and we could work those out.

But I am troubled very deeply by the ten-year period where there is no film badge data available to us right now. It is simple as that.

CHAIRMAN ZIEMER: Okay, other

comments on the second issue?

DR. McKEEL: Dr. Ziemer?

CHAIRMAN ZIEMER: Yes.

DR. McKEEL: I would like to comment.

CHAIRMAN ZIEMER: Yes.

DR. McKEEL: I have been listening to finding one and finding two and the bounding discussion. And I believe -- I sort of hesitate because you are the health physicist and I am not, but it seems to me that in all instances where you all are talking about bounding and you can probably do it, what is left out of the equation is that you don't know the basic features of some of the major source terms that have to be bounded.

And this has been brought out in the discussion. You know quite a bit about the betatron but there is no definition of the cobalt sources. We have some anecdotal idea from the men about what the sizes were.

Nobody has discussed the portable x-ray unit or how that dose can be bound. And I believe and I have an explicit example in my critique to the SEC evaluation report by NIOSH and what I think is, you all seem to say that you can bound things by looking at the seven sources or so that there are at NIOSH, I mean at GSI, and you can pick the one that has the highest dose rate and say, well, that bounds all the others. And if it were true that radiation doses were not cumulative over time, I would say, well, okay maybe so. But the fact of the matter is, they are cumulative.

And so I think the way you have to bound things correctly is you have to first do the hard work of characterizing all of the sources completely, as in OCAS-IG-003. Then you have to set an upper dose range, 95th percentile, something, for that cumulative dose and then that could be used to set an acceptable bound.

But what I think you all have is

you have a bound that you can place for uranium but not all the forms of uranium because they haven't really been covered adequately. You can place an upper bound for the betatron beam but not for the betatron beam and the glancing shots on the uranium, for example. But you cannot adequately place an upper bound on isotopic sources where you don't have any licenses and you really don't know their strength at a given time. You know the half life of cobalt but that changes over a 13-year period. You know, some of the cobalt sources would have decayed down to their half value and have to have been replaced.

So that is one comment. I just don't think -- and everybody is talking about what can be done. And we are four years into this process and I don't think you all have any more time to carry out the can-be-done thing. The issue, I believe is, can you do it now and has it been done. And basically what

SC&A says, and I am sure we will get into this, but you know, they said that the bases for calculating accurate doses is not there in Appendix BB and that the dose reconstructions done thus far are flawed. And I just can't sit here and listen to the discussions and not make that as a very major point.

And so, you know, I was waiting today to hear some characterization. Now, I do have another comment about the efforts that have been expended to get characterization of those isotopic sources. And I have pointed out repeatedly that there was a law enacted in Illinois in 1957 -- I sent you actually the language of that law -- that required all radiation devices in that state to be registered with the State of Illinois. Now, somebody has got to have those records or at least explain why they don't have them. The law was to be administered by the Illinois Department of Health, which actually hosted the Nuclear Safety Division for a long time

before it ever became IEMA. And so you know, I just think those things have to be looked for.

And I want to comment about my FOIA request to the NRC in 2006. At that time, there was a great amount of controversy about Granite City Steel versus General Steel Industries. And when I wrote that FOIA back then, I was confused about the issue somewhat. And it was late at night on the web and I filed a FOIA request because my thought at that time was, well, we have been talking about these sources, why not see if we can get the licenses. And that was three years ago. And so my FOIA request asked for Granite City Steel.

Now just recently, I submitted another request to the NRC. So I ask that that issue be revisited.

I also ask that -- Dr. Anigstein, you know did a tremendous job of trying to track down those licenses but I did notice in

his narrative when he mentions that NARA said that they usually destroy things after 30 years, did not ask the next question which I think is crucial, and that is, well, would you please look and see if by some chance those records from GSI and those source term licenses were not destroyed at the end of the 30-year period.

So I think somebody -- once again, this is a data capture issue. Somebody from NIOSH or ORAU or whoever captures data should go to NARA and pursue that with vigor and look for those licenses. Because I sent you all recently a Case Western Reserve license that was terminated in 1996. It was active in 1956-57. They were able to recover all of those records back then. That is the same era as we are talking about at GSI.

So you know, I hate to say this but I am going to say it anyway. I don't think we have tried hard enough and that was what SC&A was doing. My comment is, why isn't

NIOSH actively pursuing all of that and sending a data capture team out to scour everywhere, including NARA. And actually Pat Worthington has agreed to extend the search she made for the sealed sources licenses at DOE to include the records from Weldon Spring and Mallinckrodt in the rare hope that in one of the Mallinckrodt technical reports, of which there were many on almost everything they did in that plan, there were hundreds of them issued, was there not one or more technical reports on 13 years of work done at GSI inspecting uranium.

I, frankly, would bet you anything that those technical reports exist. We need to find them. And I guess that is all I need to say on this issue.

CHAIRMAN ZIEMER: Okay.

DR. McKEEL: But we need to try harder.

CHAIRMAN ZIEMER: Thanks, Dan, for those comments. And certainly characterizing

the sources is important.

On the bounding issue, I was focusing specifically on bounding the betatron exposures. I wasn't actually addressing the other ones but I agree that they have to be looked at as well and that is one of the reasons we had the concern about the size of these sources.

Let me add one other things on the documents on licensing and registration. I would guess that registration records would be more important and I will tell you why. Most places that I am familiar with, the licenses do not correspond to what people actually have. For example, if I want to use an 80-millicurie cobalt source, I am probably going to ask for a license for 100 because I am not exactly sure that the vendor is going to be able to give me exactly 80 and if he gives me 81, I will be in violation of a license.

I have had many licenses at my institution over the years and I have had

many, many things on the license that I never possessed simply because you put them in there in case you want to get them. Or if you know you are going to get them like a cobalt irradiator, which I have for many years a couple of them, the activity I asked to be licensed was always greater than what I knew I was going to get, just to make sure that the actual device I got was lower than the license limit. Because if I am over, I am in violation.

On the other hand, registration, and I have been involved in that because most states early on had registration rather than licensing because NRC or AEC at that time took care of licensing. They registered the actual things they had.

And so I think your point that the Illinois registration information, it would seem to me, is the likeliest to be more in one-to-one correspondence with what actually existed on that site because you would

register exactly what you had, usually no more and no less. So I personally would be interested if we were able to track it down in seeing what the facility registered.

Bob, you are shaking your head but --

DR. ANIGSTEIN: We contacted Illinois.

CHAIRMAN ZIEMER: Well, --

DR. ANIGSTEIN: They said they had nothing on it. They had no records. A fellow named [identifying information redacted] used to work for Landauer, he lives Chicago and knows who to talk to --

CHAIRMAN ZIEMER: Well.

DR. ANIGSTEIN: He said they have nothing and go to NRC.

CHAIRMAN ZIEMER: Well, NRC would only have licensing records. They wouldn't have the --

DR. ANIGSTEIN: Yes, but I mean they said they had no knowledge. No

information whatsoever.

You know, as for General Steel Industry, General Steel Castings --

CHAIRMAN ZIEMER: Is this an official search by --

DR. ANIGSTEIN: I guess not.

DR. MAURO: No, we just took it upon ourselves to see --

CHAIRMAN ZIEMER: Well, --

DR. MAURO: -- because we knew this was going to be important.

CHAIRMAN ZIEMER: All right. I don't know if it makes any difference.

DR. ANIGSTEIN: I think it was a private citizen inquiry.

CHAIRMAN ZIEMER: Well, I don't know. I mean, we are assuming anecdotally that the small source was really small.

DR. ANIGSTEIN: Right.

CHAIRMAN ZIEMER: It sounds like from what you have seen, Jim, other factors that it probably was.

DR. NETON: I don't know that we did contact the Department of State.

MR. ALLEN: No --

CHAIRMAN ZIEMER: You did contact them?

MR. ALLEN: We contacted NRC and the Department of Illinois --

CHAIRMAN ZIEMER: Department of Nuclear Safety and their predecessor? They should have inherited those records. Right?

MR. ALLEN: Yes, the request wasn't isolated to licenses. We asked for any information they had on these sites and we didn't limit it to the particular dates either. We ended up with licenses for --

CHAIRMAN ZIEMER: Well, they became a licensing agency later.

MR. ALLEN: Yes, that was all the information we got was some licenses. They were for years after, I think the '90s. I don't remember the dates. There was nothing in the time frame we were interested in. They

included the other GSI sites. And I think they were primarily the other site and on the license itself, on a couple of them, it gave two or three addresses, one of which was including this address.

But the impression I got was moisture, density gauges and cesium, americium -- I am thinking it was the 1990s but I don't recall off the top of my head. I mean, it was definitely nowhere near the time frame we are interested in.

DR. ANIGSTEIN: GSI didn't exist after 1973.

MR. ALLEN: I actually wrote it down.

CHAIRMAN ZIEMER: After what date?

DR. ANIGSTEIN: Seventy-three was when GSI went out of business.

CHAIRMAN ZIEMER: And what you had Dave was dated what?

MR. ALLEN: I have got termination of license January 8, 1992.

CHAIRMAN ZIEMER: For what site?

MR. ALLEN: That is what I am trying to find here. I have got in the '80s, an amendment to that license was National Steel Corp., General City Division.

DR. ANIGSTEIN: Yes, they acquired the Granite Steel -- they acquired the GSI property but not the GSI operation.

MR. ALLEN: Yes, we tried to find anything with any names of its predecessors.

DR. ANIGSTEIN: But, they did not inherit the company.

CHAIRMAN ZIEMER: Where were the betatrons at that point?

DR. ANIGSTEIN: The betatrons remained in -- both betatrons were put into, I think, one of the two betatron buildings, I don't know which one.

CHAIRMAN ZIEMER: And the sources?

DR. ANIGSTEIN: The sources we have no knowledge. If the company went out of business in 1973, then they dismantled it.

They sold the property, not the machinery, not the operation. They didn't sell the business. They just sold the property to Granite City Steel. As a matter of fact, a number of the workers simply crossed the street and got jobs with Granite City Steel.

But the operation did not continue and all records were destroyed and I remember there was a worker who testified to being ordered to destroy the records and supervise them being land-filled or incinerated.

CHAIRMAN ZIEMER: Do any of the site experts, John, do you or Mr. Dutko know or have some idea of the disposition of the sources?

MR. DUTKO: No, sir, I don't. This is John Dutko. I really don't, sir.

CHAIRMAN ZIEMER: We don't know if they were, for example, sent to a burial ground, a waste site, versus returning to a vendor or transferred to another kind of similar facility somewhere then, I gather.

MR. DUTKO: Sir, I have no idea. I think the plant was sold in '73, '74 -- '73, I believe. And I have no idea what happened to the sources.

CHAIRMAN ZIEMER: Okay, thank you.

DR. McKEEL: Dr. Ziemer, this is Dan McKeel. I would like to say again, though, [identifying information redacted] was an extremely well versed person. He ran the film badge program. It is totally inconceivable to me that, yes, the company went out of business in 1973, but you probably know better than I do that when you terminate a source license, particularly for an 80-curie source, you know, somebody had to terminate those licenses and go through that process. And that is what I was trying to point out when I sent you all the decommissioning for the large cobalt-60 source at Case Western Reserve. That was 100 curies. CHAIRMAN ZIEMER: Well --

DR. McKEEL: It was many years, 25

years after that source was disposed of that NRC finally closed out and terminated the license.

So again, I just can't believe there is no track of where those source licenses went and they were decommissioned. And I really think it is not fair to attribute to a fellow like [identifying information redacted] that he wouldn't have taken care of that as the plant closed down in an orderly fashion.

CHAIRMAN ZIEMER: I would assume he would, too. And of course, in the case of Case Western Reserve, they still exist. They could have, I don't know when they actually closed the license.

DR. McKEEL: 1996.

CHAIRMAN ZIEMER: `96, so they possessed those sources up until recent years. So it remained in place --

DR. McKEEL: No, I'm sorry. They got rid of the sources a long time ago.

CHAIRMAN ZIEMER: But the license.

DR. McKEEL: The license termination was not finally --

CHAIRMAN ZIEMER: Right. So the records, in a sense, are much more recent.

But I think you are exactly right. There certainly was a requirement in place in the '70s they would have had to have either transferred those sources to another licensee or they would have had to have disposed of them to a licensed facility. There is no way you could just dump an 80-curie source and have it -- I mean, I don't think it is going to happen. So the license had to be closed out for those sources by the NRC. That is why it is --

DR. McKEEL: Okay.

CHAIRMAN ZIEMER: Yes, I agree that it had to have occurred.

DR. McKEEL: Thank you.

DR. ANIGSTEIN: Would it still have been AEC in '73?

CHAIRMAN ZIEMER: It would have been, or ERDA. No, it wouldn't have been ERDA. It would have been NRC. Either NRC or AEC, yes --

DR. ANIGSTEIN: NRC came back --

CHAIRMAN ZIEMER: Well, in any event, NRC or --

DR. ANIGSTEIN: Yes, but the point about how long the records are kept, the point that Dr. McKeel made that, here were the records going back to the '50s, yes, but it was a license that wasn't closed until recent years.

CHAIRMAN ZIEMER: Yes, they still had the license.

DR. ANIGSTEIN: Whereas a license that's been closed over 30 years, they may not have had the records.

CHAIRMAN ZIEMER: Okay. Well, you have contacted Illinois Department of Nuclear Safety then and they claim that they don't have the records.

MR. ALLEN: All we did was cast a wide net with a lot of names and time frames. What we got back was not relevant.

CHAIRMAN ZIEMER: Oh. I guess I am a little surprised that they would destroy those kind of records in any event.

DR. NETON: They may not have destroyed them, they just don't know where they are, the storage vault they are located in.

MR. ALLEN: They actually had them. The licenses, like I said, were not relevant. They actually had those and we got copies of those but they are all from the '80s and '90s.

CHAIRMAN ZIEMER: Not the earlier ones.

MR. ALLEN: No, nothing earlier.

CHAIRMAN ZIEMER: The later licenses were for this other company?

MR. ALLEN: Primarily -- yes.

DR. McKEEL: I got copies. This

is Dan McKeel. I got copies of those later licenses, too and they were for basically Granite City Steel in the later years, owned by National Steel and U.S. Steel and subsequent owners.

CHAIRMAN ZIEMER: There is no hint that the sources went over to Granite City, is there, that you can see?

DR. McKEEL: You know, those companies, they really didn't use -- well, all the source licenses I got from Granite City Steel were like Dave Allen mentioned, you know, americium-241. They looked like small tiny sources. I don't know what they would have used them for.

MR. ALLEN: There were some cesium and some americium. They were like the nuclear density gauges.

CHAIRMAN ZIEMER: Oh, okay. I got you.

MR. ALLEN: I'm not sure if that is correct but --

CHAIRMAN ZIEMER: We need to take a comfort break here and then we will come back and continue. Give us 15 minutes.

(Whereupon, the above-entitled matter went off the record at 3:03 p.m. and resumed at 3:15 p.m.)

MR. KATZ: Mark, are you still with us? We are just starting up again.

CHAIRMAN ZIEMER: That's okay. We will come back to order again, anyway. We are going through the resolution matrix of the SC&A findings on the Special Exposure Cohort Petition Evaluation Report. We are ready to look at Issue 3, which is called lack of documentation.

MR. DUTKO: Dr. Ziemer?

CHAIRMAN ZIEMER: Yes. Somebody have a comment there?

MR. KATZ: John?

MR. DUTKO: I have a question, sir.

CHAIRMAN ZIEMER: Go ahead.

MR. DUTKO: How are we given the correct bounding dose when our hours have been wrong for two years?

CHAIRMAN ZIEMER: Oh, you are talking about the hours per week that are assigned to the workers?

MR. DUTKO: Yes, sir.

CHAIRMAN ZIEMER: Yes, that is an issue. Let's see, I am not sure if that comes up on this item but we are aware of the concerns on that issue.

MR. DUTKO: Well, we are shorted by 35 percent, sir, and it is hard to understand how we can be given correct credit for anything with such an hour shortage. When we gave an estimate of hours, it was an across-the-board average. And believe me, we had some people work quite a bit more than the hours average we gave you.

CHAIRMAN ZIEMER: Okay. Yes, we will ask NIOSH at the appropriate time to address that issue as well.

MR. DUTKO: Thank you, sir.

CHAIRMAN ZIEMER: Right now we are going to look at the third issue on the matrix. Bob, are you ready to go on this?

DR. ANIGSTEIN: Yes.

CHAIRMAN ZIEMER: Okay, proceed.

DR. ANIGSTEIN: Okay, we came to a particular discussion of this matrix, of this issue -- gets bigger than the issue so a lot of it spills over from one issue to another. We have sort of partially discussed this. But the basic thing is, in summary, is that there is really very little documentation. We have the accounts of the workers that we just discussed. We have no records of the sources from either the possible source vendor that we contracted or the state or federal agency. So it is basically information estimates from workers of what they thought the sources were.

Similarly, there is the purchase orders for the uranium from 1958 through 1966 and nothing beforehand. So NIOSH assigned the

first dose -- I guess it's the highest dose -- not dose, the hours of exposure during which the uranium was being radiographed and handled.

And then so it is a philosophical question which arises. What constitutes sufficient accuracy? In other words, when there was speculation and anecdotal, and I might say without impugning anything to anyone, not always consistent -- different workers have different recollections. Some people I've interviewed even changed their recollection, you know, over a period of months or it may even be two years now.

And so then the question is, what is sufficient accuracy. Is it sufficient accuracy to say let's take the bounding case, well the one person says we worked 45 hours a week and another one says we worked 80 hours a week, should we take 80? Should we take a consensus, which is like an average of 65? That is one example, and that is very

tractable for a person. You are not going to be off by more than a factor of two. Full-time workers work 40 hours. Hardly anyone would ever work more than 80, week in and week out. So that is a factor of two.

The sources, you know there is really that small source, especially well defined, the hours. So there was just a lot of well defined parameters and the question is, is it enough to take the worst possible case. Is that sufficiently accurate? We can certainly take the worst possible cases.

John Mauro said it is certainly highly unlikely that no one got more than 100 rads a year because you would be getting some symptoms. Should that be a bounding case? Or should the film badge records for those -- or should the average film badge records which shows hardly anyone got more than 10 millirem a week if you can believe that M corresponds with a millirem bounding dose, should that be the bounding dose and the others considered a

succession?

So I am just raising the philosophical question of how do you bound it with sufficient accuracy. And I have no answer.

CHAIRMAN ZIEMER: Okay. So, and you spelled out some specifics in the discussion there. NIOSH had made a response that their assignments of doses, giving everyone a dose that is equivalent to the operators would be claimant-favorable.

DR. ANIGSTEIN: Yes, basically --

CHAIRMAN ZIEMER: Then there are some other related questions that you have raised. Maybe the numbers of hours per week comes into this. I am trying to remember. I think some numbers were taken into consideration when you did your bounding. And that can be discussed more. I guess we have a range of different testimonies where numbers have come in.

DR. MAURO: Or shots, wasn't it?

DR. ANIGSTEIN: There were two things. One was work hours and the original Appendix BB tried to get it on the basis of the pay scale, which, you know, there was unanimous consent by the workers at the meeting, at the Collinsville meeting that this was not an appropriate approach and that their recollection was that it could be from 50 to 80. They proposed anything from 50 to 80 hours was a typical workweek. So they told us to compromise it, if we say 65, would it be reasonable and they said yes. And that corresponds to, if you say 64, that corresponds to three additional shifts a week, which is -- during the peak years. So that is a reasonably tractable, calculable issue.

And the point again about the analysis which we did which showed that under a very particular set of circumstances, the radiography of steel actually has higher doses of uranium, one reason being that the assumption, which has now been contradicted,

was that all the uranium was in the form of four-inch slices and was simply way, way back two and a half years ago did some calculations, actually we got the information from the, I can't remember the name, something with the word Penny in it, an arsenal in Pennsylvania which is still operational, has a 25 MeV betatron and they advertised they can go up to 20-inch thick steel.

So I simply put the associated coefficients for steel and for uranium and that translates into four inches for uranium.

And then the workers agreed with perhaps a little bit of suggestion on my part, would you say those are four-inch slices? Yes, they were four-inch slices. So I might have put words into their mouth, but that is what we did.

Now more recently, Mr. Dutko and another worker that John Ramspott recommended that I interview, which I did, both said, oh, yes, they did these corner shots. I am still

not 100 percent sure but those things I have yet to -- and those would have been shorter shots and they would have had less time protruding the uranium and more time up close and personally handling it. So those doses would go up.

Again, what we did, we were not trying to redo NIOSH's job. We were simply saying here are some examples. They are not binding. So, I would not necessarily -- I disagree with NIOSH saying, well, SC&A said that the uranium gives you less dose than the steel. In this particular example, yes.

CHAIRMAN ZIEMER: Not necessarily in general.

DR. ANIGSTEIN: Not necessarily in general.

CHAIRMAN ZIEMER: Well, let's see. Jim or Dave, do you have any discussion on this third one? You have your response here.

Any additional comments on this particular issue?

MR. DUTKO: Dr. Ziemer?

CHAIRMAN ZIEMER: Yes?

MR. DUTKO: I originally talked to Dr. Anigstein on x-raying of slices: that's for sure, we did. However, I forgot, which was my fault at the time, about corner shots we fired on ingots. We did agree that you cannot penetrate, because of density, a full ingot. But the corner shots were performed and inspect the first inch and a half of depth for metallurgy purposes. But I simply forgot at the time I was talking to Dr. Anigstein about the ingots about the corner shots.

[identifying information redacted] wrote up an affidavit quite some time ago, years ago, about the corner shots and laid it out in detail, actually.

DR. McKEEL: This is Dan McKeel.

CHAIRMAN ZIEMER: Yes, Dan?

DR. McKEEL: [identifying information redacted] put that testimony on the record. It was posted on OCAS August the

11th, 2006. So these recent findings are what are discouraging me. There doesn't need to be a recent finding. You know, he described the process. And between then and now, John Ramspott and I have offered voluminous direct evidence that both Mallinckrodt, Destrehan Street, and Weldon Spring, undoubtedly one of their main goals in having their ingots and dingots examined at GSI was to define that outer crust and the interface with the inner pure uranium core. So we believe that was a major thrust for the inspection work all along. And there are just, every report except Dr. Anigstein's and SC&A's indicates that ingots, not just slices, were sent over to General Steel. So that again is something I hope the new search by Pat Worthington at DOE or under Dr. Worthington at DOE by their chief researcher, she said, would disclose that in fact what we are claiming and what we have produced many documents to show by now probably is the truth.

CHAIRMAN ZIEMER: Okay, thank you. Let me ask Dave or Jim, what is the impact on your bounding, original bounding calculations of the corner shots? Was that included or is that going to change things very much, or at all, or a great deal, or do you have a feel for that at the moment?

MR. ALLEN: Not a good feel. There are competing effects. We originally in Appendix BB used essentially just a large slab of uranium, tried to x-ray it for a good amount of time to build up the fission products in it and develop a couple of scenarios and thought based on what we were told at that time that this would be a reasonably bounding estimate because at that time, we were told primarily it was four out of the troughs.

Now we have started working on it a little more. This idea of the cone of the machine getting near enough, activated to produce residual radiation from the cone of

the machine has become one of the larger pieces of dose in any kind of a scenario. So it suddenly becomes more bounding but shorter to shot. But you have also got to consider that the short shots are very short and that the dose of that cone has got to be a lesser amount than it had been for a long shot. It has got to be cone-activated first.

A lot of different competing --

MR. DUTKO: Dr. Ziemer?

CHAIRMAN ZIEMER: But you haven't actually looked at it in any detail yet?

MR. ALLEN: We haven't looked at every possible scenario. We looked at what we thought would be a bounding --

CHAIRMAN ZIEMER: Oh, okay.

MR. DUTKO: Dr. Ziemer?

CHAIRMAN ZIEMER: Yes, go ahead.

MR. DUTKO: When we are shooting short shots, which is 90 percent of the time, ten percent of our work was probably long shots or intermediate. We are in the shooting

room, out of 15 minutes we are in the shooting room about 12 minutes setting up the shot. And simply, we have got a hot machine to our rear 100 percent of the time and a hot casting to the front of us 100 percent of the time.

I have heard the Board remark that we are shooting behind ten-foot walls. But this scenario, I wonder if it hasn't been overlooked. I know it was covered by Dr. Anigstein but if we are on activation at 100 percent of the time, but I only shoot four shots an hour, one every 15 minutes, 52 minutes we are in the shooting room, eight minutes we are in the control room.

Now, I don't understand where ten-foot walls are very safe in this factor, sir.

CHAIRMAN ZIEMER: Well of course, there is a big difference between the beam itself and the activation in terms of those levels but, nonetheless, we are going to have to look at some additional -- do you need to look at the corner shots anymore or do you

think you have got them covered at this point?

MR. ALLEN: Well, I thought when we were putting together the evaluation report was that the film badge was going to cover whatever scenarios we come up with. It has got to be consistent with the measurements.

CHAIRMAN ZIEMER: Right. Bob you had a comment?

DR. ANIGSTEIN: Two things. One is the way it would affect our analysis of the uranium, of the exposure from uranium, I assume the uranium slices. So what we call the Puzier effect would be small because you would have the large ingots, which would have the enhanced thorium all over its surface but now you are cutting a slice like a salami from the center. So that slice, which is four inches thick, 18 inches in diameter, only the circumferential surface has its enhancement. The flat surfaces, planar surfaces, do not. And so it is assumed that the worker was exposed 60 percent of the time, looking at the

effective percent of the time and he got some beta dose. Primarily it would have been a beta dose. I think also he would get some photon dose.

Now, if in fact some of the time there were in fact ingots, there would have been a much larger surface for the thorium-234 and 234-m really, I think the real culprit, to have an effect. So it would make a difference, that exposure.

Also, speaking of the activation, back in March -- and we issued in April 2008 report, I concluded Chapter Two by saying -- I'll read from it. The major source of uncertainty in the exposure analysis of the betatron operator is the residual incubation from the betatron itself after it is de-energized. Our only sources of information are 2007 and further from the location with that author who reported having taken a measurement of which he had no written record. He was going by his recollection from two

years earlier, that he went out into the shooting room immediately after or shortly after the thing was shut off and took a measurement at six feet from the target, from the betatron target to measure 15 millirems per hour or micro -- millirem per hour which then was gone within 16 minutes.

Now our MCMP X model could not reproduce that. We could not find where it was. We were quite certain they would not leave -- in the beam and it did not show any activation product that would account for anything like that kind of an exposure.

Now, on the other hand, we did not model the entire betatron apparatus. We just modeled the tube and the cone. We didn't try to model the magnet and everything surrounding it. It was too complicated. We didn't have enough data on it.

So my suggestion was -- so at that time when it was still operational, the original betatron or the piece of it had been

bought out but this company called MVP, to do testing and they would go there. Since then, from what I understand, their machine has self-destructed. It fell off the train and is no longer operational.

But there are still two metal facilities, one in Pennsylvania and another in China Lake that is operated by the Army and the one in China Lake Naval Testing, Naval Weapons Station in California. And it might, you know, it would be a fairly simple matter to send one or two people there, you know, make an arrangement to go into routine testing and run out immediately after it has shut off with the appropriate radiation monitor and try to measure that. It is a major part of the radiation.

DR. NETON: Actually, I am having trouble understanding why all of this film badge data we have is not relevant towards helping bound it and then the fact that the MCMP calculations are a factor of two or more

higher than the film badge data indicate, why would we bother refining that model even more?

MR. DUTKO: Dr. Ziemer?

DR. ANIGSTEIN: Well that brings up one other issue. With the film badge, you bring another issue. If we do not know the quality of that radiation, we have no idea what it is.

DR. NETON: Well, we --

DR. ANIGSTEIN: Then if the man is spending most of his time with his back to the machines and he is launching off the casting and the betatron is behind him. The film badge is on his chest. If you don't know the energy of the photon, we cannot make a correction for the absorption, but if the photons are say below 50 KeV, then you can adjust the volume. I mean, round it off to two decimal places, the number is zero.

And so consequently, it is --

DR. NETON: Every scenario you have was sort of the worst-case scenario along

the line here. And I just have trouble with these theories, almost like, are just sort of defeatist, almost.

DR. ANIGSTEIN: No.

DR. NETON: I just think it is unlikely that every scenario along the way is as you portray.

You are pointing out technical issues that are possible. Are they plausible? I say no. I mean, that is my thought.

DR. ANIGSTEIN: Okay, it is a matter of --

DR. NETON: I mean sure, you could have a guy with his back to the source every single time. At worst case, it is a rotational geometry.

DR. ANIGSTEIN: Assuming that he is turning and -- you see, he has removed, there is no reason for him to face the betatron because he has remote controls to adjust the position of the betatron.

DR. NETON: Well you are not in

there when the betatron is on.

DR. ANIGSTEIN: Pardon me?

DR. NETON: You are not in there when the betatron is on.

DR. ANIGSTEIN: Of course not. I am not suggesting that the betatron is on.

I am talking about this residual radiation. It is an unknown. It is a complete unknown.

CHAIRMAN ZIEMER: You would have that with any monitoring situation. It is very rare that it is only one direction unless there is a particular task in some cases, such as hot cells and glove boxes, where the orientation is always a certain way.

Almost all jobs, and there is a lot of data to show this, get a mix of angles and that sort of thing. But I do want to ask a question here and then I think John or somebody on the phone had a question.

There is a concern that the 80-curie source would be decaying and therefore,

your dose is changing. Well if I were bounding it, I would just say just call it 80.

DR. ANIGSTEIN: I agree.

CHAIRMAN ZIEMER: So why would it be a concern that it is decaying? It is always getting lower, if anything.

DR. ANIGSTEIN: Of course. I guess I --

CHAIRMAN ZIEMER: I mean, at that point, it doesn't matter when it was acquired if it was an 80-curie. Do we know it was an 80-curie? I mean, it must have been labeled.

DR. McKEEL: This is Dan McKeel. No, you don't know it was an 80-curie.

CHAIRMAN ZIEMER: Why was it called an 80-curie?

DR. ANIGSTEIN: Somebody said it was.

DR. McKEEL: You know, there is no evidence. There is no record of anything written about that source.

CHAIRMAN ZIEMER: Well wait a

minute, how do we know they had a source then?

MR. RAMSPOTT: Dr. Ziemer?

DR. McKEEL: I'll tell you why. Because we have --

CHAIRMAN ZIEMER: I'm being facetious but somebody knows.

DR. McKEEL: I am not being facetious.

CHAIRMAN ZIEMER: I said I was. Dan, I said I was being facetious.

DR. McKEEL: Oh.

CHAIRMAN ZIEMER: No, I didn't say you were. I was being facetious. I know they had a source. I am just -- somebody has identified it as 80. That didn't come out of the blue.

MR. RAMSPOTT: We did identify it, Dr. Ziemer. [identifying information redacted], who was the real safety officer, identified it as 80. I spoke with no fewer than five isotope experts at the site to identify it as 80.

CHAIRMAN ZIEMER: Yes, so there is no reason for us to say it wasn't 80. And I am saying then we don't worry about decaying it down. We leave it at 80 so it always gives the maximum dose whenever we are calculating exposure to workers. We wouldn't necessarily, although you could, say okay then ten years later it has gone through two half-lives and we will cut that down. But I don't think the fact that it is decaying is an issue. You can either leave it uncorrected and you are over-estimating or you can correct it. So, unless there is some reason to think there is really 500 or something.

MR. RAMSPOTT: This is John Ramspott again.

CHAIRMAN ZIEMER: Yes, John.

MR. RAMSPOTT: We have heard occasionally 100, nothing more.

CHAIRMAN ZIEMER: Yes.

MR. RAMSPOTT: I did ask to speak just a second ago.

CHAIRMAN ZIEMER: Sure. Yes, go ahead, John.

MR. RAMSPOTT: It is addressing Dr. Neton's question about all of the badge information and part of the reason, Dr. Neton, that the badge information would be inaccurate and incomplete; the men did not, the recognized badge-wearers did not wear the badges all of the time. Even though they were in radiological areas like 10 Building on the other side of the ribbon door, the same people, everybody is assuming they wore these badges full-time. That is 100 percent incorrect and we don't know what that breakdown is. That is one reason the badges are pretty much inaccurate.

Now the other reason is the front-back thing. We are missing part of the reason here, too. The frontal back, posterior badge dose coming through the body, if it does, only getting part of it as noted at other sites. The other sites usually only had one radiation

dose and, true, the person was spinning around and moving and you can do that. But at GSI, these guys were like an Oreo cookie, them being the cream. They had a hot spot in the front, being the uranium or the activated casting and you also had the activated betatron to the backside. So there were two radiation doses at the same time going from a badge that was on the front.

If they had a badge on the front and they had a badge on the back and you added them together, I would have to agree with you. But that is the other thing. We are missing it. There is two radiation sources in the room with the guy.

The other reason, and I think we are going to address this later, the badges did nothing with the neutrons, absolutely nothing. And I am talking about the neutrons coming off the uranium and the neutrons coming off, I guess, the metal product. My understanding is these kind of badges that

they had did not read neutrons. And I looked at that Landauer site, too. They actually had badges that would read neutrons and that is not what these guys had. They had the red badges. They didn't have the blue ones.

And then the other thing was something we were waiting for from you and that is the film information. We know it was dental film. I have had workers say no filters, whatever that conversation was about today. I don't understand that completely. But the power, the photon beamed and the beams coming off, or the energy coming off the various sources, were they picked up by these badges? That I don't know. I have got to rely on you guys. You guys are the experts but that is something we still don't have an answer on either.

So there is four, maybe five things that we -- the badges are essentially useless. It is just my feeling. You have got to have good data and good foundation to build

an assumption on. I hope that helps.

CHAIRMAN ZIEMER: Okay. Jim, you had a comment here or did you?

DR. NETON: Well just a comment. I didn't mean to imply that the badges covered all exposures. I was trying to bring out the fact that we modeled exposures from the betatron itself would have been measured by the badges, not the time periods when the workers allegedly, supposedly weren't wearing their badges outside the betatron area.

CHAIRMAN ZIEMER: Okay.

DR. NETON: And then also on this other issue, we can't have it both ways. The x-rays, the energy can't be 50 KeV and not recorded in AP geometry and they can't be so high if they are not recorded by the film badges. If they are that high, the AP geometry, the geometry is almost irrelevant. It just penetrates the body completely.

So somewhere in the middle, I think, is going to be the exact story.

MEMBER MUNN: By the same token, you can't say the badges were worn always when there was low or no exposure.

DR. NETON: Yes. I agree though, John, that you raise a lot of good issues that do deserve to be addressed.

MR. RAMSPOTT: Thank you.

CHAIRMAN ZIEMER: I think I am certainly satisfied that there were filters in the badges. I am not aware of any Landauer badges that didn't have filters. I actually have used Landauer service myself since the first year they were in business back in the '50s and on up through. Their badges, those red ones particularly always had filters.

I don't know that any of our workers would know that that was the case. That is, the radiation safety staff was aware of it because they are very important in assessing whether you have got beta, gamma, low-energy photons, high energy. And the film badge company, Landauer, then assessed that

very readily from the badge. But I don't think the average worker would be aware, number one, that there were filters, number two, what they were all about anyway.

So it wouldn't surprise me. I mean, we didn't tell people that your badge has filters in it. They are not typically visible to the person wearing the badge. They are inside the packet. When the film is in there you don't see any filters. So I don't know that they would be aware of them even.

DR. ANIGSTEIN: I think that issue came up from a worker who actually changed the film. Somebody said it, though. But there were also badge designs where the filters were molded into the plastic and they would not have been visible.

CHAIRMAN ZIEMER: You couldn't see them.

DR. ANIGSTEIN: Yes, they would not have been visible.

CHAIRMAN ZIEMER: Well in any

event.

DR. ANIGSTEIN: And as far as the sensitivity to high energy, we looked into that and it could be a factor of two. It was definitely not, like, invisible. I mean, high energy programs were definitely not invisible to somebody.

DR. MAURO: It is important we know whose side and what the weight of the evidence is telling us and that is that these workers didn't wear their badges when they were involved in doing their betatron operations. The overwhelming evidence is that the readouts we were getting there were very, very low. Most of them below the limit of detection on the badge. Whether the limit of detection was 10 millirem per change-out, or 20 millirem. So in the end by going with the model to characterize the exposures, certainly the model itself is assigning a dose. In your case, six rem.

DR. ANIGSTEIN: Down to two,

depending on what you are --

DR. MAURO: Depending on the thing. And of course our model, I think was as high as 13 because of certain differences.

But I think that I agree with Jim completely. The value of the film badge data that we do have certainly does one thing. It shows that the doses that are going to be assigned to the people involved in the betatron operations are certainly claimant-favorable, as from the perspective of what did the film badge data tell you.

Now are they as claimant-favorable as they can be? Well, SC&A says well now, I think we could give you a little bit more on that. But we are talking about a completely tractable part of the problem. What is unfortunate here is I think that we are spending an awful lot of time modeling and arguing about different aspects of the betatron operation which in my mind, that is a tractable problem. We could deal with that.

We will find a way. We will find a way to achieve closure on what is the best way to deal with those exposures.

So to me, I think the real challenge here, and this goes to the SEC issue, the real challenge here is -- and this is going to be a tough call -- can you assign doses to those workers for those ten-year period when there was no film badge data available to us. Is it reasonable for a health physicist to say, I think I could place a plausible upper bound with sufficient accuracy? It now becomes a definition of sufficient accuracy. Now we are in a realm where I think different people could reasonably differ on this. I know where I come down and where SC&A comes down on this. I think you have got a real problem there in terms of sufficient accuracy for that ten-year period.

And I mean, I guess I am at the point where I know we are spending a lot of

time talking about the betatron but that is not where the issues are. The issues are the lack of film badge data for ten-year period. We will solve our betatron problem.

DR. ANIGSTEIN: Well if I could quote, this is from a report of the Work Group on the Special Exposure Cohort Petition Review January 16, 2006 plan. This was written, it was produced by SC&A, but it is a report on the meeting.

CHAIRMAN ZIEMER: Which work group was this?

DR. ANIGSTEIN: Pardon me?

CHAIRMAN ZIEMER: Which work group?

DR. ANIGSTEIN: This is the Work Group on Special Exposure Cohort Petition Review.

CHAIRMAN ZIEMER: Oh, okay.

DR. ANIGSTEIN: And so there was a report. There was a long procedure document prepared by SC&A but I think the pertinent

thing is the Appendix A to that procedure which was the actual report of the Work Group, and the key criterion that is spelled out in the regulation is radiation dose that can be estimated with sufficient accuracy that NIOSH has established that it has access to sufficient information to estimate the maximum radiation dose for every type of cancer for which radiation doses are reconstructed that could have been incurred in plausible circumstances by any member of the class. So, that seems to be the guiding principle.

CHAIRMAN ZIEMER: Yes.

DR. MAURO: Now you are talking. Right on target.

CHAIRMAN ZIEMER: That is exactly right.

DR. MAURO: Right. We are all operating from that premise. And as you heard from me, I mean, this is where I come out, I think that the way that, even though there are considerable uncertainties and differences of

opinion on how best to come at the betatron issues, whether it is the mix of concrete, how much europium there might be in the count, I mean, all of these are issues that go toward how best to model that.

I think that, according to that definition, it is tractable. We can come someplace. And I think that, but according to that definition, we have got a problem with those. I am going to say it over and over again because that is where it is now.

Folks, if we are fortunate enough to get that data for the ten-year period, I mean, that is going to be very important. Because then we are in a situation where we have a dataset that will allow us to know the degree to which we have these unusual circumstances. So in the end, you know what we really have here is that we know that even the people who were working with the sources during the time period the badges were worn, they didn't get very much exposure at all.

But we also know that once in a while something bad happens.

Now in theory, if you have got ten years' worth of data, that puts you in a pretty good position to say that with that data, whether or not anything unusual occurred and when it occurred and who it occurred to, so that you can deal with that person's unusual circumstance and then you would be in a much stronger position to say we could place a plausible upper bound on just about every worker there because you have the badges.

So to me, and this is, and I am speaking as SC&A's position is that that is where I believe we believe the SEC issue lies.

CHAIRMAN ZIEMER: John, let me point out, and maybe we will skip ahead here, issue four has to do with some badge dosimetry energy dependence. We sort of talked about that a little bit.

Issue five has validation of the models of the exposure to the betatron

operators. And we talked about some of that although there may be some refinements but I think with what you just said, that is solvable.

And then issue six, the external exposure of unmonitored workers. And in the finding it is titled underestimate. But -- and I guess that is part of what you are talking about now. It is that unmonitored part.

DR. MAURO: I think that the one thing, it is panning out.

CHAIRMAN ZIEMER: Right.

DR. MAURO: They are very much related.

CHAIRMAN ZIEMER: Right. And then I do want to point out I think --

DR. ANIGSTEIN: There is a distinction. Unmonitored, meaning ones who were normally not -- even during that time period --

CHAIRMAN ZIEMER: Yes, I

understand that.

DR. ANIGSTEIN: -- because they were not considered radiation workers.

CHAIRMAN ZIEMER: Right.

DR. MAURO: I'm sorry but if they were working with, at that time period, now we are talking about the late '60s now.

DR. ANIGSTEIN: We are talking about the Landauer time.

DR. MAURO: During the Landauer time period, it is my understanding if you were working with a radioactive source or a betatron, you were wearing a film badge.

DR. ANIGSTEIN: Right but I am talking about the workers using -- working on the roof --

DR. MAURO: Okay.

DR. ANIGSTEIN: -- using the restroom, working in an area where they would spray betatron beams --

DR. MAURO: Yes.

DR. ANIGSTEIN: -- who were not --

who were, by the present policies, are not given a higher dose.

DR. MAURO: But we think that is correct. I think that is tractable.

DR. NETON: That is a modeling issue.

DR. MAURO: Yes, that is a modeling issue, yes. It is only issue one.

DR. NETON: I thought you were also referring to these people who were not monitored who were involved. That is the one that sticks in my mind.

DR. MAURO: That is what I am worried about. I am saying that people who were not monitored of an incidence, could have gotten multi-rem exposure.

DR. NETON: From these radiography --

DR. MAURO: Right. And it does, the idea that you are assigning six rem -- you are not doing that. Right now you are not doing that.

DR. ANIGSTEIN: Right.

DR. MAURO: But let's say you were to do that. In my mind, that is pushing the boundaries of --

CHAIRMAN ZIEMER: You are talking about unmonitored workers in the early --

DR. ANIGSTEIN: Right now we are talking about the later period.

DR. MAURO: No, no, no.

CHAIRMAN ZIEMER: Oh, you are talking about during the Landauer period but the unmonitored workers.

DR. ANIGSTEIN: I am really talking about, perhaps the unmonitored is misleading here. What I am really talking about here in issue six is the workers who are assigned a 0.72 mR per hour. That this distinction between these two classes is not necessarily claimant-favorable because they did not -- the assumption made in Appendix BB was that there was a -- I never saw the details of the ATILLA analysis but my guess is

that it simply said there was a ten-foot wall solid with no breaks all the way around the betatron, and the control room has the highest dose rate which is 0.72 mR per hour.

And I would say based on -- assuming that the betatron was in the center of the room, of the shooting room, not off to the edge so that the ten-foot wall was in fact this area, I would agree with that. But the fact is, showing the picture I showed before, a lot of areas were much, much higher. And consequently, I don't agree that 0.72 mR per hour is a sufficient bounding dose to the non-radiation worker, under NIOSH.

DR. NETON: And we can talk about that but it needs to be calculable. I mean, it can be solved. I mean if we are going to try to incorporate this if it can be solved or it can't be solved.

CHAIRMAN ZIEMER: There is a disagreement on the assumptions, not on the fact that it can be done.

DR. NETON: But the overriding issue on top of that, from what I am hearing, is that there will be other sources of exposure out by the betatron that could have gone unmonitored by workers who were frequenting the roped-off areas where people went to drink coffee and they walked through or had incidents, that sort of thing.

DR. MAURO: Yes, there is that category and I guess my -- you are right. You are bringing up another dimension.

My main concern is workers who were badged during that ten-year period. We don't have their data. And without their data, it is very difficult to assign a dose to those workers with sufficient accuracy for those workers, which include all these workers that were working with sources.

Now you bring up another category, which is, here is a worker who might have found himself in a very unusual circumstance who would normally not be monitored to wear a

badge. In other words, you mentioned it, is the case where a person was inside the tank that was being irradiated and he wasn't wearing a badge because it was an incident.

Now here is a place where I think we could have a good discussion that these are very unusual incidents that, when they do occur, especially if you had a radiation protection program place with the badges, you would record doses and we would know a little bit more about it.

So I am sort of inclined to see the virtue in your argument. That is, listen, when those very strange things happened in the program where people were badged, there was a radiation protection program in place, and something very unusual like that occurred where some guy wasn't wearing a badge, wasn't supposed to be there, found himself in harm's way, there is going to be a record of that.

But you are saying, okay, --

DR. ANIGSTEIN: There is no reason

-- the main thing is, all internal GSI records were destroyed but there was no reason why they would report to Landauer or we would have a worker that was not covered of the badge program and he was on the premises, that is none of Landauer's business.

CHAIRMAN ZIEMER: We only get the information through Landauer anyway on that. The workers are self-reporting it. Right?

MEMBER MUNN: Yes, absolutely.

DR. MAURO: So Bob, --

CHAIRMAN ZIEMER: The guy that got irradiated in the tank was not badged anyway. Right?

DR. ANIGSTEIN: He wasn't badged and the only reason we know about it is that a supervisor at the time remembered the incident but there was some question as to how long he was a supervisor.

I know when he terminated, when he stopped be a supervisor, because that is when his badge record stopped, but when he started

is a little fuzzy.

DR. NETON: I have a little problem with the sort of the logic of this. Because there are incidents and because we can't possibly know of every single incident that occurred, then we can't do reasonable dose reconstructions for the individual worker because that essentially applies to every single site. Every single site we have done has that.

DR. MAURO: I like to always put everything on the table. When we are working at these DOE facilities and there is a health physics program and people are badged, records are kept, radiation work permits are in place, and when these kinds of strange things happen, there is a record. All right?

Now, Bob brings up a point that I guess in reality is what you are saying is well, there may have been a record. These unusual things occurred, but we don't have them.

So I guess there are two tiers here. The big tier is that we don't have the film badge records for ten years. That is my number one concern. And then I would say then behind that you are saying that, well, there might have been some records of these unusual occurrences at one time but they don't exist anymore.

So you are in a difficult spot. It is not like a DOE facility where you can argue, and rightly so, when there was an unusual circumstance, there was a record made of it and we could go back and identify that person and somehow deal with it. But what I am hearing is that, if there was a strange circumstance that did occur here, the records don't exist anymore.

DR. ANIGSTEIN: So what we hear from the workers is the GSI management, that was the last thing they were interested in. They were interested in doing the business, producing the casting, keeping their contract,

and to help report something where there was no outside evidence of it, they many not have wanted to do it.

DR. NETON: I don't know.

MR. ALLEN: Well I mean the incidents themselves came about not from any records but from memories of the operators. And it wasn't one guy that remembered or told some story. It is several guys, different settings telling the same story with the same names of who was involved.

DR. ANIGSTEIN: Yes.

MR. ALLEN: These are memorable events for these guys.

CHAIRMAN ZIEMER: Yes, right. More than one person knows about it because it is shared within the group. They do emerge, significant events like that emerge with --

MR. ALLEN: Yes, a common everyday event is not going to have that kind of clarity and detail that these events --

MR. DUTKO: Dr. Ziemer?

CHAIRMAN ZIEMER: Yes?

MR. DUTKO: Sir, I know film badge records have their purpose. But also those dosimeter logbooks have their purpose. We have dosimeter log exposure books in both betatrons. And you will probably find them in the dump somewhere because they ordered the last guy to leave the plant -- personally burned and destroyed, on orders, these records.

DR. McKEEL: I need to put on the record -- this is Dan McKeel.

CHAIRMAN ZIEMER: Yes, Dan.

DR. McKEEL: There is one thing that is incorrect about what is being said and that is that [identifying information redacted] saw some records being destroyed but he also said, and I think this may be in his affidavit but it certainly was told to us, but he also saw loaded onto trucks several, and I think he said three or four, file cabinets that were taken to GSI headquarters in

Clayton, Missouri.

Because as a matter of fact, when GSI went out of business at the current site, the facility that is covered, they did not close their doors forever, fold up their tents and go away. In fact, they had a corporate life of their own after that at National Roll in Avonmore, Pennsylvania, and we have tracked and gone to those people and seen whether they had any additional records.

So as a matter of fact, I am not saying that those records are now recoverable but to say that they were all completely, 100 percent destroyed in 1973 goes against the information that we found and we have provided.

So, we need to be accurate in the comments that we make.

CHAIRMAN ZIEMER: Yes, thank you for clarifying that, Dan.

DR. McKEEL: Okay.

CHAIRMAN ZIEMER: Let me make one

other comment on film badges and dosimeters. It certainly would have been helpful to have the dosimeter readings as kind of a verification.

I will tell you that in most facilities from the legal point of view, unless almost you get permission from the NRC, the film badge is the so-called dose of record. And for example, if you have pocket dosimeters that totaled below the legal quarterly dose limit and the film badges are over -- and this happens. They never agree 100 percent. It is the film badge record that will be the one that will determine whether or not a licensee is in compliance.

MR. DUTKO: I understand what you are saying.

CHAIRMAN ZIEMER: So the film badges, from the legal point of view and partially because those records can be retained and reviewed as we are able to recover them from Landauer and they keep those

sort of forever, those are considered legally the dose of record. So, that has some sort of legal force. Obviously, we have to be careful how we interpret those and understand what they mean and what they don't mean. But as a starting point, they do carry some legal weight in this country.

So it certainly, whenever we have those kind of records, it is important that we do try to interpret them in terms of what do they mean, in terms of organ doses. Do the numbers mean, you know, for example, we don't have neutron information but can we calculate that based on what the gamma is and so on. So they are helpful.

MR. DUTKO: Dr. Ziemer, my point being --

CHAIRMAN ZIEMER: Yes?

MR. DUTKO: -- why do we have one and not the other?

CHAIRMAN ZIEMER: Well I think one of the reasons for that is the film badge

records were with Landauer and they don't destroy records.

MR. DUTKO: I understand that.

CHAIRMAN ZIEMER: Yes, but the others, from a legal point of view, would not be considered dose of record. And there would be nothing to prevent a company from destroying those. The legal system normally would not consider those to be the dose of record.

MR. ALLEN: I was going to say, I mean, Landauer kept a copy but the customers who would have gotten the report from Landauer and GSI and we never tracked those down. We never found one report. We never found anything from GSI.

CHAIRMAN ZIEMER: Right.

MR. ELLIOTT: Even though we looked.

MR. ALLEN: Yes. There is not a lot of places to look for GSI but --

CHAIRMAN ZIEMER: I was hoping we

could at least get through all of these issues. Let me kind of see where we are here and see what we can focus on here.

Let me ask at this point, and I am not even sure this is part of the findings but I know that there has been a question about the neutron exposures. And could we discuss that for a moment? There are not neutron records but NIOSH has indicated that they are able to calculate neutron doses. And I think the petitioners have basically asked, how is that going to be done. Can you speak to that issue?

MR. ALLEN: The basic idea is that the only evidence of any neutron is good evidence, which is the physics behind what is going on there. And the physics behind the neutron creation creates much more gamma. And we have, like you said, film badge records for the gamma, depending on minor differences, depending on exposure scenarios and timing and stuff as far as what the ratio of the two are.

But if you know what the gamma is from the film badge measurements, they can determine the component of neutron that should be associated with it.

CHAIRMAN ZIEMER: Yes.

MR. ALLEN: That is the basic idea.

CHAIRMAN ZIEMER: You have not actually done the calculation.

MR. ALLEN: In the White Paper from the last Work Group meeting we used what SC&A had come up with in the Appendix BB review and adjusted that for the film badge data and adjusted the appropriate neutron portions of that down.

CHAIRMAN ZIEMER: Right. Do you recall, and of course we know there is neutrons there because there is neutron activation as well as photon activation. But my experience with these is that the numbers of neutrons generated or the neutron flux is extremely low, compared to what it takes to

give significant doses.

And do we have that number? I just want to make sure that the --

DR. ANIGSTEIN: Yes. The actual flux but that is not really -- it is relevant to build --

CHAIRMAN ZIEMER: Well you have a flux and you have an energy spectrum but go ahead.

DR. ANIGSTEIN: The MCMP calculations said that there are 7.6 ten to the minus four neutrons per source electron.

CHAIRMAN ZIEMER: Say it again.

DR. ANIGSTEIN: 7.56 E minus four neutrons per source electron. There are --

CHAIRMAN ZIEMER: Per electron.

DR. ANIGSTEIN: Per electron in the beam striking the target. Per electron striking the target.

CHAIRMAN ZIEMER: Okay. Now, did anyone calculate the neutron -- well, either ask for the neutron fluence per unit photon

fluence or the neutron dose per unit photon dose.

DR. ANIGSTEIN: Yes, that we have in the review of Appendix BB and they are very variable. It varies, for instance, in the control room with the betatron in the center of the shooting room pointing away from the control room, you get almost one to one. If you round it off, it is 0.4 millirems -- we are talking about dose now -- 0.4 millirem per hour photon, 0.3 millirem per hour neutron. That is at the one extreme.

On the other extreme, I am just eyeballing it but it looks like the other extreme would be in the restroom. I am quoting from Table 2 from my report, 21 millirem per hour photon, 0.5 neutron. So in one case it is almost three to four and the other case it is one to 40. So the question is -- and all of the others are in-between.

So the question is, given that, how can you determine a neutron to photon

ratio, short of doing what we did, which is analyzing each location and each exposure geometry. The reason being that the photons are, first of all, highly directional in a forward direction. The neutrons, I think, are isotropic, giving off -- I don't know the direction of the neutron. I should just say I don't know. But I don't think they necessarily follow the same shape as a photon beam.

And second of all, the continuation is very different, easier to attenuate photons than neutrons.

So, in this heavily shielded area in the control room --

CHAIRMAN ZIEMER: The shielding is concrete?

DR. ANIGSTEIN: Yes, it is concrete and sand. The way we modeled it for lack of better information is two 12-inch walls of concrete -- because it seems that less than that, from an engineering

standpoint, it is not feasible -- and then in-between filled with sand. And the dimensions are different because from the drawings of the FUSRAP report, the water is less than ten feet.

CHAIRMAN ZIEMER: Does your program determine the neutron spectrum as it goes through the --

DR. ANIGSTEIN: Yes, what we do or what the program does -- yes. What the program does is it tracks each particle. We have it in this coupled neutron/photon mode, which is what was done. I conferred with my colleague [identifying information redacted] about this night before last. It tracks each particle. So basically, it tracks the electron, it swipes the platinum target and it goes through all the cross-sections of all of the particle interactions. The bremsstrahlung, which is the main reaction that produces the photons and also the short-lived activation of the target -- short-lived interaction. I'm

sorry, it is not activation. The electrons actually knock neutrons out of the target, 25 MeV. The 25 MeV electrons, the binding energies of the nucleons are on the order of 10 MeV. So you can actually knock the neutron out of the platinum target.

And we did not take the trouble to characterize the spectrum. I mean, the program does it, but we did not ask for that output. We could.

CHAIRMAN ZIEMER: Well if there is that much concrete, you have got to have almost all thermals, don't you?

DR. ANIGSTEIN: Pardon?

CHAIRMAN ZIEMER: You must have almost all thermal neutrons by the time it gets into the control room.

DR. ANIGSTEIN: We did not ask that question.

CHAIRMAN ZIEMER: No, but the program must have --

DR. ANIGSTEIN: No, no. You are

entirely right. You are probably right. But I just said, we did not put that question to the program. Simply, in the program we have the --

CHAIRMAN ZIEMER: You have conversion built-in.

DR. ANIGSTEIN: We have the dose conversion factor as a function of energy. The table dose conversion factors, so whatever energy the neutron comes in, it is assigned, it interpolates from the table that it is assigned a dose. If there was interest, we could re-run the calculations.

CHAIRMAN ZIEMER: No, no.

DR. MAURO: Well, you want to get to the dose and you factor that in.

DR. ANIGSTEIN: Right.

CHAIRMAN ZIEMER: I guess I was a little surprised that the neutron dose in the control room approached that of the photon. Intuitively, I wouldn't have guessed that.

DR. ANIGSTEIN: Because this is

for the case -- this is only for the case where the betatron is in the center of the shooting room, pointing away from the control room. So therefore, the photon dose is only from scattered radiation.

CHAIRMAN ZIEMER: Right. So the photon dose is dropped way off, anyway. The neutrons are leaking out in all directions.

DR. ANIGSTEIN: Right.

DR. NETON: I was going to say, the photon dose in the control room is pretty small.

DR. ANIGSTEIN: That is right. It is just that the neutron dose is slightly smaller but comparable.

DR. NETON: Yes, but it is a small dose of a --

DR. ANIGSTEIN: It is a large factor.

DR. NETON: It is a big factor in a small dose.

DR. ANIGSTEIN: Exactly.

As far as the other, I looked into that, as far as the activation of the steel, any neutron-emitting radio nuclides are so short-lived that they would be gone by the time the worker came out of the control room and approached the steel, they would be long ago dead.

CHAIRMAN ZIEMER: Really short-lived stuff.

DR. ANIGSTEIN: It takes a few seconds to get there and a small fraction of a second.

The question that was raised by John Ramspott, as far as uranium, yes, uranium, there is some spontaneous fission of uranium and it does give off some neutrons. But it is a very, very small fraction of the photon dose. So we just did it on theory.

CHAIRMAN ZIEMER: You are talking about --

DR. ANIGSTEIN: The natural uranium.

CHAIRMAN ZIEMER: -- the natural spontaneous fission rate of U-238?

DR. ANIGSTEIN: Yes, U-238 has a higher spontaneous rate of fission than 235.

DR. NETON: Oh, you mean just the spontaneous fission.

DR. ANIGSTEIN: Yes, it is tiny. It is small. It is very small.

CHAIRMAN ZIEMER: I don't think you could detect that.

DR. NETON: We have a TIB that has that calculation.

DR. ANIGSTEIN: And then as far as the delayed -- and we did that. We looked for delayed neutrons out of uranium. And after one second, there are none.

CHAIRMAN ZIEMER: Yes. What a physicist means by delayed may be more than a millisecond.

DR. ANIGSTEIN: No, no. The latest version that we have, it was in the latest version SC&A had just introduced the

delayed gamma and delayed intra-capabilities.

And you start off with a shake, which is ten to the minus eight seconds. And during that shake, you get -- well, but as soon as you go past that.

CHAIRMAN ZIEMER: No, but delayed neutrons for what we are talking about, a worker going in, has no meaning. They go on before --

DR. ANIGSTEIN: Well, I'm just saying we analyzed it and I agree, there were none.

MR. DUTKO: Dr. Ziemer?

CHAIRMAN ZIEMER: That is -- no, never mind.

DR. NETON: Bob, my question is what percentage of the total photon dose does the neutron dose represent, under the most extreme circumstance?

DR. MAURO: So you are limiting case.

DR. NETON: I mean, that is the

goal --

CHAIRMAN ZIEMER: Well, we may not know the limiting case. The worst case that you saw was the restroom which was --

DR. ANIGSTEIN: No, the worst case is the roof.

CHAIRMAN ZIEMER: -- the one that went on in the control room.

DR. ANIGSTEIN: No, the worst case is the roof. I just used the restroom as a --

CHAIRMAN ZIEMER: The roof is what?

DR. ANIGSTEIN: The roof of the betatron building right above the betatron and again, they were not necessarily the limiting configuration. Because as I showed before, the betatron beam is horizontal.

Now, with a round casting, there will definitely be some shots. They never shoot straight out but there were definitely some shots at an elevated angle. And therefore, the dose for the roof would have

been higher than we calculated.

CHAIRMAN ZIEMER: What did you find for neutron versus --

DR. ANIGSTEIN: Oh, for the neutron, 16.2 and 192 for photon.

CHAIRMAN ZIEMER: So that is a ten to one.

DR. ANIGSTEIN: About.

CHAIRMAN ZIEMER: Roughly.

DR. ANIGSTEIN: A little less than ten to one.

CHAIRMAN ZIEMER: Or 16.2 and 192?

DR. ANIGSTEIN: And 192, right. It was less than 11, 12 to one. Eleven to one, twelve to one.

CHAIRMAN ZIEMER: So the stuff you have given us, the worst case is roughly one to one in the control room --

DR. ANIGSTEIN: Yes.

CHAIRMAN ZIEMER: -- but the dose is --

DR. MAURO: Small. The dose is

small.

DR. ANIGSTEIN: The dose is small. I mean, the range of neutron doses goes, you know, the dose rates for all the scenarios ranges from 0.3 to 16 on the roof; 0.3 in the control room, 16 on the roof. The range of photon doses goes from 0.4 in the control room to 192 on the roof.

DR. NETON: What I am trying to get at, though is that the six rem total dose that we are assigning for photon, we are going to increase it by some --

CHAIRMAN ZIEMER: But you haven't settled on a factor yet. Is that correct?

DR. NETON: I don't know.

MR. ALLEN: Like I said in that White Paper, you got different factors so we put them to a scenario. There are other scenarios in here where you get, really, a ratio of zero. You can't use numbers that don't have neutrons associated with them that would show up on a film badge.

CHAIRMAN ZIEMER: Right. But based on this, you are using the same approach then, this kind of a model and then --

MR. ALLEN: In the White Paper, we did.

CHAIRMAN ZIEMER: In the White Paper. And what is the bottom line there? Remind me so I don't have to look it up.

MR. ALLEN: I'm trying to remember. We got an adjustment to the film badge dose. The gamma went way down, obviously, and we already know there are errors now from what we were told. But that was 0.74 rem photon and 41 millirem neutron.

CHAIRMAN ZIEMER: So, 0.74 --

MR. ALLEN: It's in the teens.

CHAIRMAN ZIEMER: -- rem photon.

DR. NETON: 0.7 versus 0.04?

CHAIRMAN ZIEMER: And what was the neutron?

DR. ANIGSTEIN: Have we seen this White Paper? Oh, this is the White Paper --

MR. ALLEN: This is from a while back.

DR. ANIGSTEIN: -- for TBD-6000.

MR. ALLEN: Yes.

DR. NETON: It is five percent.

CHAIRMAN ZIEMER: 0.04?

MR. ALLEN: Yes, 0.04.

DR. NETON: 0.7 versus 0.04, around five percent.

MR. ALLEN: Around. It is a little higher than that. That is the overall scenario for this particular scenario.

CHAIRMAN ZIEMER: Right, okay.

MR. ALLEN: And that is adjusted for film badge, like I said. Like I said, it took some analysis because sometimes you could adjust the gamma. You know, based on the scenario, you could adjust the gamma down to the film badge but the neutrons you couldn't do directly because it depended on when it was exposed to neutrons and gammas and when it was exposed to just gamma. The scenario was

important there.

CHAIRMAN ZIEMER: Okay, but I am trying to help the petitioner get an answer to the question. And Dan McKeel, are you still on the line?

DR. McKEEL: Yes, sir, and I would like to --

CHAIRMAN ZIEMER: I want you to ask -- you have heard this discussion here.

DR. McKEEL: Yes.

CHAIRMAN ZIEMER: You probably have some questions now but at least you, at this point, have an idea of the approach that is being proposed for assigning neutron dose so you may have some questions at this point.

DR. McKEEL: I do.

CHAIRMAN ZIEMER: Yes. Go ahead.

DR. McKEEL: Basically, I have three comments and a question. My original question was that, on page 30 of the NIOSH evaluation report of SEC-105, it says that a photon to neutron study is in place, quote.

And I asked four times where was this study published. Where is it? Is it a White Paper? Where is the actual report? In place, to me means it is done.

And I wrote to Laurie Breyer, the SEC counsel. Then I copied it to Larry Elliott and then I copied it to Larry and Dr. Neton. And I could not get an answer from them but Laurie said it was in that White Paper in November 2008. And then I looked at that carefully and I wrote back and said well, I do see neutron doses listed but there is no, zero, none, no methodology. And so how could you do a study without at least describing the basic methods and what you did.

And I said so, if I am missing something, please show me. Tell me the page numbers in that November 2008 White Paper where the photon to neutron study is located. And I got no answer.

The second observation I would make is I think it is important to note that,

as far as I can determine, NIOSH has not used a dose calculation for neutrons in any of the dose reconstructions completed to date. And you know, it seems to me that that is a definite inadequacy. They did not describe a methodology for calculating neutrons in Appendix BB. So that seems like another big problem.

So I primarily -- oh. And the other thing that seems to me extremely odd is that we have been hearing all day about the calculations that SC&A has done of neutrons at GSI. And it seems to me that that is exactly backwards of what I understand everybody's jobs to be.

It seems to me the job of NIOSH is to calculate neutrons and apply them in dose reconstructions. And if they can't, that would contribute, as it did at Rocky Flats, to awarding an SEC or recommending an SEC.

In this case, NIOSH, as far as I can tell, has not done that. They may have a

way to approach the problem but they have not actually approached it and done a study that they can hand to anyone to see. And somehow, SC&A has taken over that role. And I will admit to you, that bewilders me completely.

So I think I don't have anything more to say about it right at this point. But I would like today to hear an answer probably from Dr. Neton, if possible, is -- has NIOSH done a separate, stand-alone, published photon-to-neutron study. And if so, could the Work Group, and myself, and SC&A please get a copy of it?

MR. ALLEN: The neutron study that was referred to, and it is the White Paper, just like you were told three times in the emails, if you would like, I will send the emails with your question and our replies to the Working Group.

DR. McKEEL: I don't think that would be useful because I think everybody can read the White Paper and there is no photon-

to-neutron methodology described in that paper. I will just make that as a flat-out statement. If I am wrong, I wish somebody would send me a correction of that. That is all I can say.

So no, I don't think that would be helpful.

CHAIRMAN ZIEMER: Remind me. The paper describes what? I don't have it open here before me.

MR. ALLEN: The paper described, essentially like I said, that SC&A did a review of Appendix BB, which included several scenarios of exposure models and that included neutron dose in those exposure models.

After they did their review or that review they published and will after we did Appendix BB, we got the Landauer film badge data.

CHAIRMAN ZIEMER: Right.

MR. ALLEN: So what we decided to do was to take what SC&A put together in their

exposure models and tried to adjust that to what the film badge data told us. And that is essentially what the White Paper did, which includes the neutrons but you couldn't just do a straight average. You had to adjust the scenarios. You know, there are different ratios of photon-to-neutron for different portions of the scenario. So we wanted to make sure we had all that correct.

CHAIRMAN ZIEMER: Right. So what you are saying is that as far as you are concerned, the White Paper describes how you have used the neutron information, which agreed was generated by SC&A simply as they were evaluating, I think, the original part, Appendix BB. And being aware that, I guess, I am trying to remember in the Appendix, you had already discussed neutrons or you hadn't discussed them at that point but you raised the point --

MR. ALLEN: Exactly.

CHAIRMAN ZIEMER: -- and used this

as an illustration --

MR. ALLEN: Yes, to see if it was important.

CHAIRMAN ZIEMER: -- to see if it was important.

MR. ALLEN: Yes. Basically when we read it we said listen, is it possible that --

CHAIRMAN ZIEMER: And I guess having done that, NIOSH basically agreed, yes, this probably should be looked at and the way you did it seemed appropriate and they would adjust it within the parameters of the other data that was available.

So, that appears -- I guess, perhaps Dr. McKeel, your concern is that you don't feel that NIOSH explained in a formal way exactly how they approached this or --

DR. McKEEL: Well, what I think is that it would be better instead of saying that a photon-to-neutron study is in place, now that the NIOSH White Paper is available, I

don't believe that White Paper, I'm not sure whether it has been published to OCAS or not, but anyway, once that becomes an official technical document, I think that should be referred to as, you know, as the reference for the statement that a photon-to-neutron study is in place. I personally don't think it is very well described at all but I guess others can make their judgment. And I can't imagine that that would be useful for dose reconstructors.

But anyway, that is up to NIOSH. But I think they ought to fairly represent. If a method they are using was originally worked out by SC&A, then that should be stated in the technical document and that would at least put the record straighter. So I guess that is what I was saying.

CHAIRMAN ZIEMER: Okay, the date on that document is what?

DR. McKEEL: It is November 2008, I believe.

CHAIRMAN ZIEMER: Do you have that, Dave? Is that a dated document? I mean, I believe I have it but --

MR. ALLEN: I know you have it but there is no date on it. I'm sorry.

DR. ANIGSTEIN: I think I could cast a little light on that because I have the White Paper and we responded to it on November 8th. Oh yes, October 31st. But then my response I cite here would be the White Paper. But October 31, 2008 and I --

CHAIRMAN ZIEMER: That was the NIOSH date?

DR. ANIGSTEIN: Yes, the -- well, there is no date on it but that is the date on which we received it.

CHAIRMAN ZIEMER: Let me remind everybody this is always an issue of mine. I am all documents. Date them because sometimes they undergo revisions, and which copy am I looking at? It is very helpful to have the date.

DR. ANIGSTEIN: This was the --

CHAIRMAN ZIEMER: Because I know they are often transmitted by email and has the date but then they get separated. I always pull my reports off the emails and file them separately because my email box, I found out on my computer, has limits and I get too many of these big documents and then my system won't accept any more.

Yes, so it would be helpful, actually, to have a formal copy of that that is dated. People can debate and Dan has rightly pointed out, we can discuss whether that is a study or not but it does describe what NIOSH is doing and I think that is helpful for all parties to know that.

DR. ANIGSTEIN: About the date, as I said, we received it on October 31st. However, as I recall, there was a PA-cleared version put out a little later with no changes.

CHAIRMAN ZIEMER: Right. The

original one, you still have a date on it. The PA-cleared version can still carry the original data. It is just the PA-cleared version of that.

DR. ANIGSTEIN: Right. But as I said, there was no actual date in the body of it.

I don't know if I can -- I just want to clarify what I said before because I think I was a little ambiguous. I was just giving you all of the exposure rates.

CHAIRMAN ZIEMER: Right.

DR. ANIGSTEIN: I forgot that we have a summary table where we do say that for instance, for the radiography of steel, on the 25 MeV betatron. The cumulative dose is, with all of the different types of shots, 1.8 to the operator now, to the betatron operator, 1.8 millirem neutron per shift, per eight-hour shift and 33.5 from photon. Or that is actually the exposure.

So we mix millirem here and mR but

the ratio is like 15 to one, something like that. And then the NIOSH White Paper, I believe, simply takes that or a similar ratio and after first using the film badge data to calculate an effective dose, weekly dose, or annual dose rather, they then use that ratio --

CHAIRMAN ZIEMER: To increase the total.

DR. ANIGSTEIN: -- to assign a neutron dose of 41 millirem, based on our calculated photon and neutron and their estimate of photons based on film badge, based on the statistical analysis of the film badge data.

CHAIRMAN ZIEMER: Okay.

DR. ANIGSTEIN: And there is no more detail. I just read this one paragraph. There is no detail.

CHAIRMAN ZIEMER: Okay. Well, we are going to have more work to do. And I had hoped to at least get through all of these

issues today. I had tried to commit to people that we would finish by 4:30. We are not going to make that. We need to allow a little time to identify sort of the path ahead and also to talk about when we can meet again.

MR. RAMSPOTT: Dr. Ziemer?

CHAIRMAN ZIEMER: Yes?

MR. RAMSPOTT: Could I ask one question? This is John Ramspott.

CHAIRMAN ZIEMER: Go ahead, John.

MR. RAMSPOTT: It was on item eight. I have been listening to this neutron information.

CHAIRMAN ZIEMER: Yes.

MR. RAMSPOTT: Dr. Anigstein's item number 8(e), NIOSH has neglected the neutron dose in performing dose reconstructions. Is that correct?

DR. ANIGSTEIN: I'm sorry. Could you repeat the question?

CHAIRMAN ZIEMER: You mean on past dose reconstructions?

MR. RAMSPOTT: NIOSH has neglected the neutron dose in performing dose reconstructions. Is that correct to date?

DR. NETON: I will try this. That is correct as far as the dose reconstructions that have been done thus far.

CHAIRMAN ZIEMER: In the past.

DR. NETON: That is true.

MR. RAMSPOTT: Okay.

DR. NETON: I would say, though, that is in conjunction with a lot of additional changes that are being discussed as part of the Appendix BB and the other review of Appendix BB. So it is just one of several items that will eventually change in the dose reconstructions for all GSI.

CHAIRMAN ZIEMER: In which case, they would go back and re-do those.

DR. NETON: Right. And we consider it our practice not to redo these dose reconstructions piecemeal because it is, frankly, onerous and burdensome on the

claimants.

MR. RAMSPOTT: I can understand that but I've got people dying. And I am just curious why has it been neglected in total to this date? Is that not contrary to the guidelines about all radiation must be included in dose reconstruction? That is my question.

DR. NETON: Well, you are right, John. This is Jim. It wasn't included. It was an oversight on our part, I guess.

MR. RAMSPOTT: Okay.

DR. NETON: If you consider that neglect, so be it.

MR. RAMSPOTT: Oversight I can understand, as long as it is addressed now. I have some people that are 49.23s and what have you and this would blow them over the top, probably. But I would just like to tell them --

CHAIRMAN ZIEMER: No, don't tell them in advance. You don't know that until --

MR. RAMSPOTT: I'm not going to tell them they are getting paid. I would just like to be able to tell them the neutrons are going to be looked into.

DR. NETON: I hear you very clearly, John.

CHAIRMAN ZIEMER: Yes.

MR. RAMSPOTT: Thank you.

CHAIRMAN ZIEMER: Now, my thought is, as I indicated earlier, maybe in six weeks or so we need to get through the rest of these items in some depth. Also, I want to get a feel for what we need to do on the issues that we already discussed.

On issue one, it is sort of what dose gets assigned for unmonitored workers. Do we need to wait and find out what we find from the Picker information before that?

DR. NETON: Are we back on -- I'm sorry --

CHAIRMAN ZIEMER: I am looking at issue one. I made a note here.

DR. NETON: It is for the ER review or the ED?

CHAIRMAN ZIEMER: Oh, this is issue one of the ER review.

DR. NETON: Okay.

CHAIRMAN ZIEMER: Issue one of the ER review. I think the other items we have sort of already covered those. But on the ER review, particularly those who were not the people with the incidents but these other unmonitored people. How do we assign dose? That is still the question.

And I don't know if you will have further thoughts on that in terms of is there a way to take into consideration no assumptions about lots of incidents but what are we going to do about the small source? One thought on the so-called small source. We might be able to get a handle on that based on the practices there at GSI. For example, John or Terry, do we know what the distance was that was used to rope off a shot from a small

source? Like was it ten feet or twenty feet?

DR. MAURO: It is mR per hour.

CHAIRMAN ZIEMER: I know that. I want to know if they can tell me about what the distance was. If I know it is --

MR. DUTKO: All the supervisor said was one and a half times. One and a half times.

CHAIRMAN ZIEMER: Yes. Yes, but can you just tell me based on your experience? Was that like five feet away or was it 20 feet away?

MR. DUTKO: I can't tell you what they roped off, sir. I was in the betatron.

CHAIRMAN ZIEMER: Okay. Do we have, is there anyone still around that knows that?

MR. DUTKO: [identifying information redacted] might be able to say.

CHAIRMAN ZIEMER: Here is my thought. We know that the one and a half times -- I mean, legally, you work hard to get

2 mR per hour, I believe. And if we know what they roped off and it was one and a half times what it required to get to two and a half, we know what the strength was at a given distance. And for cobalt it is very easy to back-calculate. We can get a handle, I think on the size of that source.

MR. DUTKO: The only thing that comes to my mind is he was referring to one and a half times a safe distance.

CHAIRMAN ZIEMER: Exactly.

MR. DUTKO: A safe distance.

CHAIRMAN ZIEMER: And does somebody know typically what that distance was? Like was it five feet or 50 feet?

MR. DUTKO: I'll check into it, Dr. Ziemer, and see if I can find out.

CHAIRMAN ZIEMER: It would very helpful because I think if we knew, and we can over-estimate a little bit but it makes a great deal of difference if that was five feet or 50 feet in terms of --

DR. McKEEL: Dr. Ziemer, Terry?

CHAIRMAN ZIEMER: Yes.

DR. McKEEL: There was no roping in 6 Building, was there, Terry? I thought you said that earlier?

MR. DUTKO: Not in 6 Building.

CHAIRMAN ZIEMER: But the small source?

MR. DUTKO: The supervisor said when the sources were set up out in the plant itself, ten or nine or eight, wherever they are going to set the source, they roped off the distance one and a half times safe area and set up the shot.

CHAIRMAN ZIEMER: Okay and that is what I am asking. Is there anyone around that knows typically what that distance is in feet?

MR. DUTKO: I will see if I can find out, sir.

CHAIRMAN ZIEMER: Yes, I think if we knew that, we could kind of pin down the source size. Because if they followed that

rule, we know that --

MR. DUTKO: Dr. Ziemer, generally the only time I worked with the sources is when they were brought into the betatron.

CHAIRMAN ZIEMER: Yes, I understand. But someone there might know the answer to that and that would be helpful.

MR. DUTKO: Sure.

CHAIRMAN ZIEMER: And then, I don't know, Jim, if there's a way to think about the possibilities of people wandering through these things, not in terms of is it an incident but is it -- no, you can model this.

DR. ANIGSTEIN: No, you can model it, if you know the time and distance.

CHAIRMAN ZIEMER: Yes or if you know the source size and then make some reasonable assumptions about it. I mean, we can find out if it something that is significant compared to the present bounding thing. Is it possible for a typical person wandering through that area -- wandering

through it. I am not talking about someone who goes in there and sits down and eats their lunch next to the source. I mean, you can think of all kinds of scenarios that aren't plausible.

A plausible scenario, I can think of a worker. Now they weren't texting in those days but they were doing something else and wandering through there with something else on their mind, maybe it is possible. I think you could determine whether it is plausible.

DR. ANIGSTEIN: I agree.

DR. NETON: And from our end, I think we need, I will push to see how long it might take to get any Picker information because that, in my opinion, is --

CHAIRMAN ZIEMER: Yes, the Picker information may be helpful there.

On issue two, which are the assumptions for bounding, at some point we may need to come to some kind of concurrence on

what should be assumed for bounding. I am not sure we can do anything between now and the next meeting, unless either of you have either SC&A or NIOSH has thoughts on that. Right now we are a factor of two at least on the --

DR. MAURO: Our case versus their case, in terms of the limiting --

CHAIRMAN ZIEMER: Yes, but that is only on the betatron.

DR. MAURO: The betatron.

CHAIRMAN ZIEMER: It is a separate issue on the other sources until we get a better handle on that.

DR. MAURO: Well to clarify, when you think about the exposures during betatron operations, we have the exposures. We have a difference of a factor of two about on the dose to the betatron operators.

DR. ANIGSTEIN: But you see, it is much more complicated than that. It is by fortuitously comes out a factor of two during the time of heavy uranium operations because

the dose from the uranium is overstated by a factor of 20 --

DR. MAURO: Okay.

DR. ANIGSTEIN: -- and the dose from the betatron and the steel is way understated.

DR. MAURO: Okay.

DR. ANIGSTEIN: So if they fix the uranium, then the difference will be much greater.

DR. MAURO: I see. Okay. Okay, never mind.

CHAIRMAN ZIEMER: I think issue five, in a sense, is part of that bounding concern. So, if we can sort of move on that, that will help with issue five.

I am not sure what else needs to be done on issue four, photon energy. Were you going to check, Jim on the response of the films from the high energy photons?

DR. NETON: I had actually looked into that. I don't know, if David you

followed up any more on that but identified a few sources that --

CHAIRMAN ZIEMER: Maybe you can just report back. There is -- now once the photons pass a certain energy, I mean, typically, the response on film badges gets pretty flat but maybe something has changed.

DR. NETON: I have looked into this and my recollection is is it is not that different. I mean, Bob mentioned a factor of two but I recall less than that.

CHAIRMAN ZIEMER: The response, typically, is much different at low energy but, we should talk about an MeV.

DR. NETON: Frankly, I don't think they hit as high as 25 MeV.

DR. ANIGSTEIN: No, of course not.

DR. NETON: You are down to around a third of that or less.

CHAIRMAN ZIEMER: Well but could you report back to us on that one?

DR. NETON: Maybe that is what I

was looking at, what I figured was sort of the average energy. And I want to say it was very close to flat out in that region. There is a graph out there, I think there was some Battelle reports that I looked at.

CHAIRMAN ZIEMER: Well, also now there is a lot of high-energy accelerators around and maybe even some of the accelerator health physics people have some publications on this, maybe SLAC or some of those would know. I just don't have a feel for it.

DR. NETON: Again, I don't think it is going to be an issue but we need to formalize.

CHAIRMAN ZIEMER: Intuitively, I don't either, but I think we should turn that down and make sure. Because the concern has been raised. I think the petitioners deserve an answer on that as well. What can we confirm in the literature on that.

And then it would be good if we could -- if you have your calendars, we can

at least see what --

MEMBER MUNN: Six weeks is Thanksgiving week.

CHAIRMAN ZIEMER: Oh, we are open Thanksgiving.

DR. NETON: I'm open on Thursday.

MEMBER MUNN: Well, it looks like the next week, then, the first week in December.

MEMBER BEACH: How about the third? That would be --

CHAIRMAN ZIEMER: You have a meeting here on the fourth, right?

MEMBER BEACH: We have one on the second and the fourth but I think there is a problem with the third.

MR. KATZ: The third is a problem. There is an OCAS can't attend. I can't attend.

MEMBER MUNN: And Tuesday the first?

MR. KATZ: The first is open right

now. That may be one of the -- yes, the first is open right now.

CHAIRMAN ZIEMER: The first of December?

MS. HOWELL: November 16th.

MR. KATZ: That is too soon for six weeks.

MEMBER MUNN: November 16 is open.

CHAIRMAN ZIEMER: I think that is too soon.

MS. HOWELL: That wasn't the first open for Mound. I thought there was a problem there.

CHAIRMAN ZIEMER: Well maybe some of the people on the Work Group.

MR. KATZ: It probably wasn't open for -- was it not an option I laid out in my email?

MEMBER BEACH: Exactly, yes.

MR. KATZ: That is a concern.

MEMBER BEACH: But I had mentioned it to you and it never came back up. So that

is why I was concerned.

MR. KATZ: Yes, which makes me think that there is something there that is not showing on my BlackBerry.

The second is Worker Outreach. I will have to check on the first. It may be that there was something there that is gone now, that is cleared or it could be a problem. Because I did look at this for Mound.

CHAIRMAN ZIEMER: December first?

MR. KATZ: Right.

CHAIRMAN ZIEMER: Let me also ask the petitioner. Dan, we want to make sure you have an opportunity to interact again. How does December first look? Dan, are you on the line?

DR. McKEEL: Yes, Dr. Ziemer, this is Dan McKeel. I think that is okay for me, so far.

CHAIRMAN ZIEMER: Okay. Shall we block that off and then Ted you will check and see if there is a problem.

MR. KATZ: Let's pencil it in but let's come up with another date, in case that is a question.

CHAIRMAN ZIEMER: And the rest of that week is already taken up. We have two other Work Groups meeting that week plus another conflict in there.

MR. KATZ: Right.

CHAIRMAN ZIEMER: We have a full Board teleconference. Is December 7th a holiday for the Feds?

MR. KATZ: It doesn't show on mine as a holiday.

CHAIRMAN ZIEMER: Pearl Harbor? I can't believe it is not a federal holiday.

MR. KATZ: It is not a holiday.

CHAIRMAN ZIEMER: You guys couldn't remember that.

We have a teleconference on the eighth.

MR. KATZ: Right.

CHAIRMAN ZIEMER: I have conflicts

the rest of the week.

MR. KATZ: December 7th is okay.

CHAIRMAN ZIEMER: I could do --

MEMBER BEACH: You'd have to fly on a Sunday.

CHAIRMAN ZIEMER: Yes.

MEMBER BEACH: And for me it is a fly home on a Saturday from the previous week.

CHAIRMAN ZIEMER: Yes, because you are --

MEMBER BEACH: Yes, that is a long week.

MR. KATZ: Oh, yes, that is long.

CHAIRMAN ZIEMER: How about the week of the 14th?

MEMBER BEACH: Clear. I am clear all week.

CHAIRMAN ZIEMER: Anybody have problems on the 14th, 15th?

MR. KATZ: The 15th is clear. The 16th looks clear.

CHAIRMAN ZIEMER: We need to check

with John Poston. He has classes. What is today? He will have classes on Tuesday.

MEMBER BEACH: Today is Wednesday.

CHAIRMAN ZIEMER: Today is Wednesday. John won't be able to do it the 15th or the 17th.

MR. KATZ: So what about the 16th?

CHAIRMAN ZIEMER: And that will be a problem for him on the first. John won't be able to --

MEMBER BEACH: Oh, that's true. The 16th is open.

MR. KATZ: So what about the 16th?

CHAIRMAN ZIEMER: The 16th, I think that would be okay. It is certainly okay for me.

MR. KATZ: Is that okay for you?

MEMBER BEACH: Yes.

MR. KATZ: Dr. McKeel, does December 16th work for you?

DR. McKEEL: That would be okay with me, yes.

MEMBER GRIFFON: This is Mark Griffon, I am still online, believe it or not.

MR. KATZ: Oh, sorry, Mark. You have been too quiet.

MEMBER GRIFFON: The 16th I may -- it may be a phone call from me again, unfortunately. I could do it but I have a commitment early that evening so I would probably have to be doing it by phone.

MEMBER MUNN: But you are okay for the first?

MEMBER GRIFFON: Okay for the first, yes.

CHAIRMAN ZIEMER: But I am almost certain that John Poston can't do the first because he teaches on Tuesday and Thursday.

So, let's --

MEMBER MUNN: But he would be finished December 15th, wouldn't he?

CHAIRMAN ZIEMER: Who?

MEMBER MUNN: Wouldn't students go home in December?

CHAIRMAN ZIEMER: I wouldn't count on it that early.

MR. KATZ: Yes, I wouldn't count on it that early either.

CHAIRMAN ZIEMER: That is, I would guess most schools aren't going to be out before the 18th.

MR. KATZ: All right, it sounds like December 16th works, though. I haven't heard anyone say it doesn't work.

CHAIRMAN ZIEMER: Let's pencil it in, then.

MR. KATZ: Mark would have to do it by telephone. Mark would probably rather not travel anyway.

MEMBER BEACH: So are we taking the first off the table then?

CHAIRMAN ZIEMER: I think so, since John won't be able to be available.

MEMBER BEACH: Okay.

CHAIRMAN ZIEMER: I think in fairness to him --

MR. KATZ: Okay. Well, December 16th, I am pretty -- oh, wait. Wait. Yes. Why do I have it already penciled in there? I already have some mysteriously TBD-6000 penciled in for December 16th.

CHAIRMAN ZIEMER: Well, good. Thanks all for your input today. We still have a lot of issues to deal with. I think we have made some progress but very clearly, there are some additional items that we need to deal with.

DR. ANIGSTEIN: Is there anything you want from SC&A between now and then?

CHAIRMAN ZIEMER: Let me see. I think I sort of said we are still basically responding to your issues. So the only thing would be, based on our discussions, if you have any additional ideas on bounding are any different from what you already have.

Let's see.

MR. KATZ: There were some action items from earlier on. Bob is going to

distribute his evaluation.

DR. MAURO: Oh, distribute documents, yes. PA-cleared documents.

DR. ANIGSTEIN: Just the very latest one.

MR. KATZ: And the presentation that you have made.

DR. ANIGSTEIN: The presentation of today and the issues with the responses --

MR. KATZ: Once everybody is involved in --

DR. ANIGSTEIN: TBD-6000.

CHAIRMAN ZIEMER: The earlier stuff that was agreed to --

DR. ANIGSTEIN: No, but also it would be the issue --

CHAIRMAN ZIEMER: -- give us the White Paper on what the revisions will cover on that issue one. Yes, and you have that.

MEMBER BEACH: And on five, we were waiting for Mark to get back to us on closing out issue five.

CHAIRMAN ZIEMER: Mark Griffon wants to have a chance to look in more detail at issue five.

MEMBER GRIFFON: Yes, I did receive the SEC --

CHAIRMAN ZIEMER: Yes, we can close that next time, Mark.

MEMBER GRIFFON: Okay.

DR. ANIGSTEIN: Can I make a suggestion? Perhaps everybody has a little --

CHAIRMAN ZIEMER: Oh, and if John or Terry, if they are able to get that information on the rope-off distance for the small source, that would be helpful also. Are they still on the line?

MR. KATZ: John Dutko, are you still on the phone?

MR. DUTKO: Yes, sir. I will do everything I can to dig up that distance for you.

CHAIRMAN ZIEMER: We appreciate that.

DR. ANIGSTEIN: I have got a procedural question or a suggestion. With all of this discussion earlier about the cleared and un-cleared matrix, what I would envision is when we first, we have this matrix and it is still essentially open. But what I would suggest is once I checked with Emily she said she cleared it, so I presume I have that, what I propose doing then is creating a PDF file. And a PDF file will have the cleared footnote on it.

CHAIRMAN ZIEMER: Yes.

DR. ANIGSTEIN: And then we retain the Word file that is un-cleared because the Word file is subject to grow.

CHAIRMAN ZIEMER: Yes, we just need a cleared version that can be distributed.

DR. ANIGSTEIN: So it might be a good idea to always have a PDF version and --

CHAIRMAN ZIEMER: And make sure --

DR. ANIGSTEIN: -- if something is

cleared, there should be a PDF.

CHAIRMAN ZIEMER: -- there is a date on that. Make sure there is a date on that.

DR. ANIGSTEIN: Exactly. With a current date. Well, my documents I always have a live date. Whenever I print it from PDF, the date is the day I print --

MR. KATZ: Just to be clear, Emily cleared the version before this meeting and we agreed that we would include the information all the way up through this meeting before putting out a cleared version. That way, the petitioners get everything, including what we have discussed today.

DR. ANIGSTEIN: So we need to update it with -- are we going to update it with --

DR. NETON: I don't think we normally -- it would be difficult to update it with what we discussed today. I think we would just --

CHAIRMAN ZIEMER: Which one are you talking about?

DR. MAURO: TBD-6000 or this one, or GSI?

MR. KATZ: TBD-6000.

DR. ANIGSTEIN: No, I have nothing to do with 6000 or at least not much.

DR. MAURO: Well, 6000 is an action on my part to fill out the matrix with the new information, which includes the material that came from David and --

CHAIRMAN ZIEMER: The White Papers.

DR. MAURO: The White Papers. I will load it right --

DR. NETON: I was looking at the ER matrix.

DR. MAURO: Oh, no, no, no. I am talking about 6000.

DR. ANIGSTEIN: But that one, I was not thinking of adding anything else to it.

CHAIRMAN ZIEMER: We weren't able to share a version because it wasn't marked cleared.

DR. ANIGSTEIN: Okay, so we will get that out as a PDF file.

CHAIRMAN ZIEMER: Okay.

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

CHAIRMAN ZIEMER: Yes, Dan?

DR. McKEEL: Please, if you could, what I need is all three matrices, the TBD-6000, --

CHAIRMAN ZIEMER: Right.

DR. McKEEL: -- the Appendix BB, and the SEC.

CHAIRMAN ZIEMER: Right. You will get all of them. The first two --

DR. McKEEL: Okay.

CHAIRMAN ZIEMER: We will get cleared versions of everything, as far as they are formally filled in.

DR. McKEEL: That's great.

Wonderful.

CHAIRMAN ZIEMER: And who is going to send those, SC&A?

MR. KATZ: They will share it with the Work Group and we will get it Dr. McKeel.

CHAIRMAN ZIEMER: Okay, we will get it to you.

DR. MAURO: We can get the mechanics of these --

CHAIRMAN ZIEMER: You guys will work it out.

DR. MAURO: We will work it out.

CHAIRMAN ZIEMER: Okay, so those will come as quick as we can, Dan.

DR. ANIGSTEIN: We basically distribute to everyone in this room.

CHAIRMAN ZIEMER: Yes. And let me thank the folks on the phone. We appreciate your input and your patience.

MR. KATZ: Yes.

CHAIRMAN ZIEMER: Guys here in the room, thank you. We appreciate your input and

patience.

Any final word for the good of the order? If not, we stand adjourned.

(Whereupon, the above-entitled matter adjourned at 5:02 p.m.)