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

convenes the

WORKING GROUP MEETING

ADVISORY BOARD ON

RADIATION AND WORKER HEALTH

DAY TWO

The verbatim transcript of the Meeting of the Advisory Board on Radiation and Worker Health held at the NIOSH, Cincinnati, Ohio, on June 1, 2005.

C O N T E N T S

June 1, 2005

TRANSCRIPT LEGEND

The following transcript contains quoted material. Such material is reproduced as read or spoken.

In the following transcript: a dash (--) indicates an unintentional or purposeful interruption of a sentence. An ellipsis (. . .) indicates halting speech or an unfinished sentence in dialogue or omission(s) of word(s) when reading written material.

-- (sic) denotes an incorrect usage or pronunciation of a word which is transcribed in its original form as reported.

-- (phonetically) indicates a phonetic spelling of the word if no confirmation of the correct spelling is available.

-- "uh-huh" represents an affirmative response, and "uh-uh" represents a negative response.

-- "*" denotes a spelling based on phonetics, without reference available.

-- (inaudible)/ (unintelligible) signifies speaker failure, usually failure to use a microphone.

In the following transcript (off microphone) refers to microphone malfunction or speaker's neglect to depress "on" button.

P A R T I C I P A N T S

ABRWH MEMBERS:

CHAIR
ZIEMER, Paul L., Ph.D.
Professor Emeritus
School of Health Sciences
Purdue University
Lafayette, Indiana

GRIFFON, Mark A.
President
Creative Pollution Solutions, Inc.
Salem, New Hampshire

ROESSLER, Genevieve S., Ph.D.
Professor Emeritus
University of Florida
Elysian, Minnesota

OTHER ATTENDEES:

MR. DAVID ALLEN, NIOSH
DR. HANS BEHLING, SC&A
MS. KATHY BEHLING, SC&A
MS. CINDY BLOOM, ORAU
MS. NANCY JOHNSON, SC&A
DR. ARJUN MAKHIJANI, SC&A
DR. JIM NETON, NIOSH

STAFF/VENDORS

STEVEN RAY GREEN, Certified Merit Court Reporter

P R O C E E D I N G S

(11:15 a.m.)

DR. NETON: Okay. We're ready to start I think, the recorded session on Mallinckrodt on -- on -- the session on Mallinckrodt with SC&A related to the site profile. Ray, you've got the list of -- of who are in attendance, so we can -- we can just get started. I don't know how we want to proceed. I think Arjun has some questions that he's -- he's come to the table with and we're -- if anyone has no objections, I guess we can start --

DR. ZIEMER: Could I -- could I just ask procedurally, we have the SC&A document that has the -- the summary table arguments. Was it your intent to go through those item by item, or is -- are there other issues that --

MR. GRIFFON: He e-mailed them, correct?

DR. NETON: Right. There -- there was a -- a --

DR. MAKHIJANI: Yeah, Dr. Ziemer, yeah, there were -- I'd tried to sharpen some of that list to start the discussion by sending a set of questions, which you have, I believe --

DR. ZIEMER: Which I may not have brought.

DR. MAKHIJANI: -- and just so we could have

questions that were more specific than what you asked us to do. And then I intend to go back to the reviews and see whether -- there's some duplication between what's in the review and the questions. And then what I intended to do was go back to the review and make sure that I've covered what I need to cover, because not everything is in these questions.

DR. ZIEMER: Right.

DR. ROESSLER: I don't have the questions, either. Would it be possible to get copies for me and Paul?

DR. NETON: Yeah. Would you go ask Helen -- or do you have the e-mail of the questions?

MR. ALLEN: I don't think so --

DR. ROESSLER: You sent that to us.

MR. ALLEN: The recent one, that one?

DR. NETON: Yeah, yeah.

DR. ZIEMER: Was this a recent e-mail, or the original --

DR. NETON: May 20th.

DR. ZIEMER: -- early -- what was the date?

DR. NETON: May 20th was the date of this letter.

MR. ALLEN: The date on the letter is the 20th.

DR. ZIEMER: Okay.

DR. ROESSLER: (unintelligible)

DR. NETON: Could you get just that letter with the questions? Dave's gone out -- going to get it. It's short. There are two pages of questions.

DR. MAKHIJANI: Could I just read the question maybe and get started that way?

DR. ZIEMER: Go ahead, go ahead and --

MR. GRIFFON: Yeah.

DR. ZIEMER: -- start. He'll -- he'll bring you --

DR. MAKHIJANI: The -- the first set of questions was just about can we see these types of claims, and we've done -- we've done most of that, I think, so we can -- maybe we can just go to the substantive portion.

DR. NETON: Sure. Yeah, I think that's fine. Yeah, again, the history behind this meeting was that Arjun wanted to have this this week and we were not as fully prepared as we -- we could have been, but we decided to move forward just to get the issues on the table, and we're not completely prepared to answer all of the questions today.

DR. MAKHIJANI: And I really appreciate Jim accommodating us, because I couldn't be here next

week and I thought the week after that will be just too difficult to meet the meeting schedule and write it up and produce drafts and have them reviewed and everything. So I really appreciate -- and I told Jim that if there's some clean-up follow-up I'm ready to come back, but just so I can get the process of drafting things started.

DR. NETON: Right.

DR. MAKHIJANI: So the first question is -- relates to the integrity of the data question that has come up numerous times. Is there a possibility that urinalysis values were adjusted downward after the discovery of contaminated blanks. I think Mark --

DR. NETON: Mark --

DR. MAKHIJANI: -- also has raised this question at the last Board meeting.

MR. GRIFFON: Right.

DR. NETON: Right. And Mark asked for --

MR. GRIFFON: No, you sent one --

DR. NETON: -- copy of the reference that was listed as an undated reference in the Mallinckrodt profile, and actually it turns out it's a dated reference that's in there that refers to the issue. I don't know how to address

it other than there is just this one instance. I asked Janet Westbrook if there were any other indications of adjusting data downward and she said she's not aware of any such -- such practice. Now the way I read this -- this note --

MR. GRIFFON: Yeah.

DR. NETON: -- is thank you for your note of January 19th. This is -- the subject is urinalysis procedure for Plant 6. It says (reading) The problem you raise is not a new one. It goes by the name of contamination. Any and all measurements material used in the plant can be performed in the plant area only if the laboratory performing these analyses remain uncontaminated.

I think the issue here is that AEC operations was assuming that the -- the analyses were being done at Barnes Hospital, when in fact they were being done I believe at Mallinckrodt at the time. That's the -- my take on this. The general experience is that the whole problem becomes simpler if these measurements can be made at some distance from the plant. Well, I -- I looked at some of the original data cards following this in

-- in the -- in the captured data and it does not appear that these values were subtracted from the original data. What I haven't had the chance to go back and look at was to see how those values poured over to the data we have in the database. I haven't made that last -- you know, my -- my thought was let's look at some of the data where they allege that the blanks were high, go back and look what was actually recorded in the data for the worker. I haven't -- I haven't matched those yet, but I think we could do that. So, you know...

MR. GRIFFON: And -- and I guess I would have -- I mean where I started this question was in the test, actually.

DR. NETON: Right, right.

MR. GRIFFON: And I probably would have never even ventured down this path too much if it wasn't for, you know, the -- the language suggesting that -- that -- that a lot of this data may not be very reliable. I think I'm looking for the words -- use caution when applying these samples.

DR. NETON: What page?

MR. GRIFFON: I'm on page 76, 77 in Rev. 1 of the

site profile.

DR. NETON: Right.

MR. GRIFFON: Yeah, it's actually on the top of page 78 where -- where the -- that paragraph is. It sort of raised a flag with me, you know, because of the questions regarding the validity of samples, the apparent variations in the sample analysis methods, and even who was doing the analysis. The Mallinckrodt urinalysis data should be used with caution and -- and especially -- I think it says at least when the data were taken by Barnes prior to '51. But from the prior pages, she raised some concerns about '51 to '55 also I think, maybe not as --

DR. MAKHIJANI: Four.

MR. GRIFFON: To '54 was it? Okay.

DR. MAKHIJANI: I believe '54.

MR. GRIFFON: But, you know, I -- I guess to me that said well, okay, how do I -- how do I use it with caution? What -- what exactly --

DR. NETON: Well --

MR. GRIFFON: -- does that mean --

DR. NETON: Yeah.

MR. GRIFFON: -- and how -- is this data reliable at all?

DR. NETON: Right. Which -- I've spoken to Janet about this and the idea was that the data would be biased high, if anything. If they were contaminated blanks, they were done in -- in -- some at the plant where I know from working at Fernald in the early days before I got there, if they did the -- the analysis with the windows open you got a much higher number than if the windows were closed. And in fact, I think if you look some of the data that follows this, here's a -- here's a chart that shows the quality control samples they ran, and they have the room air bottle open reading .14 millirems uranium per liter, and then a bottle closed reading .07. The inference here is that the air actually concentrations were affecting the blanks. And the table I have here that's -- that's in -- it's in the book -- it's in the data capture effort. It says (reading) Each sample contains sufficient uranium to ensure a reliable analysis. Since significant quantities of uranium were found in the closed blank sample bottle as well as the open bottle, it seems reasonable to assume that these four bottles at least were contaminated. There's two open blanks and two closed blanks.

Sample 9 blank is obviously grossly contaminated. The possibility must also exist that the urine samples are similarly contaminated.

So they did have a contamination control problem in the laboratory, but I've seen no indication where they said let's subtract those to get the real result. Now again, I could take -- I have a number of a person here and the date of urine -- my intent, I haven't done this yet --

DR. ZIEMER: Crosswalk it --

DR. NETON: -- to crosswalk that over to see --

DR. ZIEMER: Yeah.

DR. NETON: -- that that value actually appears in the bioassay records which, in my mind, would give us some comfort that they weren't subtracting contaminated blanks.

DR. ZIEMER: But the practice would -- if you ask how -- what people do in practice, don't they actually do the subtraction?

DR. NETON: No. No, these are method-drawn* blanks. I think --

DR. ZIEMER: Oh, they are?

DR. NETON: When you run blanks through your process, it's -- it's a method blank, you know, with a full bottle running through and it -- it's

normal quality control. It's just to see do you have a problem with your samples at all.

MR. GRIFFON: It's not an environmental blank that you would --

DR. NETON: Right. It's not -- it's not like a (unintelligible) background blank, you know, that you'd subtract the signal.

MR. GRIFFON: Right.

DR. NETON: It's just a method blank that you'd run through and in fact it's a good quality control practice I think, to do that. So I need to run this -- we need to run this --

MR. GRIFFON: I guess -- I guess the, you know, the -- the larger question here is, you know, I can -- I can take that explanation for this one given circumstance, but the question is, where everything over that time period is so vague, you don't know what labs even did the data, you have these questions of contamination. We -- we weren't -- they might have handled it this way and they might be biased high. At least for this circumstance, they seem to be.

DR. NETON: Right.

MR. GRIFFON: But to me it also raises the question of well, what -- what kind of

reliability on that whole dataset do we have. I mean is it useful data? Is it always a way -- just from this one memo, you would say let's assume it's all -- if it's biased at all, it's biased high. I mean I don't know that six months from then they didn't run some spikes and they were all low, you know. I -- I just -- you're hanging a lot on this one memo, in my opinion.

DR. NETON: Well, this is the only indication that we have and -- according to Janet Westbrook, at least -- there were these contamination issues. I mean we don't have anything else to indicate that there were problems. Now we can speculate all we want that the laboratory had poor practices, but we have no evidence that indicates that. In fact, these are pretty standard fluorometric methods which I believe after '49 was -- you know, you even had the health physics program in place and you've got the AEC HASL laboratory involved in mentoring these folks and -- yeah, I don't know. I --

MR. GRIFFON: Yeah. Well, you have no evidence, but on the other hand you don't have the original records --

DR. NETON: I'm not sure that --

MR. GRIFFON: -- from the labs.

DR. NETON: -- we don't, actually.

MR. GRIFFON: Or you might.

DR. NETON: I don't. I don't know that but, you know, short of looking at every single analysis, though, and the calibration records, I'm not sure how you would give -- you know, what comfort level would you need, though, I guess to validate the -- the entire program. I don't know.

DR. MAKHIJANI: Well, Jim, one -- one way to think about comfort level is, is there any paper trail regarding the quality control of urinalyses that were actually done? Was there like a split sample occasionally that was sent to HASL and they verified it? Because if you had something like that, then you could say well, okay, HASL at some point actually looked over their measurements and said yeah, good -- or bad, or something.

MR. GRIFFON: Uh-huh.

DR. MAKHIJANI: But I haven't actually seen --

MR. GRIFFON: Right.

DR. MAKHIJANI: -- any reference to a record like that.

DR. NETON: Okay.

MR. GRIFFON: And I don't know if they exist, but that -- that's -- I guess that's kind of what I was looking for, just some sort of...

DR. NETON: I don't know that we have any evidence of -- well, there must be procedures out there somewhere that I don't know -- but, you know, I have not looked through this entire data sample so...

DR. MAKHIJANI: Yeah, because like at Bethlehem Steel, you know, when we raised questions about air concentration data, you had, you know, somebody from the time come and give us some evidence about what was done then and, you know, at least some -- the intensity of the questions got diminished when there was some level of comfort that somebody was doing what they were talking about --

MR. GRIFFON: I mean I am --

DR. MAKHIJANI: -- and tell us something (unintelligible).

MR. GRIFFON: I'll turn that off because you can't hear.

THE COURT REPORTER: It's like a big -- it's like the ocean. If y'all aren't using it. You're not using it at all?

MR. GRIFFON: It doesn't feel like you're at the beach.

UNIDENTIFIED: It's also hot.

THE COURT REPORTER: Thank you.

DR. NETON: It'll take a few minutes to go off.

THE COURT REPORTER: Thank you.

DR. NETON: Well, we obviously can't point to any right now, but it -- you raise a point that we're going to have to go back and see what we can find in that area.

MR. GRIFFON: But I -- I think part of it is -- I just lost my train of thought. The -- you know, the -- the site profile, the -- that summary statement there sort of points to the fact that -- you know, when you read that -- I mean because of questions regarding the validity of the samples, the apparent variations in the sample analysis methods and even who was doing the analysis, it doesn't give me, as a member of the public, very much confidence that they know what the -- how good or bad this data was. I mean that's -- that's -- you know, she goes on --

DR. NETON: Yeah.

MS. BLOOM: I hate to put words in Janet's mouth, but knowing Janet, the way she wrote that is she

wants these to be scientifically defensible --
MR. GRIFFON: Yeah.
MS. BLOOM: -- site profiles, and her thought was not that everybody was going to think she meant that the results were low and that you should be careful not to account for enough dose. You should be aware that these are going to be high numbers and so beware -- you know, these are probably overestimates.
DR. NETON: I think it even states that somewhere.
MR. GRIFFON: Yeah, it does. It says however --
MS. BLOOM: I think early on.
MR. GRIFFON: -- it appears that errors, if any, are -- are in the conservative high direction.
DR. NETON: Right, right.
MR. GRIFFON: And that they're claimant-favorable, but -- and that's -- you know, for me that's the red flag to ask you guys what's your basis for that final statement? How do, you know -- and then when I come back with one memo defending it --
DR. NETON: Right.
MR. GRIFFON: -- I'm like, you know, isn't there a little bit more to say, you know, we -- we

checked this out. And I'm not saying -- like I said, a hundred percent checks but, you know, didn't -- did HASL -- like Arjun suggested, did HASL do some sort of summary report looking at that -- that issue for that time period or -- and I don't know if it exists, but that's all I was asking with that.

DR. NETON: Right.

DR. MAKHIJANI: (Unintelligible)

UNIDENTIFIED: Sure.

DR. MAKHIJANI: The next question, I think it's related, are there documents beyond the discussion of contaminated blanks in the TBD that would allow some conclusion that bioassay data were consistently biased high in the 1949 to '54 period, so we've covered that.

DR. NETON: I think we covered that.

DR. MAKHIJANI: Then Mallinckrodt urinalysis only measured uranium. Does this mean that air concentration and job data are the only input for dose estimation in area where -- areas where uranium isotopes were not the main radionuclides. So it is a question of how -- how and when are you factoring in the non-equilibrium radium, thorium, protactinium radionuclides. What --

what are the criteria for that?

DR. NETON: Well, it's true that if you don't have -- if -- if it's a non-equilibrium, I think a uranium urine sample is not going to be useful for -- for bracketing the dose. So you would need to rely on air sample data.

MS. BLOOM: Air sample and source term data.

DR. NETON: And source term, what was there. And so yes, it would be air sample data. And how we would go about doing that, I think the profile is not as prescriptive as it needs to be. I think, Cindy, you mentioned that you think this is related -- it's related to job title, you know, where for some work during the time period, which plant and what job title they had, whether or not they were a raffinate worker or maybe worked with the Sperry cake --

MS. BLOOM: Uh-huh.

DR. NETON: -- that sort of thing.

MR. GRIFFON: And do -- do we -- I mean I guess -- I guess it references what Jim had sent for the last meeting, I just didn't have a chance at that meeting really to -- to understand them. But it -- it -- to me, again, that -- that is the extent of the knowledge on the various concentrations,

and are those -- I -- I'm not even familiar with these references myself, I got to be honest. I didn't have a chance to pull all those documents. But do those involve like the -- the worst case raffinate concentrations, the average raffinate concentrations? How are those numbers compiled for the various applicable operations? And again, what -- are -- are these Plant 6, Plant 7, I'm not -- you guys know Mallinckrodt much better than I do so...

DR. NETON: I don't know. Maybe, you know, Janet is available on the phone to talk.

(Unintelligible)

MS. BLOOM: About two hours in the afternoon she'll be available --

DR. NETON: I wonder if she's available.

MS. BLOOM: -- and we might be able to reach --

DR. NETON: -- we have some questions that really -- Janet, of course, couldn't make it here --

MR. GRIFFON: Yeah. No, that's --

DR. NETON: -- because of conflicts but --

MS. BLOOM: Uh-huh.

DR. MAKHIJANI: There are lots of follow-up questions, because they came out, you know, off and running as to -- since what's missing in a

way -- well, one of the things that's missing in the -- in -- in the TBD is a -- is a clear idea, and it's not faulting the TBD. As I told you sort of informally, I think the TBD is actually a very good historical document.

MR. GRIFFON: Yeah.

DR. MAKHIJANI: And -- but what's missing is a kind of time line. This is the period when the SLAPS waste were being brought back for reprocessing, so you apply -- and it was here and this is what -- just like we have that for the thorium refining. We have a very discrete period from '55 and --

MR. GRIFFON: Or it might be this --

DR. MAKHIJANI: -- '56, but we don't have that for the other residues.

MR. GRIFFON: Or it might be this -- this -- like Jim said, maybe some sort of dose reconstructors user guide that interfaces -- but, you know -- and maybe the -- the -- I mean sometimes in some sites, I think those workbooks end up doing that, but they're sort of the user's guide that tells you about certain time periods what --

MS. BLOOM: Takes it to the next step.

MR. GRIFFON: Right.

MS. BLOOM: And I think at some point we do want to go back and do that with Mallinckrodt and some of these other documents. They're very big and we've got a very ambitious schedule for other site profiles. But what we're trying to do is take those generic assumptions for claims where we don't have data and say okay, this is what we know about when people worked. You know, if it says they started in '59, we're going to assume that means January 1st, 1959 because we don't have any better information. We have this information that they were using this raffinate waste here. There's no start and end date, so does it make sense to -- to expand it to the whole period, or can we bound it somehow. And we have been trying to do that and we'll continue to try to do that. This -- we're having a hard time being able to move backwards so we can move -- because we're having to move forward at the same time.

MR. GRIFFON: Right. I guess -- I guess what I'm -- you know, what I'm understanding from Jim on this -- on the raffinate/Sperry cake question is that, you know, you can't rely on the urinalysis data so you're going to rely on air and source

term information. Then the question -- you know, I have two questions on that. Number one, how well can we define average or max air source term information. And number two -- and I think this is a critical one -- can we place these potential claimants into the various environments or -- or -- or are there maximizing situations you would use instead where you don't know where they worked. You sort of use a maximizing case.

DR. NETON: I think that's -- that's the case. I mean that's the easier to answer is -- is if we have representative data for those periods and if you don't know where they worked, we're going to default assume that they were -- they were working in those areas I think. You know, that's sort of the standard way we do business with our dose reconstructions. As to whether or -- you know, we have air data for many areas of the plant that are in the TBD and if one -- You got it?

UNIDENTIFIED: Yeah.

DR. NETON: Great. So if -- if you assume that all of the air concentration was related, and I wouldn't want to go to this extreme, but one of the extremes would be, for instance, to possibly

assume that it were all actinium 227, which is probably one of the --

MR. GRIFFON: Or whatever gives you the highest --

DR. NETON: -- highest, the highest dose per unit intake. And Cindy, you and I discussed this, it may be actually organ specific --

MR. GRIFFON: Right.

DR. NETON: -- (unintelligible) model this.

MR. GRIFFON: Yeah.

DR. NETON: But if you do have air concentration data you can hang your hat on, then it is not that hard a stretch to come up with some -- some dose from a disequilibrium situation using maximizing radionuclides.

MR. GRIFFON: I guess the --

DR. NETON: (Unintelligible) representative of the data.

MR. GRIFFON: Excuse me. Then the other question I guess you get into is the maximum plausible -- that's not a site profile discussion, but in my mind we're grappling with that, too.

DR. NETON: Well, I think -- I think it's a little different when -- when you have actual monitoring data versus when you source term. The

source term is where you get on the edge a bit of these plausible scenarios, much like happened in Iowa where people thought that the doses were not plausible. And -- and then you get in the situation of discomfort. If you have an air sample date itself, I think that at least becomes closer -- more closely tied to the work situation. This amount of alpha activity was in the air at this time and, you know, whether the worker was there or not, you know, we could debate. But, you know, we would default to that. So I -- I think plausible, when it's tied to air data -- plant monitoring data I think is -- it's probably not that big a stretch.

Now if we were to take source term and say there was no air data and we -- we would model some mechanical process where they would agitate this and throw it into the air, then you start pushing the bounds of plausibility because to -- to document the dose could be no higher than X, you're going to have to throw in some pretty generous assumptions whenever you enter the sort of shakier calculations.

MR. GRIFFON: But -- but when you -- when you deal with this raffinate question, you are really

getting into -- into source term questions, too. I mean you have air data --

DR. NETON: You have air data, you have bounding air data that --

MR. GRIFFON: -- that's how (unintelligible) did it, yeah.

DR. NETON: -- can say, you know, ten to the seventh, whatever, picocurie per year intake or something to that effect.

MR. GRIFFON: But you have to make some --

DR. NETON: And you're going to have to make some -- some assumptions, although the original question you had was how well -- we have the characterization data, and I'll be honest, I don't know them like Janet does. But given that we have characterization data of the Sperry cake and some of the other raffinate streams, I think that would allow us to do some sort of bounding estimates based on even the air sample and using those ratios and applying it to the air.

The other unknown factor here that I had not really intended that we would rely on necessarily, is these radon breath measurements.

MS. BLOOM: Uh-huh.

DR. NETON: A lot of people don't necessarily

have a lot of confidence in those things, but they do, again, allow for some bounding values (a) if a worker has a radon breath measurement -- I think there's about 2400 of them over the course of time that we're talking about here. If you have a radon breath measurement, then, in my mind, at least there was a potential for exposure to the ore. I mean you weren't working only after the -- after the daughters had been extracted. And then if -- if the data are reliable then, you know, one can infer what the radium body burden maximum would have been, given the exhalation of radon. That, again, has some limitations, but one could -- let's say for example one did some bounding and now just came up with this huge intake and then you look at the radon breath data and say well, that -- you know, much like you do with whole body count, you could say well, the worst case assumption is this, but the whole body count indicates that it had to be much lower than that, so you can (unintelligible) bracket. That's not addressed in the -- in the profile.

MR. GRIFFON: I was going to say, is that documented how you -- how you --

DR. NETON: There is a procedure --
MR. GRIFFON: -- use the radon breath to -- to --
DR. NETON: Yeah, uh-huh. There's a procedure that was just -- I just signed a week or two ago, I think.
MR. ALLEN: TIB.
DR. NETON: It's a TIB, not a procedure, and it's based on, you know, the Argonne experience. They've done a lot of radium -- radium dial painters.
MS. BLOOM: (Unintelligible)
DR. NETON: Yeah. (Unintelligible) and then went to Argonne later on. I think they used like a 60 percent emanation fraction and there are differences whether you take that measurement shortly after you ate or not. And of course if you haven't been off work, you know, then you're -- you're really just ventilating radon that's naturally dissolved in the body fluids. There are -- there are some uncertainties in that sense.
DR. BEHLING: Can you give me just a ballpark number what a picocurie per liter of exhaled air would correspond to in terms of body burden of radium?

DR. NETON: Yeah. It's pretty high. The detection limit is pretty high. I think it's somewhere around 250 nanocuries, maybe.

DR. BEHLING: Per picocurie of liter?

DR. NETON: But the sensitivity of this technique goes down well below that I believe, so I think it's in the -- it's in the TIB somewhere.

MR. GRIFFON: You don't know the TIB number? It's coming out soon or --

DR. NETON: No, it's out. It's out --

MR. GRIFFON: I can look it up.

DR. NETON: -- it's issued -- 30-something. I don't know, 20-something?

MS. BLOOM: 24 or 25.

MR. ALLEN: I can go --

DR. NETON: Yeah, Dave can look it up --

MR. ALLEN: -- print off a copy.

DR. BEHLING: How do you -- how do you differentiate? You were talking earlier about 19 picocuries per liter as being an ambient dose -- concentration level. Would these measurements have been taken obviously in a low background area outside the facility?

MS. BLOOM: They definitely should be. There were concerns in some of breath analyses that

they were in areas where the concentrations were a little bit higher than they wanted them to be, so there was more work in later years moving the worker to a different area.

DR. BEHLING: I think one picocurie per liter is what ambient levels are in average homes.

MS. BLOOM: Uh-huh.

DR. BEHLING: And so if that corresponds to that kind of a body burden, you'd have a problem basically identifying what is a real value and what's not a real value.

DR. NETON: Yeah. I think actually these people would -- well, I don't know. I may be speaking without looking too much, but later on I know at Argonne, they had these people breathe aged air that, you know, you sort of ventilate the -- the environmental radon out of your system and you'd -- you'd not want to take their measurement unless you were off work for a while, 'cause if you were in a high work area, there is a saturation or equilibrium of radon gas, being a noble gas, with the body tissues. That said, I mean any of these factors would again bias the results high, so you're not going to -- I don't think, going to have a low -- low analysis.

DR. MAKHIJANI: Right. I think that in this case that is correct, but if you use -- if you use the radon breath at face value --

DR. NETON: Yeah.

DR. MAKHIJANI: -- you would bias the results high.

DR. NETON: And -- and you know, I --

DR. MAKHIJANI: If the measure -- if there are no measurement problem at those low levels, which would be my question --

DR. NETON: Yeah.

DR. MAKHIJANI: -- this is how -- how well in those days can you rely on a picocurie per liter recording.

DR. NETON: Right. And that would need to be -- be fleshed out. I think these are scintillation cells that are the Lucas flask type -- type things. Yeah, I -- I'm speaking out of school here because I haven't really looked through this, but that is one technique that would be available to help -- I'm talking about the universal techniques available to bracket doses to raffinate workers, and I think we have some tools here.

MR. ALLEN: Is Janet --

DR. ZIEMER: I would think the uncertainty would be much greater in the model itself than in the data, so you can make those measurements pretty well. but what do they mean in terms of body burden is --

DR. NETON: Yeah, I think it's like any -- any bioassay measurement, interpretation is -- I'm going to see if I can get ahold of Janet real quick here.

MR. ALLEN: That -- that radon breath TIB was TIB number 25. Here's a copy if you want it. It's -- basically just develops the conversion factor.

MR. GRIFFON: Okay.

DR. NETON: Yeah, it's very simple.

MR. GRIFFON: Screening her calls.

MS. WESTBROOK: (By telephone) Hello, Janet Westbrook.

DR. NETON: Hello, Janet.

MS. WESTBROOK: Yes.

DR. NETON: This is Jim Neton. How are you doing?

MS. WESTBROOK: Uh-huh. Fine, you?

DR. NETON: Good. I was actually going to say I was Regis Philbin, but I didn't think you'd believe me, Who Wants To Be a Millionaire. We're

phoning a friend, taking one of our -- never mind. Janet, are you available to chat for a few minutes?

MS. WESTBROOK: Yes.

DR. NETON: Okay. I've got a -- a host of people here. We're meeting, as you know, related to a discussion on the Mallinckrodt profile. And the question came up related to the -- the -- sort of the depth and the representativeness of the -- of the data for the raffinate materials. I think you indicated in a previous discussion that we did have some information on the isotopic composition of the raffinate.

MS. WESTBROOK: Depends which raffinate you're talking about.

DR. NETON: Okay. I wonder if you could maybe just in general give us a -- give us a sort of a overview of what we -- what we may have in this area, if you can do that.

MS. WESTBROOK: Well, let me just pull my Electronet notes out. It seems to me that I sent somebody something about the Sperry cake.

DR. NETON: Yes. That was -- I think Mark Griffon and I asked for something on that, and Arjun, and --

MS. WESTBROOK: Okay. Well, first of all, there's the K-65 raffinate, and that was the raffinate from basically the first step where they took out the radium. So the K-65 was barreled up and shipped out to a -- it was either put in a storage area until there got to, I assume, be so many barrels, and AEC had it sent out to the airport site --

DR. NETON: Right.

MS. WESTBROOK: -- where, once somebody dumped it, it was then no more dose-producing until somebody brought more barrels.

DR. NETON: Right.

MS. WESTBROOK: Okay. So only when people were out at the airport was it dose-producing and so forth. Now they did do some airborne measurements, once, of different areas where they counted the -- they were trying to distinguish between uranium in the air and thus they didn't do just gross alpha measurements. They actually isotopically counted for uranium, I guess U-238 or whatever, and radium. And they found the results that you might expect, which was that the radium was in near equilibrium in the regular uranium areas. But in that raffinate area where

the dust was mainly the raffinate dust, the radium was about a hundred times the uranium, which was consistent with uranium left over in the raffinate being just like less than a percent --

DR. NETON: Right.

MS. WESTBROOK: -- of the -- so that I think we can assume that the big actor in the K-65 was in fact the radium and any radium daughters. And of course then there was the radon emanation from that. Okay.

DR. NETON: Right. So --

MS. WESTBROOK: Now that was that.

DR. NETON: Well, do we know like what time frame and what areas this would apply to?

MS. WESTBROOK: Yes. I think that's pretty clear from the time they started using the pitchblende to the time they stopped using the pitchblende. That -- those were the years in which they produced the K-65.

DR. NETON: Right. And which -- which areas would this be? Like Plant 6 or --

MS. WESTBROOK: Yes. And actually before Plant 6 was built, there was time in like 1945 when they were doing it on the lab level and maybe the

pilot level, but that I believe was relatively brief compared to, of course, at the Plant 6 time. They -- they built Plant 6 specifically because they anticipated having to process larger quantities, and thus they would -- knew they would have a dose problem if they tried to do it in the smaller spaces that they had back in the K1E and all those Plant 1 buildings.

DR. NETON: So in your mind, though, then anybody working in Plant 6 in this pitchblende era could potentially have been exposed to this disequilibrium.

MS. WESTBROOK: No, I think it was pretty much restricted to just the areas where the K-65 was. Reason being, remember it was separated in a wet process in tanks, okay, and that precipitate was then collected -- I guess on a filter -- and that filter was scraped off into the barrels and then the barrels were closed, sealed, and -- and taken off. Now there was some like spillage on the floor and so forth, but I think it -- it's very reasonable to assume that didn't get tracked around much because it was just in limited areas that that was done. There were many more stages in the process and then there were all the other

operations that were done. So I think most of the building was pretty far removed from the -- just those little spots. And then these -- these guys who were the cloth operators who would have dealt with the -- the powdery form and -- and replacing the cloth, opening the full filters, taking the stuff off and barreling it, those people were kind of dedicated guys. You'd see them month after month, year after year, they're the same guys. So I tend to think that we don't really have a whole lot of turnover and a whole lot of people going back and forth. And I think that was partly because AEC recognized -- and Mallinckrodt, pre-Plant 6 -- that it might be a problem and therefore, although Plant 6 wasn't that well designed from many points of view, nevertheless they did make that a kind of a -- a limited area process.

DR. NETON: Right.

MR. GRIFFON: Were those people changing the cloth, Janet, were those -- did they have a particular job title or you said they --

MS. WESTBROOK: Yeah, they were -- they were the cloth operators and --

MR. GRIFFON: Oh, cloth operators, I thought I

saw --

MS. WESTBROOK: -- and usually it'll be pretty clear, from the name of the filter or the name of the guy, who it was.

DR. MAKHIJANI: Janet, when I -- I was in St. Louis -- this is Arjun. When I was in St. Louis last week and I talked with some people who worked in Plant 6, and they were like maintenance workers who, you know, were all over the radiological operations who worked around these filters, who kind of cleaned up, fixed things, transport workers -- including some who said they transported this stuff back and forth from the airport in their private vehicles. And so it seems a little more fuzzy to me, so I agree that, you know, there were -- there were some job titles of people who would be there, the operators. This -- also seemed to be other people who would have been there, and from what I understand, these kind of roving job titles are electricians, maintenance people, cleanup people, sheet metal workers -- they have a whole set of them. One guesstimate, and the person did say it was a guesstimate, was that it -- it was as many as 25 percent of the workers were not stationed

at a particular location. Would that -- does that correspond to your research, or do you have a different view of that or...

MS. WESTBROOK: I don't -- I don't know, but I -- I tend to think that -- well, full filter -- filter like this, it didn't -- I'm trying to remember which of the filters were the more problematic ones and might require some maintenance folks to visit them. I think you could certainly assume that these filters did have some maintenance, but there might have been roving plant guys, but how many of them -- like an electrician might not be -- have much to do around a filter like this. Okay? It would be maybe the more mechanical guys, you know, the millwrights or whatever, who might be doing something with a filter like this. And so that might limit the number right there. I don't think clerks would have any occasion to go in this area and so forth. Now -- however, once this stuff was barreled, there -- there was for a -- for a time, a storage area where they put this stuff, so there might have been a clerk that went over there and marked the names of the -- you know, wrote down the numbers of the barrels. But

again, that would be like a few minutes and then he's off to doing something else. I -- I think the warehouse workers where the pitchblende came in and so on and so forth, if -- some of these people may be -- and then there were those other two kinds of raffinate, some of these people may not be remembering this particular raffinate. They may just be saying oh, I transported some waste. And in their private cars, I find that a bit incredible, you know, unless the truck was really broken down and somebody volunteered. But I think that that would have been a very, very infrequent thing if it indeed ever happened. But I don't think they would have transported a drum of K-65 in their private cars. I just -- you know, because they had these trucks and these dedicated spaces and AEC went out to the airport and measured this and that and the other and so did the Mallinckrodt guys, I just feel that they treated the K-65 in a kind of a special way. And so I -- I do believe yes, there were infrequent access by other than the raffinate workers, but I think the general population of Plant 6 had only a very distant exposure to the gamma rays. I don't think that they were really

in the area of the dust. I don't think, for the most part, that they were really likely to have picked up much dose from that just because of that special treatment. I could be wrong.

DR. NETON: Okay, Janet. That's -- that's good. I didn't -- I forgot to let you know that we are on the record here in this session, not that you would change what you say, but you need to know that Ray Green is here and we're preparing a transcript of this session, so...

MS. WESTBROOK: I have no idea who Ray Green is.

DR. NETON: Ray Green is a court recorder who -- who attends many of our meetings and --

MS. WESTBROOK: Ah, okay.

DR. NETON: -- and prepares a transcript. So just so you know that. It's only fair that, you know, you be aware of that fact. So as far as you know, we only have an air sample or so of isotopic analysis of the K-65 raffinate area. Is that what you were saying?

MS. WESTBROOK: Well, there were -- there were other measurements --

DR. NETON: Other measurements.

MS. WESTBROOK: -- but they were the gross alpha measurements that were taken everywhere.

DR. NETON: Right, right.
MS. WESTBROOK: Okay? But we can assume those gross measurements, as far as the isotope goes, that the dominant contributors to that alpha thing would be the radium and its daughters.
DR. NETON: Understood and --
MS. WESTBROOK: Okay.
MR. GRIFFON: Can you give the reference for that one isotopic survey or air sampling effort that was done?
MS. WESTBROOK: It's in the TBD.
MR. GRIFFON: You might have given it to me already but --
MS. WESTBROOK: It's in the TBD.
MR. GRIFFON: It's in the TBD.
MS. WESTBROOK: Yeah, and I think I mentioned it in something I sent to somebody, so it could have been, you know, whatever was sent to you.
DR. NETON: Frankly, I haven't had a chance to look at what you sent us, Janet, so I apologize that I'm not up to speed on those.
One thing that crossed my mind is that we do know this ratio of 100 -- what's that Mark?
MR. GRIFFON: (Unintelligible)
DR. NETON: It's 100 to 1.

MS. WESTBROOK: Something like that, yeah.

DR. NETON: Then, in a sense then, if we had urine samples on the person, we're not -- we're not confined to using the air monitoring data. If --

MS. WESTBROOK: That is correct.

DR. NETON: If we know that the ratio of the isotopic airborne is 100 to 1 uranium -- radium to radium -- radium to uranium, then we can take a urine sample and just take any intake from the uranium urinary output and assume that it's 100 times the uranium intake. So in a sense -- my original point was that if we don't know, we're going to have use airborne is not correct if we do know the isotopic mix in the air -- in the air samples themselves. So that -- that's good, in a way. That helps us.

DR. MAKHIJANI: I have a question, another question about the K-65 isotopic composition. I know that at Fernald in silos 1 and 2 where some of the stuff went, they had thorium 230, also. Now I know thorium 230 was not -- and this is from memory now -- not in equilibrium with -- not all the thorium 230 went along with the radium. Do we have a thorium 230 measurement of these K-

65 samples in that -- in that one measurement that you refer to, or are we assuming only radium here?

MS. WESTBROOK: No.

DR. NETON: We do not?

MS. WESTBROOK: No. They discounted those two elements.

DR. MAKHIJANI: That might be an area where --

DR. NETON: Something, yeah, that's worth pursuing. I don't know. Thorium 230 -- yeah, we need to look at that. That was one of my original thoughts was we have the residue in the K-65 silos and there's virtually hundreds of measurements made on that. Whether its on the same exact equilibrium state as when it was processed, I don't know, but -- and -- and in fact I think -- well, we need to look, but it depends on the organ, of course. But radium 226, being a somewhat soluble radioisotope, is going to deliver a pretty high dose -- relatively high dose per unit intake to systemic organs compared to something like thorium 230, other than the deliverer and the skeleton. So here you have a situation where radium would be predominant in the dose delivered to the systemic organs. It's

something to look at.

Okay. Now Janet, you mentioned there's a couple other raffinate streams where we have data.

MS. WESTBROOK: Yes.

DR. NETON: Could you just briefly describe what those are?

MS. WESTBROOK: Well, there's the barium sulfate which, by volume, I think was about the biggest one. And I'm sitting here trying to look through my notes here. I have all the -- most of my notes in one file which is an Excel file which about -- with about a zillion little tabs and I'm trying to find the right one here where I have the stuff listed. Dang, I can't seem to find it and I'm just drawing a blank, you know, like -- I'm thinking oh, my gosh, what is the third one. But anyway, let's see. Airport --

DR. BEHLING: (Unintelligible)

MS. WESTBROOK: I absolutely at this moment -- I'm sorry, I'm drawing a blank. I can't remember what number three is, but there are three main ones. And as I pointed out, I believe the Sperry cake was treated as a subset of the -- I know, I'll go to my materials table, my basic table over here -- subset of the -- I can't remember.

Okay. Let's see. First of all we have the K-65, the pitchblende raffinate. Oh -- oh, the airport cake, that was the Am-7. That was the third one. Okay. So you've got your barium sulfate, your K-65, and your -- what -- what they generically called "the raffinate" was Am-7 and that was --

MR. GRIFFON: Airport.

MS. WESTBROOK: -- like the last one after the K-65 and the barium sulfate. First they took out the radium, then they precipitated the barium, so that produced those first two cakes, and then the leftovers then were kind of a -- I think sometimes they kind of mixed a few cakes together to get the pitchblende raffinate, the Am-7 and it's nickname was airport cake.

MR. GRIFFON: Where does the Sperry cake fit into those?

DR. NETON: I think it's a subset of the barium sulfate raffinate?

MR. GRIFFON: Is it --

MS. WESTBROOK: Now the Am-7, we do have some references for what it contained in terms of the thorium 232 and the thorium 230, because that was analyzed -- well, the reference is Figgins 1962 and that's in the TBD and it's discussed in the

under-the-table and everything. But they say so many parts per million -- they found so many parts per million thorium 232; so many parts per million thorium 230. Okay?

DR. NETON: Okay.

MR. GRIFFON: Yeah.

MS. WESTBROOK: And anyway, on -- on that -- in that vein, okay?

DR. NETON: Okay.

MS. WESTBROOK: But we don't seem to have any thorium content for either the K-65 or the barium sulfate. I'm looking at this table here. They did say so much uranium. If there's a reasonable -- I mean a carryover of the thorium, like uranium, we could estimate it from that. Otherwise, I don't know. I -- I have tried for a long time to figure this out and track down what -- what the other isotopes were and I hoped that they had at some time done an isotopic breakdown of all these different cakes, but I don't think they did it except when they wanted to sell off the cakes at the airport, but they didn't do that with the K-65 because of course, it had moved on elsewhere and they weren't selling it.

DR. NETON: Right.

MS. WESTBROOK: But this Am-7, we did have some more information about it.

DR. NETON: So you do have some isotopic on the Am-7?

MS. WESTBROOK: Not -- not a total isotopic, but we have some more information about the thorium and that.

MR. GRIFFON: Is the Sperry cake -- again, I'm not sure where the Sperry cake fits into this --

MS. WESTBROOK: The Sperry cake seems to be a subset of the Am-7, the last one, and I think the reason was, there's a -- the Am-7 was produced with every single batch, whereas they drew the Sperry cake off only -- off the column only intermittently, you know, once in a while. Like maybe when it got -- it kind of precipitated to the bottom of the column but the column was still usable. So from the description and -- and this is somewhat inferred from the way they put it, but I -- I believe the Sperry cake was a much smaller volume than any of these others by far, and that when they dumped it at the airport, it was lumped in with the Am-7 like they might have -- just drum it in and then take it out there and -- or wherever they put it, and then dump it out.

MR. GRIFFON: And the Sperry cake, the focus was the protactinium. Is that right?

MS. WESTBROOK: Yes.

MS. BLOOM: Janet, a question on the Am-7. This is Cindy, by the way. Did you look at any of the Mound documentation?

MS. WESTBROOK: Yes.

MS. BLOOM: And you didn't find anything in there?

MS. WESTBROOK: Well, what I did, I -- I milked out of there -- and it's in the TBD -- everything that I could find. Every -- every detail about isotopic content, experience with it or whatever, is in the TBD.

MS. BLOOM: Okay.

MS. WESTBROOK: If it isn't there, I -- I don't have it. I didn't leave anything out.

MS. BLOOM: Okay. Thank you.

DR. MAKHIJANI: Questions about their timing, if we're done with isotopic --

DR. NETON: Yes.

DR. MAKHIJANI: Janet, this is Arjun again. In -- in the TBD, I don't -- I don't have a date number in front of me, but you mentioned that -- that raffinates were brought back, I think

starting 1950, or '49, for extraction of uranium, and then from time to time this seems to have happened. But there doesn't seem to be -- so at that time the whole of Plant 6 presumably in those periods, the workers would have been exposed to this disequilibrium. Would -- am I understanding your write-up correctly?

MS. WESTBROOK: I -- I'm sorry. I'm having trouble hearing you. Now -- now --

DR. MAKHIJANI: Sorry.

MS. WESTBROOK: -- what -- when the workers were exposed to disequilibrium, they would have been -- some workers, the raffinate workers, would have been exposed to the disequilibrium, or let's just say the raffinate dust, during the whole time because it was -- it was like a manual removal or -- or at least a semi-manual removal from -- of the cake into the drum and the replacement of the cloth in the filter. And, you know, there's always a little bit left over in the filter, you know, that can dry out and get in the air, and then there was some that would fall on the floor. Little bits would get on the floor and would be swept up periodically, but might sit around and dry out. They pointed that out in the memo.

Okay. So some workers would have been exposed to that during the whole time of (unintelligible) processing. Okay? But most of the workers would have not been exposed to it directly, like they weren't in the room or the core filter room or wherever where it was, or even in the corridor outside, let's say. But then there would have been the guys who were transporting the drums out to the -- like to maybe a temporary staging area and then out to the airport. Those guys, though, would have been exposed to it only to what might have been on the outside of the drum, and then -- I have no information as to whether they cleaned the outside or not. I think they were supposed to, but who knows. Anyway, so there might have been a little on the outside of the drum. But other than that, see, that seems to me -- they put the used cloth into a drum, I believe, because they actually took some measurements of one drum, and in it fit three cloths. And so they took some measurements on the outside to see how hot the cloths were because apparently they thought maybe the radium might soak into the material more than it would -- you know, might concentrate there for whatever reason. And I

don't think they found that, but anyway, just -- just so you know that -- so we have all these -- the filter itself, the cloth, and the material -- I mean and the cake, and the cloths and the cake would have been drummed at the place where it was removed from the filter. This is my understanding. Okay?

So then once it was sealed in the drum, then it would be transported. So those -- you can kind of see the spectrum of workers that might be exposed in all that operation, those tasks.

DR. MAKHIJANI: Sorry. I think -- I think maybe I didn't speak loudly enough. You mention in the TBD that waste -- after it was taken to the airport some of the raffinate, I think the K-65, was still high enough in uranium that they were brought back for uranium extraction.

MS. WESTBROOK: No, not the K-65.

DR. MAKHIJANI: Were some raffinates brought back for uranium extraction? I'm pretty sure you mentioned that in the -- I wish I'd tabbed the page.

MS. WESTBROOK: Well, just remind me. Remind me.

DR. MAKHIJANI: I'll have to do a search here. In 1949 or 1950 -- I'm wondering what to search

for. If you don't remember, it's in these.
DR. NETON: Well, it says here, in -- most or all the K-65 was brought back in drums from SLAPS and reprocessed starting in early 1948.
MS. WESTBROOK: Oh, well. Ah, there you go --
DR. MAKHIJANI: What page?
DR. NETON: Forty-seven.
DR. MAKHIJANI: Thank you.
MS. WESTBROOK: Oh, okay. I may be mis-remembering here. Let me -- let me get back.
DR. MAKHIJANI: And then it indicates, it's -- there's a sort of fair amount of vagueness as to the time, and that's what's puzzling me is --
MS. WESTBROOK: Hang on a minute.
DR. BEHLING: -- how do we place people in time with this reprocessing, and what happens to Plant 6 dose calculations during those times.
MS. WESTBROOK: Just -- just a second here. Let me --
DR. MAKHIJANI: Sure.
MS. WESTBROOK: Okay. Now page what?
DR. NETON: Forty-seven.
DR. MAKHIJANI: Forty-seven.
DR. NETON: Third paragraph or second --
MS. WESTBROOK: Forty-seven, third paragraph. I

hate Word. Why it doesn't clear your search when you open a new file, I don't know, but it doesn't. Anyway, okay, let's see. Where do -- where do -- see, I don't know that I have the same copy that you do. Sometimes stuff is sent over to NIOSH and I don't get a copy of it and --

DR. NETON: This is Rev 1. It's the same --

MS. WESTBROOK: Okay. Rev 1?

DR. NETON: Yeah.

MS. WESTBROOK: Well, see, I'm opening my working copy which is the last that I had -- now, I may have it --

MS. BLOOM: She'll have the Word file rather than the Adobe copy that we have --

DR. NETON: Oh, this is a -- this a PDF file, so it might be on a different page.

MS. BLOOM: -- because those are harder to work with for --

MS. WESTBROOK: Okay. Well, just tell me three --

UNIDENTIFIED: Section 542.3, would that help?

DR. BEHLING: Yes.

MS. WESTBROOK: Tell me three consecutive words to search for.

DR. BEHLING: As noted in Section 4.7.

MS. WESTBROOK: As noted in Section 4.7. Okay. That's good. That's good. Thank you. Let me remind myself here, I'm -- oh, oh, oh. Let me go back to Section 4.7. This is good. I didn't -- I completely forgot about that. Ah, residues and effluents. Here we go. Let's see. Let's see. Yeah, right, right, right. Let's see. Ah, some reprocessing of residues is also done to recover uranium. All right. Let's see here.

Oh, yes. Okay. Following the development and installation of the sodium carbonate -- thank you, I had forgotten this -- the sodium carbonate/sodium bicarbonate leach process in 1948 to '49 to recover more of the uranium, the K-65 produced up to that point was brought out of storage in lots and reprocessed -- reprocessed in about 1949, resulting in a final uranium content in the residue of .05 percent. So that was apparently done in the same vessels and in the same general manner as ore would be processed, including heating the K-65 drums in the thawing oven used to thaw ore drums. Just consequent rate on emanation, right?

Okay. And then they sent that residue to Lake Ontario. Okay?

DR. NETON: Yeah.

MS. WESTBROOK: All right. So there -- you're right about that. I forgot about that. But what they did was they -- they opened the drums and dumped the stuff in, but they heated the barrels. They loosen them and then they'd heat them to drive off the radon so when they were dumping them, presumably it was reasonably dry, relatively dry. I think they packed it kind of wet but when they heated it, maybe at least some of the moisture would be driven off. So I don't know -- I believe at that time they had an automatic ore dumper, like it would hold -- it would -- they put the barrel on it and it would do the dumping. The person wouldn't actually physically have to dump it. I'm -- I'm not sure. I'd have to double check that, because they did get an automatic ore dumper at some point in the '40s. Anyway, so yeah. But -- but once they dumped it in, it would then be treated just -- it would go through the process just like regular -- it would come out in the next step, again as the K-65, only this time there would be less uranium in it.

DR. NETON: See, it's listed as starting in early

'48. We don't know, I guess, when it ended.

MS. WESTBROOK: Well, a couple of the -- it was all done in 19-- by the end of 1949 because we have two separate references that -- one of them says that it started in late '48 and ended -- but they both say it ended in '49, like it was done over a period of months. But the leach process was researched and installed in '48 to '49, so that may be why one of them thought it started in '48 but the other one said it was done in '48.

DR. NETON: Okay.

MS. WESTBROOK: Okay? So they probably used some K-65 they had not taken out to the airport yet to test the process the first few times, and once that was established -- maybe in '48 or early '49 -- then in '49 they brought back the barrels and reprocessed them. That's my best -- but you can go back to the original --

DR. NETON: Well, let me ask you this.

MS. WESTBROOK: -- memos and read them yourself.

DR. NETON: When was this K-65 stopped processing then? I mean if this was all prior to '49, it's really not relevant for our discussion.

MS. WESTBROOK: Well, they reprocessed the K-65 that they had already processed.

DR. NETON: But they -- oh, but they were continuing to run it through.

MS. WESTBROOK: But after that then they had the higher recovery so --

DR. NETON: Yeah, I got you.

MS. WESTBROOK: -- didn't have to reprocess it.

DR. NETON: All right. Okay.

DR. MAKHIJANI: Do -- do we have an ending date for the raffinate processing for uranium extraction? I mean was this the only -- since they developed the process and the early extraction -- you know, they had some Canadian ores, ten percent and all that. And I don't have all the words in front of me, just a little bit of an impression in my mind from reading your write-up, Janet, that there is some -- that this may have been done sort of in lots from time to time after this big one-time thing in 1949 when they did the K-65 silos, but maybe I'm not reading it right.

MS. WESTBROOK: Where -- where would it say that, or where would you take that from --

DR. MAKHIJANI: I don't remember. See, that's why I wished I'd made the page references. Which paragraph in 4.7 were you at?

MS. WESTBROOK: Okay. This would be one, two, three, four -- four paragraphs from the end of 4.7. It's the fourth paragraph.

DR. MAKHIJANI: How do the paragraphs -- oh, some reprocessing.

MS. WESTBROOK: Yes, that's right.

DR. MAKHIJANI: That paragraph? Yeah, I -- I don't know why I have that impression. Maybe -- maybe -- I'd have to go back and check. Maybe not a correct remembering.

MS. WESTBROOK: Well, I already made my memory mistake for the day, so you're entitled to have yours.

DR. MAKHIJANI: Okay. So so far, you know the other -- there wasn't -- other than the thorium Sperry cake thing, there wasn't more bringing back of raffinates after '49?

MS. WESTBROOK: Well, this paragraph also says at least some of the barium sulfate cake was reprocessed similarly, and I think that was after that.

DR. MAKHIJANI: That must have been why I remembered that. Thank you.

MS. WESTBROOK: Yeah, yeah.

DR. MAKHIJANI: So that's the time question that

I have, is if you have the barium sulfate residue -- which was the bulk of the residue, right?

MS. WESTBROOK: I'm sorry. What?

DR. MAKHIJANI: The barium sulfate residue was the bulk of the residue, right?

MS. WESTBROOK: I don't -- I -- I -- I'm not able to remember that, but my -- my memory is that the Am-7 was the biggest --

DR. MAKHIJANI: Okay.

MS. WESTBROOK: -- amount, but -- but I could be wrong there.

DR. MAKHIJANI: Yeah. Yeah, I think you might be right about that. The -- but anyway, they had -- barium sulfate had a fair amount of radium in it, and certainly in disequilibrium, if I remember correctly, and so if the -- the problem here would be to put some kind of time bound on -- you know, time limits starting and stopping dates for this barium sulfate reprocessing. Is there any evidence of that?

MS. WESTBROOK: Well, I -- I -- they -- they noted that they reprocessed the barium cake and one of the references is 1951 and one of them is '48. And the '51 I think referred to it as having been done, if I'm remembering correctly.

So therefore that means it must have been done -- I think either maybe prior to the K-65 or just after it, which I think is a little more likely. But anyway, the 1948 reference may have been prospective, you know, we're going to do it. But anyway, I -- so I think they had finished it all probably in the like '49 to '50 time frame, but -- but you'd have to look at the references for that.

DR. MAKHIJANI: I'll do that. Thank you. I will do that.

DR. NETON: Okay. Any other questions on the raffinates as far as --

DR. ZIEMER: There is a paragraph that states that in '55 thorium-bearing raffinate residue was brought back from storage of SLAPS for plant 6.

DR. NETON: Where is that, Paul?

DR. ZIEMER: Top of page 33, the second paragraph (reading) conveyed by dumpster from Plant 6 to Plant 7 as needed. Processing done on a crash basis in early '55.

But that looks like it's a small scale lab operation.

MS. WESTBROOK: Oh, that was the thorium processing.

DR. MAKHIJANI: Yeah, this is -- this is the Sperry cake, right, Janet?

MS. WESTBROOK: Yes. No.

DR. ZIEMER: It says it's Am-7 raffinate.

DR. MAKHIJANI: Am-7. Yeah, okay.

MS. WESTBROOK: The Am-7, that was the -- the -- the airport cake basically, the bulk residue that I -- I think is the bulk residue, anyway -- hedge my bets there -- the Am-7. And they took it back because it was -- it was where -- it was the one we had the thorium content of and the reason was, they did it -- somebody did a thorium assay on it and of course it was known to be somewhat concentrated in thorium, so they processed it to make the concentrate that was then sent to Mound for further concentration of the thorium.

DR. NETON: Uh-huh. Right.

MS. WESTBROOK: Okay. So that's what that was. So let's see, they reprocessed some K-65, some barium sulfate, and I think all of the -- pretty much all of the Am-7 -- no, some of the Am-7, but -- but it turned out to be I think most of it. But anyway, quite a lot of it.

DR. MAKHIJANI: Now didn't we just say Am-7 was most of the residues?

MS. WESTBROOK: Yeah, but I -- I -- I think I hedged my bets in writing this. The purpose of that was to process -- reprocess some of the Am-7 because it wasn't clear to me how much there was out there at the time. I know how much they reprocessed, but I don't know how much had been sent to the airport at that time.

DR. MAKHIJANI: And the Am-7 would have had highly variable ratios of uranium to radium, radium to uranium I'm thinking, because they had -- it wasn't all -- I mean it was -- it was various grades of ore. It wasn't all pitchblende. There were all different kinds of residues from different ores, right?

MS. WESTBROOK: Well, actually, the Am-7 was pitchblende residue --

DR. MAKHIJANI: Okay.

MS. WESTBROOK: And we do have the -- the AM-10 was the carnotite residues.

DR. MAKHIJANI: Oh, I see.

MS. WESTBROOK: And -- and we do have a thorium ratio for them. I mean we have some thorium information, anyway, for them. So that the -- it was also called -- their Am-7, the carnotite residue, raffinate, was also called airport cake.

But it -- it definitely had its own code name, the Am-7 -- I mean AM-10. Okay. So they -- they did distinguish between those two. Now mostly what I'm reading off to you I'm taking from the materials table, and I forget whether it's Table 4 or whatever, but it's one of the first five tables. It's that one that goes on for pages and pages in landscape mode, but it's got -- there's some information there in the -- that -- and in mostly some references. So in case you want to track down where I got any of these numbers, I believe you can just find it there. You'll find more information and -- and adjust it in your own time there.

DR. MAKHIJANI: Okay. Thank you. Thank you.

DR. NETON: Okay. Any other issues with raffinates while we've got Janet on the phone? I know, Janet, you've got an appointment or something coming up soon so we don't want to keep you too much longer.

MS. WESTBROOK: Oh, no. That's -- that's okay. I still have some time.

DR. NETON: Okay.

DR. MAKHIJANI: Were there -- were there area dose -- were there area dose -- external dose

measurements made in the areas where raffinates were particularly concentrated?

MS. WESTBROOK: Well, they had some detector measurements, and they -- I think they took a lot that they either, you know, said oh, this is consistent with what we measured before and so they didn't record it, or else -- as I suspect -- it was written down like internally in Mallinckrodt and -- and we don't have those records anymore. We just have maybe the AEC's measurements or what is recorded in memos that have been recovered. Now it's known that they did use film badges, spares and controls and things like that. They -- they used some of the extra film badges as area monitors and in fact I think it had some kind of a program for placing them, like to -- to have -- I think Mallinckrodt pioneered some of this stuff because they were so big and did so many things, and they were cooperative in stuff like that. So I know they did do a lot of -- especially in like the '50s. Yeah, they used the film badges as area monitors. Now we mostly don't have that -- the data for that. I think it's out there somewhere, but who knows. Anyway, so those are the two -- two

things they did. Apart from the human film badges they -- they did those detector and film badge measurements.

MR. GRIFFON: Is there going to be any survey data you ran across during any of the decommissioning activities for these sites? Isotopic survey data. Janet?

MS. WESTBROOK: Yes.

MR. GRIFFON: I'm sorry. I was too far away from the mike. Are there any survey data you ran across for -- during the decommissioning period for this site?

MS. WESTBROOK: What that I -- we ran across?

MR. GRIFFON: Survey data.

MS. WESTBROOK: Please?

MR. GRIFFON: Survey data, like isotopic particularly, survey data.

MS. WESTBROOK: Well, not isotopic, but they -- they did of course have a -- years-later survey. Let's see, was that by Oak Ridge, ORNL, and they said oh, we found uranium here, or we found radium, we found some thorium there. They did do it to that extent, but during the time of decommissioning they mostly were just looking to get it down to below their limits of beta, gamma,

and alpha --

MR. GRIFFON: Right.

MS. WESTBROOK: -- by smear and by direct measurements, so they didn't really care about the isotopic stuff and so I think they never -- I do not think there is any data for that.

MR. GRIFFON: And that characterization report, does that -- that does have some uranium, radium, and thorium data? Is it -- is it mainly soil sampling? Is it also building survey stuff, or is it mainly soils?

MS. WESTBROOK: No, it was -- they did a thorough -- let me -- let me look at -- yeah, it was ORNL and they surveyed both the airport site, and they surveyed -- I think they surveyed Mallinckrodt itself, if I'm not mis-remembering here, although somehow I seem to have just hit on the -- can only find the airport thing at the moment. Ah, here we go. Radiological Survey of the Mallinckrodt Chemicals, et cetera. They measured all these buildings. They checked for uranium, radium, actinium, and thorium concentrations in the soil, and they again seem to have done some observations of what -- where they were in the buildings if they found the -- not the actinium

but the other three, they -- they noted that here and there. So that's about all I can tell you about what they did.

DR. MAKHIJANI: This is the 1981 Oak Ridge survey?

MS. WESTBROOK: Yeah.

DR. MAKHIJANI: Is it on the -- on the database there on the -- on your database?

MS. WESTBROOK: On the O drive in the library? Yes.

DR. MAKHIJANI: Thanks.

MS. WESTBROOK: They also measured radon. Of course remember, this was like -- oh, you know, more than -- about 20 years, 22 years later, something like that. They -- they also measured radon, which of course will give you some idea of what was going on, but anyway -- they did smears, indirect measurements, plus the soil business.

DR. MAKHIJANI: I -- I have nothing more on raffinates.

MS. WESTBROOK: Okay.

DR. NETON: Let's just -- I guess if there's no more questions -- I -- I hate to let you go, Janet, because you're a loss of knowledge here, but I don't want to hold you up all day. So

that's it. I guess -- I guess you're off the hook for now. Are you going to be available later on in the afternoon?

MS. WESTBROOK: Yes.

MR. GRIFFON: Why don't -- can we -- I mean while she's on the phone, I'm just curious about the -- we were talking earlier about the laboratory data in general.

DR. NETON: Oh, okay.

MS. WESTBROOK: Yeah.

MR. GRIFFON: And there's that one memo that Jim has showed us, and it referenced on page 77, 78, something like that about the blank -- the sealed blanks and the urine data tending to be -- if -- if it was biased, it was probably biased high. Have you run across any other -- any other sort of quality control documents or -- or --

MS. WESTBROOK: Whatever I ran into I thought -- along those lines, I thought was important for the dose reconstructors to know, so everything I knew about that is in there. Now a knowledgeable person reading the references, looking at the references, might be able to deduce something more than I have been able to do, like somebody who's really, you know, knows the meanings behind

the words or whatever. But everything that I thought was of a quality control or how they did it or what the limitations were, that's all in the TBD.

DR. NETON: Okay. So -- this is Jim. Have you not run across anything like split samples that were run maybe at HASL, or any procedures related to what they were doing, or things of that nature?

MS. WESTBROOK: Only -- only that interview that John Harley* gave to ORAU way back when they were starting their four-plant study and one of those four plants, of course was Mallinckrodt --

DR. NETON: Right.

MS. WESTBROOK: -- and he talked about how HASL did their things and aliquots and so forth, and I think there was one other thing in there, but again it's this kind of retrospective thing rather than what we did in real time but --

DR. NETON: Right.

MS. WESTBROOK: -- I -- I think that was probably their usual method. And I -- I think in order to do the urinalyses themselves, Mallinckrodt had to satisfy AEC that they were using approved AEC methods, or -- or that Barnes Hospital would --

who --

DR. NETON: Right.

MS. WESTBROOK: -- was supposed to be doing the urinalyses, would be doing that. So -- so I think we can assume that, on paper at least, what AEC did was what they did.

DR. NETON: Right. It would just be nice if we had some memos to that effect, you know, that --

MS. WESTBROOK: Well, I -- I don't know what to tell you.

DR. NETON: I -- no, I'm not asking you to make up anything, I just -- I'm just pointing out, you know, where -- if you run across something, it'd certainly be nice. And maybe we need to take a little closer look at some of that stuff ourselves --

MS. WESTBROOK: Well, you're the kind of guy who at Christmas says oh, is this all the presents.

DR. NETON: You know, I may be. I think if you ask my wife...

DR. ZIEMER: How much more can I get.

DR. NETON: Okay. All right. I think that answers that question. Is there anything else that we have for Janet --

MR. GRIFFON: Good place to stop.

DR. NETON: -- that's -- that's relevant at this time? Okay. Janet, is it safe that we have some issues later, like say -- I don't know what time, 2:00-ish or so, we could call you back or --

MS. WESTBROOK: Oh, of course. Of course.

DR. NETON: All right. Well, we'll do that. I think we're going to hopefully be breaking for lunch fairly shortly and --

MS. WESTBROOK: Oh, my gosh. I should hope so.

DR. NETON: Well, food's not here yet, but it may get here shortly. All right. Well, thanks, Janet, and we'll be in touch.

MS. WESTBROOK: Okay.

DR. NETON: Okay. Bye.

MS. WESTBROOK: Bye, everybody.

MR. GRIFFON: Thanks.

MS. BLOOM: Bye.

DR. NETON: It might be good just to take a little break now.

(Whereupon, a recess was taken from 12:35 p.m. to 1:40 p.m.)

DR. NETON: Okay. We're ready to start the afternoon session, and I guess I'll just leave it up to SC&A and Arjun to bring forth whatever

issues you care to.

DR. MAKHIJANI: Yeah. We still have some questions along the same lines in the same set that we were doing right before lunch, so I'll just go to the next question, which is just a -- sort of a -- if you have an idea, what proportion of claims have no bioassay data, like where you're going to rely on air concentration -- rough idea?

DR. NETON: You know, I can't give you a -- a handle. I tried -- I started to go through this. I don't have the data yet, but I will -- I will get that. My -- my feeling is the majority of claims have bioassay data of some sort. Now that may mean that you have some bioassay data that are from the Weldon Springs era. Say -- say the person works and started -- you know, maybe you have nothing at Mallinckrodt. All of a sudden you have a 1957 Weldon Springs bioassay or something. That is information that one can use to try to bracket some of these exposures. So in going through roughly, I found bioassay data for most of the cases, but I can't give you any better answer than that, short of going through each individual file. It's hard to say.

DR. MAKHIJANI: I -- I didn't understand your -- your comment, though, how you would use Weldon Spring data to bracket the Destrehan Street doses. I didn't get that.

DR. NETON: Well, let's say we -- and this is just a technique, an example of a technique. In 1957 you have a -- a sample on the first day of employment and it -- it's essentially nondetectable and measures 10 micrograms uranium per liter. One could put together, using that data point, a bioassay scenario that would predict what could be the maximum exposure of that person in their Mallinckrodt time frame at Destrehan Street, yet still have a .010 urine sample in 1957. That may or may not be useful. I'm saying to the extent possible, we would use it.

Say, for example, if this were a -- a -- just a systemic cancer, didn't concentrate uranium, you could make some assumptions about solubility class and do a bracketing estimate of the dose. I saw there's --there's several cases like that that I noticed where there were no bioassay data, at least found or -- or observed in the Mallinckrodt Destrehan Street era, and some for

Weldon Springs.

DR. MAKHIJANI: Yeah. I came across a couple --

DR. NETON: It's -- it's -- I just raise that as a possibility that we -- we -- we, you know, we may end up being able to use some of those data points. But I -- I -- I'm sorry. I just can't give you a better --

DR. MAKHIJANI: Yeah.

DR. NETON: -- feel.

DR. MAKHIJANI: It's -- it's just on the off chance that you had an idea. Okay. Now at the Board meeting you had this hypothetical example of how you were going to address this sort of data gaps, data integrity question, by using urine data, air concentration data, and -- radon breath data, was it? Something like that?

MR. GRIFFON: Source term.

DR. MAKHIJANI: Source term, I'm sorry --

DR. NETON: Source term to (unintelligible) -- right.

DR. MAKHIJANI: Is there a real-world example that you --

DR. NETON: No, I don't have that yet. I'll be working on it. That was one of reasons I was hoping to do this a little later, but --

DR. MAKHIJANI: Yeah.

DR. NETON: -- we're going through the dataset. I'm -- I'm going to try to approach it from several levels. One is to look at the -- at the individual datasets themselves and show that the are somewhat consistent in their -- their ranges and spreads. For example, if you plot -- if you have a cumulative probability plot for the urine data, and then you do a cumulative probability plot for the dust data for a given year, and the lines are quite parallel and move along, it gives you some sense that low air concentrations have low air samples; high concentration you have higher samples, and -- and it gives you some feeling there. And then to take it to the next step and -- and take a few cases and try to compare where that would stand using the air data, the urine data, and the source term data, it will give you some comfort that the -- the numbers are internally consistent, given that these type of comparisons rarely correlate perfectly or even greatly. I mean we've got to acknowledge that -- you know, there are a number of reasons why air samples would -- would possibly show higher exposures than urine

samples. Particularly if particle size selection wasn't done and you're just sampling the entire spectrum, much of the -- the dust may be nonrespirable, you know, that kind of thing. We take -- we take no credit for respiratory protection in any of these dose reconstructions, even though there's some indication that people did wear respirators. So somehow -- it's a difficult task to have to do this, but -- so that's why it's taking a little longer than I thought. But we are moving -- moving forward.

DR. MAKHIJANI: You will -- you'll have some of this in the next -- in the --

DR. NETON: The next four --

DR. MAKHIJANI: -- couple weeks?

DR. NETON: Yeah, I'd like to -- I'm hoping by the 13th to have some type of analysis that we can sit down and discuss.

DR. MAKHIJANI: I'm making my own notes, but I don't anticipate I'm going to get grades --

DR. NETON: No, not --

DR. MAKHIJANI: -- making summary notes.

UNIDENTIFIED: I figured that's what you were doing.

DR. NETON: That's fine.

DR. MAKHIJANI: So I can rely on them and then verify later on. Okay. So this is sort of the big methodological question in actually applying a lot of the TBD data. And here -- part of the thing, you know, in the last review that we did that kind of -- when I -- when I was doing the analysis that's in the -- in the review, there's this problem of, you know, two and three measurements and with considerable scatter. It's very important in some cases -- in some cases it doesn't matter, you know, if you've got two measurements in the lunchroom and the lunchroom doesn't really contribute anything, that -- that doesn't amount to anything. But in some cases that I showed, that the uncertainty from a single -- single operation in a set of measurements can triple your -- triple your dose estimate if you're going to 95 percentile. And so I'm just wondering -- and I personally found it, just in that short amount of time, I wasn't quite able to come up with a good suggestion as to what method you would use when you had uniformly very few measurements as to how to aggregate all the uncertainties. It just -- it wasn't obvious. So I'm wondering where you are with that.

DR. NETON: I thought, when you're talking about those individual measurements, you're talking about a very specific function, right, like some job description or some function. My thought on this was more broad-based than that, and it would be to use the facility distribution at that point. So, you know, if you don't have any confidence at all, or much confidence in the -- the very specific job that you were looking at, I don't know why -- you know, we might be able to use the facility distribution at that point which encompasses, you know, the range of values. It's just a thought. I mean, you know, but we've got a plant by year and you know the range of the concentrations. But -- but then you take a 95th percentile of facility distribution.

DR. MAKHIJANI: But how does that help you with the individual? Like you have Plant 4 and you have a lot of different things going on, you have different -- distinct things going on in Plant 4. You have the UO-2 becoming UF-4, so that's a discrete operation. And I think, if I remember correctly, that's done in Plant 4.

DR. NETON: Uh-huh.

DR. MAKHIJANI: And then they take it next door

and they load the bombs and they put them in the furnaces and that's -- even in a separate room, that's all in Plant 4.

DR. NETON: Right.

DR. MAKHIJANI: And so you've got different -- first of all, you've got different solubilities.

DR. NETON: Well, the solubility is taken care of by the bracketing, you know, whether -- we're going to pick a solubility that is the most claimant-favorable.

DR. MAKHIJANI: Okay. But if you have different -- different operations all together --

DR. NETON: Right.

DR. MAKHIJANI: -- and it seems to me -- the difficulty -- the difficulty I -- when I looked at the data sort of carefully and tried to come up with a set of calculations, it seemed to me that the calculation of measurements for each operation is actually different and so, because different things are happening, you probably construct a different distribution for each operation.

DR. NETON: But within those family of distributions, I think you -- you will find a lognormal distribution of air samples. Cure the

probability plot, you know, it's got to be a straight line if you do it in a lognormal distribution and you pick the 95th percentile. I'm -- I'm just, you know, throwing out ideas here.

DR. MAKHIJANI: Yeah, yeah.

DR. NETON: I think that, you know, if -- if your argument is that we have almost no data for that facility-specific job, then the only thing we can offer is that we would take the facility distribution and use that value and apply it to that class of workers.

DR. MAKHIJANI: I'm not saying there's --

DR. NETON: Yeah.

DR. MAKHIJANI: -- there's no -- no usable data. I think the data for air concentration do appear to be usable. I think since our discussions at Bethlehem Steel -- I mean there are still some questions to be settled, but as I think you may have noted --

DR. NETON: Yeah. Right.

DR. MAKHIJANI: -- we're not kind of putting a lot of weight where we did initially about how were these samples taken and how do we know the result.

DR. NETON: Right.

DR. MAKHIJANI: I mean that's still in the footnotes and the fine print, but it's not -- it's not -- I don't imagine it as vague because I think you presented some evidence that this can be used for -- you know, at least as a first cut -- to go ahead and think what (unintelligible). But in -- in looking at this data, it's not that you can't do anything with three measurements.

DR. NETON: Well --

DR. MAKHIJANI: It's that the uncertainties -- I'll give you a -- the uncertainties are actually bigger than what I represented in -- the last time because I just -- we didn't have any information. So one of the things I asked people who worked in Plant 4 in St. Louis last week is -- and show them the AEC information -- is how long did it take to load up one of these bombs, mix the -- and he said, you know, by the time you got started loading up -- preparing the bomb, loading the uranium, mixing it, jolting it so it was all properly tamped down, closing it and loading it, it was half an hour. And when I showed them that the AEC estimate was six and a half minutes, they all laughed. And so you've

got -- now, I don't -- the AEC doesn't actually have a jolting thing in that list, but it clearly is part of a set of operations, so maybe somebody missed something. Also, the number of operations doesn't match, so there are a number of furnaces, so I don't know how it was all added up. So actually now I have more uncertainties --

DR. NETON: Uh-huh.

DR. MAKHIJANI: -- than -- because I don't know what is the uncertainty in the time, and you're talking about the uncertainties in the most sensitive part of the operation where your air concentration is the biggest. I mean I've only looked at one as an example because -- I don't know why I picked that one. I think I had the data at hand, so -- and it was relatively straightforward to do it, so I picked it. And by chance there happened to be at least two people who were very -- very familiar with -- with -- sorry -- Plant 4 and the bomb chargers and they actually did that work who showed up in St. Louis, so I was able to ask them in detail. So it's -- I'm -- I'm just -- I'm -- if we're going to use -- if there are no bioassay data, so I agree with you on that. If you have bioassay

data, you don't have a problem. But if you're going to use the air concentration data in the TBD, I think -- it seems to me not a simple exercise to actually convert that into demonstrably claimant-favorable reasonable dose estimate. I haven't been able to (unintelligible).

DR. NETON: I don't know. I -- I'm not sure, you know, what we can say. If it's -- there's certainly uncertainties you can put about the values, I mean how certain are you, and it's -- it's, you know, you can use some statistics, too. But two measurements, three measurements with T-distributions, wherever you can add -- you know, add things on there.

DR. MAKHIJANI: Well, I guess the most straightforward question in this regard is -- I mean in the next -- since we have to present something to the Board in terms of our review, my question is are you going to show us how this is to be done, because it seems not -- to me it seems not an easy problem. Maybe you have a solution to it and then we can all agree that it is a solution. But right now I -- I can't. I don't -- I don't have one in my head or I'd offer

it to you and --

DR. NETON: Well, you know, I mean not -- there's not one answer for all your questions. You know, there's not one answer for everybody. I mean you can see what we've done in the example I showed early on where they -- they took the highest air concentration -- they attempted to take the highest air concentration measured in any facility in that year and apply it to the worker. I mean I think that is a pretty demonstrably claimant-favorable approach. I'm not unconvinced that that wouldn't work for most systemic cancers that don't concentrate uranium. So, you know, it's sort of -- you know, you have to try these approaches. But you know, that one would -- in my mind would be the most claimant-favorable approach.

MR. GRIFFON: Barring the --

DR. NETON: Barring, you know --

MR. GRIFFON: -- the raffinate questions.

DR. NETON: -- raffinate, the raffinate questions, right. We're talking now just about uranium --

UNIDENTIFIED: Multiply that --

DR. NETON: -- and then you multiply that times a

hundred and you've got your --

UNIDENTIFIED: You're done.

DR. NETON: -- your K-65 raffinate. But that -- that's possible. Now I guess at the end of the day, you know, you need to refine it. And our approach is if you can't refine it any better than what you've got, you're going to go with the unrefined estimate, which would be the maximum air concentra-- I'm not suggesting that we will do that, but that would be the fallback approach. That's that. I mean we -- we certainly probably need -- we need to think about this some more but --

MR. GRIFFON: Yeah.

DR. NETON: -- I don't know. Dave, you got any ideas?

MR. ALLEN: Like you said, it depends very much on the dataset you're dealing --

DR. NETON: Yeah.

MR. ALLEN: -- with, et cetera, the case of -- I mean you're talking about some additional uncertainties in time-weighted averages and in a situation where you only have three -- I mean three data points isn't a lot to work with any way you look at it.

DR. MAKHIJANI: Sometimes there's only one.
MS. BLOOM: And if it's all you have --
DR. MAKHIJANI: And then you really...
DR. NETON: Right. That's -- I'm suggesting the facility distribution makes no sense to me, whether it's the highest value ever measured in the facility --
MR. ALLEN: Yeah, as far as how far to break it down --
DR. NETON: Yeah.
MR. ALLEN: -- it's usually how far are we going to be able to break down where that claimant was --
DR. NETON: Right, and then what's your comfort level with that as a bracketing value.
MR. GRIFFON: I guess that's why my line of questioning on the -- can we narrow it down, this population, whoever worked with or around the raffinates, you know, and --
DR. NETON: Yeah.
MR. GRIFFON: -- separate that off because otherwise, if you go maximizing all the way, you're going to get into this almost default SEC question. I mean -- I don't know potential --
DR. NETON: Yeah.

MR. GRIFFON: -- I'm not sure.

DR. NETON: Yeah.

DR. MAKHIJANI: Well, I just -- I just have a request -- and there are three Board members here so, you know, please advise us, SC&A, in that you asked us to, you know, evaluate how the TBD might be used in dose reconstruction. And the air concentration distributions and tables are obviously a very big part of the TBD and they are intended to be applied when urinalysis data are not there or deficient in some serious way. And -- and we've agreed on that. So my request would be that, you know, in the next two weeks or so that NIOSH should propose something, otherwise it would be -- I mean otherwise we'd be disconstrained to say that we're still in the same place, that it seems difficult to do this and we don't have a proposed method to apply it, which would -- so it would be nice to have something from NIOSH as a proposed method --

DR. NETON: Well --

DR. MAKHIJANI: -- whether it is this what you've been saying, or something that's applied to some case, or maybe two or three different approaches --

DR. NETON: Right.

DR. MAKHIJANI: -- for different cases, as you've been saying.

DR. NETON: I think you're right because, you know, you -- you -- a lot of this is dependent upon what the answer to your first question was, which is how many cases don't we have any bioassay samples. If the answer is, let's say theoretically ten -- which I think it's probably more than that but let's say it's -- then this question becomes less of an issue. I mean okay, we're going to have to --

MR. GRIFFON: Yeah, that's a good starting point --

DR. NETON: Well, that's what I'm saying. That's a good starting point and then you say okay, of those ten who have no bioassay samples -- because we have statements that say virtually everybody that needed to be bioassayed was. Now whether you believe that or not -- but let's start there and then look at the job title, and it's a secretary, the question is a lot different, you know, so what do we use then. And -- and should we not go back and use the coworker urine data and -- and, you know, instead of the air

monitoring data because there's so many different angles that one could take on this. So just because there are tables of air data does not mean we're constrained to use them if you don't have bioassay data, so --

DR. MAKHIJANI: Yeah. Well, I'm not --

DR. NETON: But you're right. You've raised an issue --

DR. MAKHIJANI: -- suggesting that. I'm just saying that just from my -- you know, I've been made the point person to give our team --

DR. NETON: I understand.

DR. MAKHIJANI: -- the draft of this and I promised them that I'd do that, you know, in the --

DR. NETON: Right.

DR. MAKHIJANI: -- next coup-- two -- 10, 15 or 20 days I'm going to give them a solid draft, and I -- whatever the proposed methods are, I need to be able to say something about that.

DR. NETON: But part of that is what Dave and I were just saying, though, is it's -- it's almost not a fair question to say exactly what method you're going to use for -- for all cases because --

DR. MAKHIJANI: Yeah.
DR. NETON: -- it doesn't apply. There is no fixed answer to these question.
MR. GRIFFON: Yeah. I guess -- I guess that's not fair, you're right --
DR. NETON: Yeah.
MR. GRIFFON: -- and I think -- I think --
DR. NETON: NIOSH does not have a standard method to apply when there's no bioassay data. Well, guilty, but I think for good reason. There are -- there is no standard approach that should be used. I don't think I'd want to constrain ourselves to say every time you have no bio-- you know --
MR. GRIFFON: Right.
DR. NETON: -- so that's my point is --
MR. GRIFFON: Right.
DR. NETON: So you need to be careful in how this question is raised and --
MR. GRIFFON: But I think you can present it in such a way -- I mean, you got to be -- maybe be careful presenting --
DR. NETON: Yeah, I think --
MR. GRIFFON: -- another theoretical model because that --

DR. NETON: Well, no. It won't be a theoretical model, either.

MR. GRIFFON: No more theoretical models but --

DR. NETON: But I think a listing --

MR. GRIFFON: Right.

DR. NETON: -- of approaches.

MR. GRIFFON: But also, and I think most important to me, is -- is just some assurance that each one of those tools in your toolbox can be used. They're not so rusted that they -- you know. For instance, the air sampling -- just to go back to the raffinate issue, you know, we're going to use this approach for people who were likely exposed to, you know, the Air Force -- or the airport cake -- Air Force -- airport cake, you know, type raffinate. Well, can you tell me, you know, at the Board meeting, do you have a way -- if you're going to use that option, do you have a way of identifying who was and was not exposed? Because otherwise, how do we define this class? I mean I guess that's -- that's --

DR. NETON: Right.

MR. GRIFFON: -- you know, one thing that -- you can say you've got all these tools, but if -- if they don't function in the reality of information

you have about your claimants -- so -- so I guess that's what we're looking for is some assurance that -- that --

DR. NETON: Right.

MR. GRIFFON: -- you know, some of those ifs you can --

DR. ZIEMER: Jim, let me also ask this question. Can you characterize raw job descriptions for most of the Mallinckrodt people? The example we had earlier today, we didn't know where that woman -- I think it was a woman --

DR. NETON: Right. Yeah, I think we have job --

DR. ZIEMER: Does that tend to be the exception on Mallinckrodt? Are there job descriptions of --

DR. NETON: Yeah, most of workers we have some type of job description -- or job title, let's put it that way.

DR. ZIEMER: Or title, so you could distinguish between a Plant 6 production line versus a secretary type of thing?

DR. NETON: We have a lot of that information, and in general I think -- yes, I agree. I think we know by plant and even more specifically by, you know, operator, chemical operators --

DR. ZIEMER: Right.
DR. NETON: -- maintenance workers, that sort of thing, you know. We always have some trouble binning people in the plant once you get there between -- as Arjun pointed out correctly, electrical -- electrical workers tend to be maybe less exposed as chemical operators in some cases so -- but yeah, we -- we could do that. We could identify who was where, to a large degree. This raffinate issue though, is going to be sticky. I mean I -- I think at the end of the day if we can't -- if we could identify that the person was in the plant and exposed, and I don't know that there's -- you know, you mentioned this SEC territory. I'm not comfortable saying that just because we would have to say that all people maybe were raffinate workers, that would necessarily move it down that path. I mean --
DR. ZIEMER: Right.
DR. NETON: -- that's, you know --
MR. GRIFFON: It may not be --
DR. NETON: Yeah.
DR. ROESSLER: Looking toward the future of other potential SEC petitions, is this raffinate something -- this will set a precedent, whatever

is decided here, for future cases? I'm looking across the board at the consistency situation.

DR. NETON: There -- there' s a finite number of -- of sites, I think that -- that processed raw ore. I mean Harshaw comes to mind I guess --

UNIDENTIFIED: Fernald.

DR. NETON: -- Harshaw Chemical, Fernald to a certain extent, but there aren't many of the DOE sites that -- that did this, you know, they started with raw. Now uranium mills, that's a different story. But I think there may be one uranium mill in covered facilities, I think. I think -- but there aren't that many compared to the people who actually took the finished product that these folks made, the uranium metal, and then started rolling it and machining it and what-not so...

DR. MAKHIJANI: So here -- here the problem is I think much more complicated than in most places because of this raffinate being brought back. Because the pitchblende was so rich that the raffinates themselves were comparable to a lot of uranium ore. You know, they had one -- one percent uranium in them. And so they were processing one percent uranium, so it was -- you

know, they had essentially ore sitting out at the airport except it had a hundred times more radium than ore. And so I think Mallinckrodt and maybe one or two other places may be kind of unique in that -- even at Fernald they did not have -- so there you have equilibrium, which at least in principle is -- is sort of simpler to handle. So you have uranium in the urine and then you go back and you can do your isotopic ratios. Here, it's -- it's sort of much more complicated because you have the disequilibrium from the reprocessing of raffinate. I don't know. I'm -- I'm not aware that there were a lot of sites that --

DR. NETON: No, I don't think so.

MS. BLOOM: I think the --

DR. MAKHIJANI: I mean this is the only one that I know --

MS. BLOOM: -- reprocessing of it would be unusual.

DR. MAKHIJANI: I think maybe Cotter*. Did Cotter* do some of that, maybe?

MR. ALLEN: I'm not sure.

DR. ROESSLER: (Unintelligible)

DR. NETON: That sounds good. It's not going to

be a large number of sites. I mean I don't know anybody that did complete isotopic measurements, especially back in these days, for these -- these type of --

DR. ROESSLER: What my bottom line I guess is, in fairness to all sites, is that they're all treated scientifically the same, not -- not treated differently because of particular advocacy groups or anything like that. I think that's where we have to make sure that it's scientifically solid. And if the sites are a lot different then it's hard to do that.

MS. BLOOM: I think one other thing that plays into it is sometimes you have much better information. Mallinckrodt was so well-studied that you have much more confidence in the job titles for that site than you do at most other sites where job titles are based on memories 50 years later by either the -- the Energy employee or the claimant, and so there's much less certainty and not as much confidence in stratifying the exposures there. I think there's -- you know, the process needs to be fair. Does it result in the same exposures everywhere? No. Does that seem equitable? It depends on your

point of view.

DR. NETON: Well, the trick is to nail down the isotopic composition of the raffinates, and Janet has given us some hints as to what those are. And it actually may end up being that one of the raffinate streams will -- will overbound the others. I mean, you know, we're worried about thorium 230. Thorium 230 for -- for systemic organs is -- nonmetabolic organs is not an issue.

MR. GRIFFON: Probably not that big of one.

DR. NETON: You know, so if one assumes that we're working in a -- in a stream with a hundred to one radium to uranium, you're going to -- my guess is, to really be claimant-favorable to those systemic organs and -- and yeah, we need to develop a coaching approach that you guys can all understand and -- and demonstrate that, you know, this is the path we're going to go down with that.

MR. GRIFFON: Great. Thanks.

DR. MAKHIJANI: Okay. Radon data. Now we have this -- that document from Mason, you know, in which he said that radon data were not really suitable for dose estimations. He said -- I think he said something that --

DR. NETON: I looked. I tried to find that, Arjun. I can't -- is it -- is it in the profile, or is it another document?

DR. MAKHIJANI: It's not in the profile.

DR. NETON: That's why I couldn't find it.

DR. MAKHIJANI: It's -- it's a Mason document --

DR. NETON: I remember talking about this.

DR. MAKHIJANI: -- and I believe I have it in my computer, but --

MS. BLOOM: Is that the one that says that the average -- they don't know how to apply the average radon data to a worker. My understanding was he wasn't saying that the data were no good, they just didn't feel that they -- that they had sufficient time and motion studies to apply that data to the workers for, you know, providing the epidemiological kind of data that they were looking for.

DR. MAKHIJANI: Yeah, I don't think it was a wholesale condemnation of the data as invalid or anything.

DR. NETON: Right.

DR. MAKHIJANI: I agree --

DR. NETON: And I think that's where --

DR. MAKHIJANI: -- let me try to --

DR. NETON: All right. My recollection is -- is what Cindy's saying is -- and I think I may have seen this.

MS. BLOOM: But I think that makes it -- not that the data is not usable for dose estimation, it's probably not usable for risk estimation in terms of developing epidemiological studies. In terms of a compensation program I think that the data is --

DR. ROESSLER: Makes a big difference.

MS. BLOOM: -- is probably very reliable -- you know, not very reliable, but --

DR. NETON: Can be used for compensation purposes, I think. And he certainly was not speaking from a compensation program perspective.

I believe we have somewhere in the vicinity of 2300 radon measurements. Is that right?

MS. BLOOM: And those are the breath analyses.

DR. NETON: Oh, no. Those were -- but I think there's also a few --

MS. BLOOM: Oh, right.

DR. NETON: -- thousand just area radon measurements.

MS. BLOOM: I think you're right.

DR. ZIEMER: Do -- do you know what Mason meant by dose estimates in that time frame?
DR. NETON: I think when they went back and they tried to reconstruct the doses to the workers in --
DR. ZIEMER: Actual --
DR. NETON: -- time frames --
DR. ZIEMER: - organ doses? Because --
DR. NETON: Oh, yeah. I believe so.
MS. BLOOM: Yes.
DR. NETON: Yeah. They were coming up with --
DR. ZIEMER: Because really the -- the legal limits were working-level months. They weren't dose limits.
DR. NETON: Right. Well, effectively they were. I mean there were some exposure limit, some exposure value --
DR. ZIEMER: More like an exposure limit, yeah. But I mean --
DR. NETON: Right.
MS. BLOOM: They weren't looking at the limits whether -- they -- they were doing dose.
DR. ZIEMER: Dose in what kind of use?
MS. BLOOM: Lung doses.
DR. ZIEMER: Lung doses?

DR. NETON: Radon though? I don't know that I saw that they were doing radon lung doses.

MS. BLOOM: Well, the radon they decided not to do because of the question -- but they were doing the uranium --

DR. NETON: See, those were sort of independent --

MS. BLOOM: -- I think they had radium in there as well.

DR. NETON: You know, there's a certain -- there's a maximum permissible body burden or lung burden for uranium, then you've got a maximum permissible exposure for radon. And in my mind, back in those days they were independent source terms, not additive.

MS. BLOOM: Uh-huh.

DR. NETON: In fact, I think even at DOE sites today, there's (unintelligible) question as to how that works, but -- so I think -- I think what he was saying, though, is we could not go back and do an accurate reconstruction of an individual worker's working level month dose -- or working level month exposure.

DR. ZIEMER: Level month --

DR. NETON: Exposure.

DR. ZIEMER: Okay.
DR. NETON: And that's probably true, you know, you -- you couple it with a few thousand measurements with -- with, you know, no time and motion studies that they recorded. But I think for our purposes, using these radon data, it -- we can use them in a compensation program and use claimant-favorable values where necessary, pick the highest radon concentration in the plant that we need be, or in some cases -- as I talked about earlier -- just using the outdoor radon concentration of somewhere in the vicinity of 19 picocuries per liter is sufficient to demonstrate the lung cancers over 50 percent. If it's not, it doesn't take a lot of radon to -- to move these into the 50 percent-plus range.
MR. ALLEN: The radon would apply to people working with pitchblende or with the raffinates with lung cancer and I can't --
DR. NETON: Well, see, yeah. You take --
MR. ALLEN: -- the real -- the real data there is generally enough to compensate them.
MR. GRIFFON: Right.
DR. NETON: The trickier part then is the people who were not process-type operators, in general

occupants of the site. Then you have these outdoor radon concentrations which I'm assuming we would assign. I think in that one year there was 30 measurements made in that one year that I looked at. We would assign that value for their -- for their exposure. And I don't know -- I mean it may be a moot issue. It may not be relevant in some ways because we may have already done all the lung cancer. I don't know. I have to look through the database. We've done 66 dose reconstructions, most of which were lung cancers. And outside of lung cancer, I don't view the radon as being a contributor to (unintelligible).

DR. MAKHIJANI: (Unintelligible) it's in the review that we did, and the document is notes and summary by M. Mason, August 1975. And what it says here, (reading) There are fragmentary measurements of air radon beginning about 1946 and continuing through about 1955. I view them as having little if any use as a measure of magnitude of individual exposure. These data can be used to show that certain jobs or job categories did entail possible exposure to radon within a mini -- max/mini range. Any interpretation beyond that would be erroneous, in

my opinion.

DR. NETON: Okay.

DR. MAKHIJANI: So --

DR. NETON: That speaks to compensation program --

DR. MAKHIJANI: Yeah.

DR. NETON: **--** usage, though.

DR. MAKHIJANI: So -- so that's what you're saying is that the only way -- so radon data -- the way you would resolve this comment is that you would use radon data for the maximum --

DR. NETON: Right.

DR. MAKHIJANI: -- of -- in order to put an upper bound but not to --

DR. NETON: Right.

DR. MAKHIJANI: -- we couldn't use it in any more refined way.

DR. NETON: We wouldn't be doing time weighted average values or anything of that nature, just no way we could do that.

DR. MAKHIJANI: So that will resolve that question. I had --

DR. NETON: There was some pretty high values too, in there. I mean it was --

MS. BLOOM: What were some of the values?

DR. NETON: Oh, I think there was some that were -- I want to say 1000 picocuries per liter or something like that.

DR. ROESSLER: (Unintelligible) say 600.

DR. MAKHIJANI: (Unintelligible) pretty nasty stuff.

DR. NETON: But since you get these in a confined space at all --

DR. ROESSLER: Of course that will be on the record. Holy cow.

DR. MAKHIJANI: That's my line, isn't it? Where I come from -- sorry.

DR. NETON: I just read something about that, they're consolidating all (unintelligible) Okay. All right. Now that -- that takes us through --

DR. MAKHIJANI: Yeah. I think the external dose question we're going to leave till tomorrow when Hans is here.

DR. NETON: I appreciate that. I just will have better intelligence here tomorrow to speak to that.

DR. MAKHIJANI: But --

DR. NETON: Yeah, let's get to --

DR. MAKHIJANI: -- (unintelligible) question about ABC or if -- if -- Dr. Ziemer, did you ask

whether we're going to go through the summary of the -- the table that we have? We could do that --

DR. ZIEMER: Well, I was -- I was really --

DR. MAKHIJANI: Are you going to be here tomorrow?

DR. ZIEMER: -- just asking where SC&A and NIOSH were with respect to the issues raised in your report.

DR. MAKHIJANI: Yeah, right.

DR. ZIEMER: And I -- I think what you told me was that, based on this information, you would be in a position to revise this table appropriately and maybe identify if there are any outstanding issues; is that correct?

DR. MAKHIJANI: Yeah. It -- it may be that we should go to this table and see what the internal dose questions are remaining and take them up so that we can deal with them.

MS. BLOOM: Do we have this table?

DR. MAKHIJANI: Yeah. I think a review of --

DR. ZIEMER: It's in their actual review --

MS. BLOOM: Okay.

DR. ZIEMER: -- SC&A review of Rev. 1.

DR. NETON: We don't have it with us but --

DR. MAKHIJANI: Would you -- or I can open my file.
MS. BLOOM: I think I've got it on my computer --
DR. MAKHIJANI: You can use mine and I'll open my file.
MS. BLOOM: Well, here. I've got it here -- Thank you.
DR. MAKHIJANI: I'll just go to it in my computer.
(Pause)
DR. MAKHIJANI: There's a breathing rate question I think is the first in that list that we haven't yet covered.
DR. NETON: Right.
DR. MAKHIJANI: It's the third item in table 1.
DR. NETON: Right. And we had talked about -- I think we went through these at one point in our phone conversation and --
DR. MAKHIJANI: Yeah.
DR. NETON: Yeah. We're -- we're no further along on this, other than I think the last time I spoke with you we were attending -- intending to address this in a -- in a generic way so it would apply to a number of different facilities because this has come up both at Bethlehem Steel and now

Mallinckrodt. And I -- I can tell you right now we're -- we have not been able to find any real definitive evidence of constant heavy breathing at any public -- published reports of the constant heavy breathing at places like steel mills or even Mallinckrodt. The heavy breathing rate, if -- this will be in our analysis -- speaks to some pretty demanding tasks such as, you know, sledge hammering, pushing a wheelbarrow around with 75 pounds of weight on a continuous basis, that kind of stuff. And so this will be addressed in a -- under separate cover and be referenced in here. But right now we're not inclined to say that Mallinckrodt should be 1.7 cubic meters per hour on a constant basis.

DR. MAKHIJANI: Well, we didn't actually -- you know, we actually modified -- after the discussion on Bethlehem Steel I went back a little bit. Bethlehem Steel was, you know, imaginably hard work a lot of the time, but I actually went back and we discussed this. And this is written somewhat differently and in the time weighting discussion this comes up in a more elaborated way in that there's some tasks that may last at least 15 minutes or, you know, when

they're really tamping these bombs and they're loading the uranium and they're shoveling stuff, it may be, you know, five minutes or ten minutes half a dozen times a day. But those happen to be the operations where there's heavy dust. For instance, they may -- may happen to be -- so you have a kind of a combination of -- that workers are breathing more hard at times when they're doing work that's more dusty. And so I think we've -- at least in this review -- refined our own thinking a little bit along in the sense that heavy breathing should actually -- in the context of time-weighted data -- be considered, you know, in a job-specific way or even in a time-specific way, or both.

DR. NETON: Right.

MS. BLOOM: I think we'd be hard-pressed to do that, just in terms of modeling things. I think we also tend to pick the more soluble or the type -- absorption type that's going to result in a larger dose. We pick times when we apply these over -- when we apply things for 2000 hours for a standard work year when we know workers weren't in those areas for that period of time. So I think there's lots of things that weight that --

those little spikes. We also take -- we have uncertainty in the metabolic models that we account for when we get to the dose reconstructions.

DR. NETON: Yeah. I -- I think -- I'm going to try to get my terminology straight here, but the heavy exercise model assumes heavy breathing for one hour out of the eight-hour work shift. That's my recollection, or -- and the terminology might be --

DR. NETON: -- wrong.

MR. ALLEN: (Unintelligible) workers in these --

DR. NETON: Heavy worker -- heavy worker, heavy exercise for one hour --

MR. ALLEN: That's right.

DR. NETON: -- which would be at -- at the high rate. And I don't think we're fundamentally opposed to using that where it might make some sense. I think -- I -- I thought early on -- the original comment was that SC&A's position that we should go beyond the highest exposure category in the ICRP models and concoct some new model that would be heavy breathing for more than one hour per work shift, and we have been hard-pressed to come up with any indication that that's the case

in -- in the literature. I mean I guess finding -- not finding information does not prove this, but there's certainly nothing out there and in -- in a pretty detailed review of the ICRP publications, some of the heavy breathing was really developed in uranium -- I mean in -- in mining. Uranium mining I believe is what it referred to. Anyway, we're going to have this written up in more detail.

MR. GRIFFON: Okay. Was there -- was there -- also I thought more of the outstanding issue was the -- the nasal versus oral breathing.

DR. NETON: That's another issue, right, oro-nasal versus --

DR. ZIEMER: You know, in general --

MR. GRIFFON: I thought that was the bigger outstan-- I thought we resolved that --

DR. ZIEMER: -- (unintelligible) deposition it seems like you'd get more swallowed stuff --

DR. NETON: You mean the heavy breathing?

DR. ZIEMER: -- with the oral -- with the oral. What happens --

DR. NETON: The oro-nasal breathing -- if you breath through your mouth preferentially you'll increase the dose. It's -- it's --

DR. ZIEMER: To the lung?

DR. NETON: What happens is you end up not filtering out the stuff through the nasal passages as much and so it's a direct deposition into the lungs.

DR. ZIEMER: Still goes down through --

DR. NETON: Right. The -- the ET-1, as they call it, acts as a pretty efficient filter.

DR. ZIEMER: Right, right.

MR. GRIFFON: And there's a default in ICRP for a certain fraction going through -- through the mouth, right -- I think.

DR. NETON: Well, it assume-- once you get the heavy breathing then it switches to a certain -- 50 percent I think oral breathing. So even most people switch to oral breathing 50 percent of the time when you have a heavy breathing rate. On the other side of the coin, there are people that are preferential nose breathers who only breath through their nose --

MR. GRIFFON: Right.

DR. NETON: I mean I know more about this than I ever really cared to.

MR. ALLEN: Me, too.

DR. NETON: So I think -- first of all, I think

this is not really very relevant when we have urine data. Right, Dave? I mean the urine data would --

MR. ALLEN: Right --

DR. NETON: Bioassay --

MR. ALLEN: -- systemic --

DR. NETON: If you have bioassay data and you're talking about systemic organs, it's -- it's not -- not an issue because we're just modeling the -- you know, the deposition directly. But we -- we have not been able to convince ourselves that oro-nasal breathing is any different than what the ICRP models predict. We've done some analyses where you can look at -- say where you do have urine data -- help me out here, Dave. I thought -- with the type M material there's no indication that the people were more mouth-breathers -- or no, is that -- what did we do --

MR. ALLEN: I'm not sure where you're heading.

DR. NETON: We've looked at the oro-nasal breathing issue for Bethlehem Steel. I mean that's one thing that we're getting ready to put out.

MR. ALLEN: Yeah. And Bert-- Simonds -- using some Simonds data --

DR. NETON: Using some Simonds data --
MR. ALLEN: -- and (unintelligible) all followed --
DR. NETON: It looks like the standard ICRP default models are not inconsistent or inappropriate to be used. If you take the urine data, compare it to the air concentration data, the air concentr-- well --
MR. GRIFFON: Yeah.
DR. NETON: -- the air concentration is much, much higher --
MR. GRIFFON: Right.
DR. NETON: -- than what the predicted urinary output is so -- there's some empirical evidence of this.
MR. GRIFFON: But there's a lot of other factors in -- combining those two things --
MS. BLOOM: Well, I would think that the solubility is what really --
MR. ALLEN: Well, I think if you take the Simonds Saw, if you take that time-weighted average, use a 1.2 and not a 1.7 and use the type M solubility for U-308, 'cause it's more like 140 days, then you'll hit the mean of the urinalysis pretty close with the average -- time-weighted average

and you'll hit the high urinalysis with the highest time-weighted average. It -- it fits pretty well.

DR. NETON: So yeah, I'm getting into the Bethlehem Steel issues, but --

MR. ALLEN: Oh, yeah, you know.

DR. NETON: Right now we're not -- I'm not -- fundamentally I'm not opposed to adjusting the heavy breathing for certain positions as long as it's consistent with the default -- the highest default ICRP model. To go beyond that, we just really have no evidence to -- to hang our hat on that that's the case.

MR. ALLEN: Right.

DR. MAKHIJANI: So -- but we won't expect this before -- in the next few -- couple of weeks.

DR. NETON: No, probably not.

DR. MAKHIJANI: But it's not a thing that, in principle, can't be addressed. This is --

DR. NETON: Yeah, well --

DR. MAKHIJANI: -- this is something that we can address. It's not a --

DR. NETON: No, this is --

DR. MAKHIJANI: -- question or modeling question like raffinates that we have -- it's not that

kind of a question.

DR. NETON: This is an approach.

DR. MAKHIJANI: Right.

DR. NETON: This is an approach issue.

MS. BLOOM: Would this be -- I guess I sort of see it as you have to identify who you're applying this to --

DR. NETON: If at all.

MS. BLOOM: -- and that gets back to the -- to everyone.

DR. NETON: Well, then you get in a situation where you have a job category. Let's say for instance we would make whoever the bomb operators were heavy breathing. Then if they -- if it were known that they were a bomb operator, you would apply that. But then -- then you get in a situation where I don't know what the person did and then you apply it. The more special cases you have, the harder it is to --

MS. BLOOM: Yeah.

DR. NETON: -- to apply.

MS. BLOOM: And I think it gets tough and I think -- well, I guess I'm concerned about having two choices out there because I think --

DR. NETON: I agree. It makes it -- makes --

there's some --

MS. BLOOM: There are other ways --

DR. NETON: -- there's some rationale --

MS. BLOOM: -- to capture it.

DR. NETON: There's some rationale for making just one choice. And if we do, it would be the conservative one. For instance, I noticed here we moved down to 1.2 cubic meters per hour. I'm not sure what happened there. I mean --

MS. BLOOM: From the 1.4?

DR. NETON: Right.

MS. BLOOM: Because that's not an option in IMBA. You can't model doses with 1.4.

DR. NETON: Right.

MS. BLOOM: You can model intakes but --

DR. NETON: Right.

MS. BLOOM: -- not doses.

DR. NETON: Okay. We -- yeah. Okay. We'll talk about that.

DR. MAKHIJANI: Okay. The -- the incidence question. Now --

DR. ZIEMER: Which page are you on?

DR. MAKHIJANI: I'm in -- I skipped the raffinates under -- because we already covered that, and then under that on page 7 --

UNIDENTIFIED: (Unintelligible) page 7?

DR. MAKHIJANI: -- on top of page 7, incidents, high risk jobs, intakes (unintelligible). So let's take incidents. I mean we -- you had an approach to incidents. We did some -- Mike Thorn ran some quick numbers that, you know, haven't been kind of checked. I just told him to do some normalized -- going backward from one microgram per liter into intake and dose at various times. You know, if you had an impulse intake after an accident just after the last urinalysis, you get pretty big numbers and quite -- well, depending on the organ. But you get -- you know, you get -- especially if you have annual -- if you have an annual bioassay, you're going to wind up with very huge numbers. In any case, I -- I don't know if you've -- and then when you apply that -- because in all the cases that we've looked at, normally you consider a chronic intake. You don't consider an impulse intake or a one-time intake. So my question about this is obviously there's going to be -- there's going to be a huge difference in -- in estimated dose depending on whether you assume a chronic intake or impulse intake.

MR. ALLEN: When you say there's huge numbers, are you talking intake or are you talking dose?
DR. MAKHIJANI: Both, you -- because --
MR. ALLEN: Because --
DR. MAKHIJANI: Yeah.
MR. ALLEN: -- because the only way you can assume --
MR. GRIFFON: Depends on --
MR. ALLEN: -- an acute intake from that urinalysis that occurred like a year before is to assume that he was not exposed for the rest of that year.
DR. MAKHIJANI: Well, that's the model that you have proposed.
MR. ALLEN: And if you do that, the doses usually aren't that much different than a chronic intake.
DR. NETON: Yeah, that's true.
MR. GRIFFON: Plus the numbers (unintelligible) --
MR. ALLEN: You get a lot of intake --
MR. GRIFFON: -- what I've done just --
DR. NETON: You either come down like this or you go like this (indicating).
MR. GRIFFON: Right.
DR. NETON: They -- they intersect at some point.

MR. ALLEN: They're not that different.
DR. MAKHIJANI: (Unintelligible) not that different.
MR. ALLEN: (Unintelligible) a million scenarios and then you can't --
MR. GRIFFON: Right. Lots of scenarios.
DR. MAKHIJANI: Okay, you come up with big numbers anyway because I didn't do a comparison.
MR. ALLEN: You see it typically from what we've seen, you know, playing with incidents in between all the chronic intakes, is that the -- the big doses come from the long-term low -- low intake rate that's just continuously going day after day after day. It seems to be where the big doses come from, and an acute intake every now and then just doesn't seem to add that much to it.
MR. GRIFFON: I would agree -- generally agree with that.
MR. ALLEN: Let me ask Jim (unintelligible) --
MR. GRIFFON: -- I've done some --
DR. NETON: Spikes just --
MR. GRIFFON: I've modeled it with all different acute intakes over all these spikes or just averaged it and you get almost the same --
DR. NETON: We've been pretty -- we've been not

real good about verbalizing that and convincing people but that's --

MR. ALLEN: Yeah.

MR. GRIFFON: Yeah.

MR. ALLEN: When working with the datasets a lot, that's what you end up seeing.

DR. MAKHIJANI: We actually have not gone and -- and done this comparison. I just -- we just ran some numbers for assuming an acute intake and -- but I didn't actually -- I assumed they would be bigger but I didn't (unintelligible).

DR. NETON: But you've looked at some of the values on that air sample table. We're talking about ten to the seventh picocuries per year intakes. I mean --

MR. ALLEN: They're huge -- huge intakes. These people --

DR. NETON: That's why these, you know, lung cancers are by and large, you know, well over 50 percent.

DR. MAKHIJANI: Okay. So are we saying that -- that this -- that the chron-- that the intake from incidents specially -- I mean blow-outs were very frequent. I mean that's -- that's very clear. And then you had -- you had these

maintenance people and electricians and the clean-out people that went into these furnaces, and they had very frequent blow-outs throughout -- until '57, actually. I came across a document in the file of Mr. B. there, who was -- who -- you know, which indicates very frequent blow-outs as recently as -- as 1957.

DR. NETON: Yeah.

DR. MAKHIJANI: And it's the DOE file, and I can give you -- it's a huge file so I can give you the page number. It'll take you a long time to find it.

DR. NETON: Right.

MR. ALLEN: (Unintelligible) occurred at Fernald (unintelligible).

DR. MAKHIJANI: So if it's not an issue then --

DR. NETON: It occurred at Fernald pretty frequently, as well. Dave worked there when -- when they happened. But, you know, generally the approach is that they clear the area when a blow-out occurs.

DR. MAKHIJANI: Yes.

DR. NETON: You're not going to be standing there --

DR. MAKHIJANI: I confirmed that.

DR. NETON: -- breathing all this. So you clear the area so, you know, you're exposed to a small -- a large mass of -- of radium in the air for a fairly short period of time. So these things, you know, would have to had occurred very, very frequently in order for the collective -- and then essentially you end up with a chronic exposure.

MR. ALLEN: I was going to say --

DR. NETON: I mean there's always a trade off between --

MR. ALLEN: To answer the question how many acutes make a chronic?

DR. NETON: How many acutes in a chronic and then, you know --

DR. MAKHIJANI: Actually that may be the more convincing point because we -- all evidence is that blow-outs were frequent. And my -- and so we discussed this and, you know, summarized -- my notes are not in shape to be distributed. All the typos even haven't been taken out of it but --

MR. GRIFFON: But I think this might be a good thing for you to demonstrate in a public meeting -- for instance, in St. Louis -- that you've

looked at certain cases, not hypothetical, and you've -- you know, since you're -- you're -- there's some concern about accidents and incidents, in some cases you assume that it was an accidental exposure from the beginning of the year because you only have yearly urine samples on some of the people or whatever, and you model it with the chronic intakes and -- you know, I mean -- you know, demonstrate just what we've been talking about. I think it's worthwhile.

DR. NETON: Well, see, you could model it with a chronic like we would, and then demonstrate how many blow-outs or --

MR. GRIFFON: Right.

DR. NETON: -- these incidents could have been versus, you know, and what the potential exposure could have been in a blow-out. Of course, you know, putting a cap on the air concentration would be a little bit difficult I think, but -- but what could -- what could have been the maximum amount in air, given these incidents, and still have that urine sample --

MR. GRIFFON: Right.

DR. NETON: Yeah.

DR. MAKHIJANI: That -- you know, it would --

that would help my life. It would really simplify --

MR. GRIFFON: Yeah.

DR. MAKHIJANI: -- my write-up a great deal because this is a very significant issue as we have raised it. And if we can have a calculation that says, you know, with once every two weeks and you have a bioassay once in three months or six months and you assume a chronic intake, they look pretty much the same.

MR. GRIFFON: And the other reason this -- this is important is --

DR. MAKHIJANI: And I -- I agree, they probably will.

MR. GRIFFON: The other reason that's important I think is 'cause, you know, part of the CATI interview process is were you involved in any incidents or accidents. These people remember these kind of blow-out things.

DR. NETON: Sure, yeah.

MR. GRIFFON: They tell you about them and then they say well, you didn't account for that, you know --

DR. NETON: Well, right.

MR. GRIFFON: -- so --

DR. NETON: I think there's a blanket statement in all the dose reconstructions to say we evaluated those and our model is --

MR. GRIFFON: Yeah.

DR. NETON: -- more generous but --

MR. GRIFFON: But it's -- yeah. They see that as boilerplate language that's like yeah, they didn't really -- yeah. So --

DR. NETON: So -- okay. You've got a fair handle on that, Dave? 'Cause Dave's going to have to help me with this.

MR. ALLEN: Do you want some sort of hypothetical type of --

DR. MAKHIJANI: Well, with some-- somebody that worked in Plant 4 --

DR. NETON: I would take a case.

MR. GRIFFON: Just take a case. Yeah.

DR. NETON: Let's take a guy who we modeled and did his integrated chronic exposure for four or five years and say okay, let's assume that he had some blow-outs -- that was involved in incidents and show how --

MR. ALLEN: Use his urinalysis and model it chronic and then model it chronic with a number of --

DR. NETON: Of acutes to --
MR. ALLEN: -- acutes --
DR. NETON: -- show what happened --
MR. ALLEN: -- (unintelligible) with it?
DR. NETON: Right. And that would effectively drop the chronic down over those periods because you can't --
MR. ALLEN: Right.
DR. MAKHIJANI: Right.
MR. ALLEN: Yeah, we can --
DR. NETON: Yeah.
MR. ALLEN: I'm trying to think whether I already have that.
DR. NETON: Yeah.
MR. ALLEN: Okay.
DR. NETON: But that would be a -- I think that would be a very compelling example to show that -- because we've been saying this repeatedly for a while now, and I've always felt that we -- we've done a good job saying that it's in there. You know, it's -- it's actually covered.
DR. MAKHIJANI: But I agree that the frequency of the blow-outs actually, in the case of blow-outs, it makes -- makes the -- would make the difference very small in any case.

DR. NETON: Right. Yeah, I mean --
DR. MAKHIJANI: But they're more -- much more frequent than the bioassay.
DR. NETON: Right. Right, but you know, if there are -- if there are 365 blow-outs in a year, then you've got -- the chronic covers blow-outs because every year -- every day you've got 365 acute intakes that are covered.
DR. MAKHIJANI: All right. This large particle ingestion business, you said that you are evaluating that or not evaluating? I don't remember. That's the item that's under incidents.
DR. NETON: Yeah. This is -- this has -- this is - has more to do generically with the ingestion model that we're using. This is not just a Mallinckrodt issue, I believe.
DR. MAKHIJANI: Yes.
DR. NETON: I'm going to need to get back to you on this. I think -- you know, our statement is that if you're using urine samples, it's --
DR. MAKHIJANI: Yes.
DR. NETON: -- it's somewhat covered. But I don't know. Dave, unless you can answer this, I -- we've gone through this for the Bethlehem

Steel analysis, as well, and I just don't remember exactly where we ended up on the logic path on this.

DR. MAKHIJANI: Now, in regard to the urine samples, how do you partition between the ingestion and the inhalation because you've got, you know, one -- one datapoint (unintelligible) notes with different metabolic implications.

MR. ALLEN: We almost always assume it's inhalation, which gives you a higher dose than the ingestion --

DR. MAKHIJANI: Is that -- is that generally true, because I haven't done that.

DR. NETON: I think inhalations always in general are going to give you a higher dose.

MR. ALLEN: For uranium definitely, and I think --

DR. MAKHIJANI: For all organs --

MR. ALLEN: Yeah, because the --

DR. MAKHIJANI: -- including colon and so on?

MR. GRIFFON: And then you'd say -- yeah. And then my understanding, from what you've done on other cases, is that you take the most conservative class going backwards and going forwards, right? So it could -- you could switch

classes.

MR. ALLEN: No, we don't do that --

MR. GRIFFON: Never do that?

DR. NETON: We -- we try to at least be scientifically consistent.

MR. GRIFFON: Oh, okay. I thought -- I thought in some cases you were saying that you --

DR. NETON: No, we tried both -- you know, we try the most conservative approach. But once we pick a pathway --

MR. GRIFFON: Okay.

DR. NETON: The only place we really diverge from that is -- is an external exposure when we assume a chronic exposure for neutrons and an acute exposure for photons, even though they were in the same batch, but that's because of the DDREF -- or the -- yeah, the DDREF.

MR. GRIFFON: DDREF.

DR. MAKHIJANI: Okay. So this -- this ingestion dose, as it is ingestion of large particles, comes in only when you're using air data for inhalation because then you've got a separate item to account for, rather than when you're using bioassay data.

DR. NETON: Right.

DR. MAKHIJANI: When assuming just one pathway for --

DR. NETON: Bioassay data is an integration of all your -- your ingestions and we pick the most conservative pathway.

DR. MAKHIJANI: Okay. So that -- that kind of limits the impact of this comment for Mallinckrodt as opposed to say Bethlehem Steel.

DR. NETON: Right.

DR. MAKHIJANI: Okay. Internal dose we'll skip for today. Surrogate worker data I think we've dealt with. It was corrected.

DR. NETON: Right.

DR. MAKHIJANI: Surrogate worker data -- yeah, so this -- I think a lot of this next page, page 8, really deals with the use of air concentration data --

DR. NETON: Right.

DR. MAKHIJANI: -- which we've dealt with and kind of bumped and you're going to send us a little explanation of various categories. And if there are very, very few cases maybe you'll just say that and outline some approaches for us.

DR. NETON: That would be my hope. Yeah. And the solubility thing I think was a

misunderstanding of -- of the table, in a way. I think there's a table that talks about type M, and it wasn't our intent that those be type M. They were examples. If it were type M, here's what it would be. That needs to clearer in the -- the profile.

DR. MAKHIJANI: How will I know all that had been cleared up?

MS. BLOOM: This is on the type M and type S issues?

DR. NETON: Right.

MS. BLOOM: That's actually -- happens in Task 5.

DR. NETON: Well, no, but there -- there is a statement -- there's a table that -- that generated this comment that is a table of potential intakes. I think it's all Table 29. No, that's Table 29 -- there's a table that has -- that used bioassay data in limited degree to come up with intakes. And they were -- they assumed type M and it says at the bottom. The footnote -- the footnote on the bottom of the table says use type M and -- and Janet -- discussing it with Janet, it was her -- her attitude that well, if the dose reconstructor knows it's type M this is what you've got.

Clearly it's not applicable if you're doing a type class Y -- a type S. So we just need to make that clearer because there are other sections of the TBD that clearly state that you use the most claimant-favorable approach.

MR. GRIFFON: It's Table 28.

DR. NETON: Table 28, that makes sense. And so that table was generated all based on -- on type M.

DR. MAKHIJANI: Okay. So that -- that explanatory correction then --

DR. NETON: Right. It will -- it will be --

DR. MAKHIJANI: -- that's on the --

DR. NETON: -- yeah, explanatory correction is in the profile.

DR. MAKHIJANI: So normally you are going -- you -- in IMBA you use the most claimant-favorable solubility.

DR. NETON: Unless you really --

MS. BLOOM: Of the choices.

DR. NETON: Of the choices. Unless you know pretty definitively what the person --

DR. MAKHIJANI: Yeah.

DR. NETON: -- was working with and then we would use the actual case. Although in practice we

rarely end up doing that, I think.

MR. ALLEN: We can generally narrow down credible cases (unintelligible) but --

DR. NETON: Yeah, but, you know, in some way --

MR. ALLEN: Sometimes it's (unintelligible).

DR. NETON: Yeah, it's hard enough to know where a person worked let alone know exactly what the soluble material was.

DR. MAKHIJANI: In -- in many of the cases it's actually remarkable how -- in Mallinckrodt it's remarkable how detailed a record does exist about -- about --

DR. NETON: Yeah. Some of these --

DR. MAKHIJANI: -- jobs. I mean I think it is quite remarkable.

MS. BLOOM: Uh-huh.

DR. MAKHIJANI: Some of the long DOE files have a lot of information in them.

MR. GRIFFON: Can I ask -- stopping at Table 28 for a second -- because I -- and I -- we've been through this table many -- I've got all the marks on this table. But there's a number of cases by each one of these. Is that the number of case -- number of -- what is that, number of cases?

DR. NETON: That's the number of cases that were

evaluated given those numbers. That's not the total number. I mean those were selected cases --

MR. GRIFFON: Right. Okay.

DR. NETON: -- so those are not --

MR. GRIFFON: Those are the ones that had good urinal-- or -- or, as you described it before, fairly uniform or -- a good set of urinalysis data, right?

DR. NETON: Yeah, and that's what -- Janet picked those and she could speak better to what those were.

MS. BLOOM: I would guess that they probably worked for a long enough period and had enough data that you could indeed think you were modeling them.

DR. NETON: But see, my -- my -- my opinion is that that table is going to be of limited use in the profile -- in the reconstructions because I would go with more of a co-worker data, you know, of the sample set looking at the urine data. We haven't done that yet necessarily.

MS. BLOOM: No, that's on the schedule (unintelligible) get there.

MR. GRIFFON: Co-worker meaning -- rather than

surrogate, you would -- you would select people that --

DR. NETON: Right.

MR. GRIFFON: -- you knew had the same job title or worked in the same area or --

DR. NETON: Groups of people or something like that, yeah, and say okay here's -- that's what that kind of is, I suppose --

MR. GRIFFON: Yeah, so it makes sense.

DR. NETON: -- but it needs to be fleshed out. I think there are more -- there are more data there than what -- what is in there.

MR. GRIFFON: 'Cause that's the way I saw this was -- was co-worker -- surrogate.

DR. MAKHIJANI: After -- after this correction -- I mean are you going to calculate it in different solubilities, type M and type S, or are you going to just leave it as it is or -- I don't understand how --

MS. BLOOM: For the co-worker data --

DR. MAKHIJANI: -- this will be used -- actually be used.

MS. BLOOM: -- when we actually do the whole co-worker data analysis, we take the urine data. We do fits to that using M or S and come up with

intakes for each of those situations, and then the intakes are available for dose reconstructors to assign. And so they would choose either M or S based on the fit and based on their organ of concern. But you'll have a different intake for M than you would for S.

DR. MAKHIJANI: And so this particular table is not going to be used or will need another -- like a 28-A and 28-B that will actually be used -- I'm not understanding.

MS. BLOOM: My sense is that this will be replaced.

DR. MAKHIJANI: Okay. With?

MS. BLOOM: Unless I -- unless there's something I don't know about this table, my sense is that it -- it will be replaced when we do the full-blown analysis.

DR. NETON: But again a lot -- how much work we put in this depends on how many people we don't have bioassay records for (unintelligible).

DR. MAKHIJANI: Yeah.

MR. GRIFFON: Right, so that is the starting point. I think this flows --

DR. NETON: It's all flowing from these -- these --

MR. GRIFFON: -- these sites or these steps for you to outline, though, is going to be critical for us because, you know, the --

DR. NETON: Right.

MR. GRIFFON: -- we can't leave St. Louis saying well, we're waiting to see this other piece --

DR. NETON: No.

MR. GRIFFON: -- you know, fleshed out. We need to know at least generally -- you know, not that you would do it on -- which cases you would use certain techniques, but that these are the techniques and here's how we -- and -- and like for this kind of thing, and we're -- we're -- you know, and you can demonstrate that I can identify who a Plant 6 generic worker is. And to take -- to take that a little further, and I can identify what kind of raffinate -- potential raffinate exposures that group of people, you know (unintelligible).

DR. MAKHIJANI: I think the fact that -- that air data are -- you know, that so -- so many workers have bioassay data. Now I've actually looked at many records myself, you know, I have much more practical input.

Okay. So this question of survivor claimants --

you know, there are survivor claimants. Here they are, no job data and so on, so in those cases I -- I guess you would apply the default procedures at that --

DR. NETON: Pretty much like that one we did for the uterine cancer. There was no job title, although we knew the person worked there and we took -- at least in this case, it was noncompensable. We took the average at a highest 10 TLD film badge measurements for those years and then took the highest air concentration measurement in the plant and applied it. That was not compensable. It -- it may be a little different at this -- if it put it over 50 percent, but we would probably refine it to a certain extent but, you know, you get to a certain point where you can't refine it any more. And if it's over 50 percent, it's over 50 percent. It just -- it's a -- it's an artifact of this program, the way it's set up, that the people with the poorest monitoring records end up getting some pretty high doses because we can't defend doing otherwise. That's just the way it works out. I mean that's the way the program was -- was set up.

DR. MAKHIJANI: There are a couple other things I know that are in the fine print of this, and then I have a question from I think Mr. B.

DR. NETON: Okay.

DR. MAKHIJANI: They -- the TBD mentions that there was uranyl fluoride that was produced there, so -- but there are no dates and there are no -- there's a little bit that was done there and then there's no more information. And we also know that recovered uranium from -- well, the document that we have, we don't know -- that said recovered uranium from Hanford went to Mallinckrodt or Oak Ridge. Now I don't know how to interpret that, but -- or what period or how many workers it might apply to, and so we know these two -- there's this recycled uranium -- and this isn't like the tank that -- the U Plant recycling that the big reports are about after the recycling started at -- at Hanford with the tank wastes. This is before the tank wastes started to be recycled through U Plant. This is 1950 when I guess it must have been the redocs* plant that they were recovering uranium from and the orange oxide was sent to Oak Ridge -- or uranyl nitrate was sent to Oak Ridge and

Mallinckrodt. I don't know. So how do we -- how do we nail down these things, because I think that -- that you -- you did look at this. There's no documentation. We have indication that these materials went to Mallinckrodt or were produced there, so how are we going to address that? 'Cause now you've got different solubility questions, too. You've got type F and you've got -- yeah, you've got type F with uranyl fluoride.

DR. NETON: I don't know. I -- I am not aware of the document that, you know, you're referring to.

DR. MAKHIJANI: Well, it says so here in the TBD. I can give you the page. I can show you the (unintelligible).

MS. BLOOM: For the uranium, the (unintelligible) uranium that they're processing, we're assuming things are in equilibrium, that they're being -- getting the thorium 230, the radium 226, the actinium, and the protactinium. If you've got recycled uranium, the radionuclides that you would be adding onto that, my sense is that if it sat for any time, you're going to be worried about neptunium 237, plutonium 239, and technetium 99. And those are going to be insignificant in terms of dose compared to

assigning the equilibrium radionuclides instead. You know, you're not -- because you're going to assign an equal amount of thorium 230.

DR. MAKHIJANI: That -- that might be right. In this case, the way it's set up, it may not matter.

MS. BLOOM: Yeah.

MR. GRIFFON: Right.

MS. BLOOM: But I -- I think saying --

MR. GRIFFON: -- so why bother with the other --

MS. BLOOM: -- that that's a bounding...

DR. MAKHIJANI: I think you're right about that because normally we don't think of adding the radium and the thorium when you're processing UO-3. I think you're right about that. Mark, would you agree as a neptunium expert?

MR. GRIFFON: That's a pretty good --

DR. MAKHIJANI: Okay.

MR. GRIFFON: -- I think that's --

DR. MAKHIJANI: All right. So -- and then there's the -- on the page --

UNIDENTIFIED: (Unintelligible)

DR. NETON: Very good.

DR. MAKHIJANI: Well, you know, the less issues there are hanging there -- and some of these

issues are kind of -- probably small in terms of time frame and workers, but then if you have to say you don't know, then -- then you don't know what to do with it. But I think I agree with the answer.

Page 18, page 29, so now we have UO2F2, the recycled uranium is gone away. So it produced apparently UO2F2 to add to the bomb to slow down the process thermally, resulting in a better separation of slag (unintelligible). And then there's a table in Section 6.1 that actually has UO2F2, says it has to be assumed as type F material and I agree with that. But the question is when do you ever assume that and what do you do with it?

DR. NETON: You're on page 18 you're talking about?

DR. MAKHIJANI: Yeah, the first out of four references to UO2F2. One is on --

DR. NETON: (Unintelligible) graph on page 18.

DR. MAKHIJANI: -- page 18. I also found another one. There are actually two. There's another reference in our review. And then on page -- page 9 in the bottom there, they say there's no information about production of the UO2F2 at the

-- last paragraph, first line of the last paragraph. The supplied uranyl nitrate can be ignored, but it said what UO2F2 was. And then the last reference is on page 103 where it simply lists the solubilities of the various kinds of uranium to be assumed. I don't know what -- how we propose to handle that. I don't know where it was produced.

DR. NETON: They were adding --

DR. MAKHIJANI: (Unintelligible) not in large quantities.

DR. NETON: Right. They were adding it to the bomb --

DR. MAKHIJANI: Yeah.

DR. NETON: -- to slow down the process.

DR. MAKHIJANI: You know, there may be technical literature from the time on the subject, but I haven't kept that.

DR. NETON: I don't know.

MR. ALLEN: If they're adding it to the bomb, they're adding to -- it just said -- I lost it already, but it said something about small amounts.

DR. MAKHIJANI: Yes, it did say small amounts.

MR. ALLEN: You're talking about a small amount

of type F in and amongst a lot of type M. I'm not sure how much difference that's going to make.

DR. MAKHIJANI: Can we address that in some way by assuming a few percent or something?

MR. ALLEN: Yeah. The bomb I think would generally -- I'm not sure what size they're talking --

DR. MAKHIJANI: Well, didn't they make a difference?

MR. ALLEN: -- it may be several hundred pounds of UF-4.

DR. MAKHIJANI: Dave, wouldn't it make a difference to some organs?

MR. ALLEN: Depending on the mode of the intake. From urinalysis, very little for a systemic organ.

DR. MAKHIJANI: Yes, I agree with that.

MR. ALLEN: And lower for lung. Or from an intake it would be -- the F would give you a higher dose for systemic organs.

DR. MAKHIJANI: Right.

MR. ALLEN: But again, it's going to be a percentage --

DR. NETON: How much higher? Because once it's

systemic, it's exactly the same. All you're talking about is the different --

MR. ALLEN: From an airborne intake. From urinalysis it's not going to make much difference.

DR. NETON: So but even from an airborne intake if you inhale it and so it clears from the lung more rapidly than type M, you get the incremental dose based on the differential and the clearance rates. Is that -- am I missing something?

MR. ALLEN: Yeah. There's some amount of type M that ends up being coughed up and swallowed, whereas type F is almost an injection.

DR. NETON: Okay. So there's a -- there's that deposition --

MR. ALLEN: Yeah.

DR. NETON: Okay.

DR. MAKHIJANI: Yeah, so this is -- again this -- we're in the same kind of thing that if you're going back on bioassay you're okay, but if you are -- if you're using air data, then you have more issues. So how many (unintelligible) you are using, et cetera, et cetera so it may be put into that same bin.

DR. NETON: Right, but it --

MR. ALLEN: Type F? I'm looking real quick here. The default model for type F is a 100-day lung removal rate.

DR. MAKHIJANI: Hundred days?

MR. ALLEN: I'm sorry. A hundred per day is the rate. The type M you have the same removal rate for the rapid fraction, which is ten percent. So if this -- basically if we assume it was all UF-4 and ten percent of it's going to be removed at the type F rate, so unless it's getting into the higher -- you know, into the high single digits, it's probably not going to make any difference at all. It's just lost in the round-off, essentially.

DR. NETON: That's good -- that's good information. So ten percent assumes it's almost -- it's like type F anyway, so --

MR. GRIFFON: Right. Yeah. I didn't know that.

DR. NETON: -- so if you add a couple percent on top of that, it's really lost in the -- That's built into the GSD of 3.

MR. ALLEN: (Unintelligible) virtually the same model dose.

DR. MAKHIJANI: Those are two kind of don't-know issues that were bothering me and so -- good.

MR. ALLEN: Does that answer that or do you still want something --

DR. MAKHIJANI: Well, I think -- I think if that's --

MR. GRIFFON: I'm okay with that ten percent --

DR. NETON: Yeah.

MR. GRIFFON: -- explanation. Yeah.

DR. MAKHIJANI: I think that that ten percent does resolve it, so if you're adding a few -- if you've got a significant percentage of type F that we modeled anyway then -- yeah. You want to take a break?

DR. NETON: Yeah. Our court recorder would like a comfort break and I know I would, as well.

MR. GRIFFON: So would I.

(Whereupon, a recess was taken from 3:00 p.m. to 3:25 p.m.)

DR. NETON: I think we're ready to -- to reconvene after our -- our break, and I think Mark had a few questions that he wanted to raise. So Mark, the floor is yours.

MR. GRIFFON: Thanks. All right. Yeah, just a -- a few points. Hey, somebody stole my notes. No. Yeah, really I just wanted to follow up on M. I think we discussed we discussed this some

this morning -- on the record and off the record I think we've discussed this. But a lot of these cases -- well, let's see. I guess the question I had was on the -- and this involves the urinalysis data and the external data for the cases that we looked at. There's -- there's one question we had when we were at our last meeting in Iowa was what fraction of these do you have the raw records for, the urine cards or the -- you know, that sort of thing and -- and -- as opposed to using the CER database data. And the -- and I think -- well, maybe I can ask that, Jim, just --

DR. NETON: Right.

MR. GRIFFON: -- you know, what -- what fraction of these cases have you got the original data as opposed to a -- a query out of a database.

DR. NETON: Right. We talked about that. My impression -- I have to verify this so I can't say this with 100 percent certainty -- is that the database itself was coded from the original data -- the cards. Now I believe those do exist. They'd be in ORAU's possession. I need to verify that, though, and I think part of what you were addressing this morning was are we going to go

back and do some sort of validation of the CER database against the cards -- you know, the original data to --

MR. GRIFFON: Right.

DR. NETON: -- to verify that there was a -- I guess an adequate job done in transcribing those records. So that's -- my sense is what we're talking about, so the short answer is I'll have to get back to you.

MR. GRIFFON: Right.

DR. NETON: But -- but I do think that we -- we have access to the original cards.

MR. GRIFFON: Okay.

DR. MAKHIJANI: Jim, will you confirm that, just that fact, for me in the next two weeks, that the cards exist? Not -- not every last one, you know, but that the bulk of the original records exist and can be verified?

DR. NETON: Right. I will do that.

MR. GRIFFON: And have you -- have you tried to -- for the unusual cases where you do have stand-in copies of the cards, have the dose reconstructors cross-walked the raw data or do they just tend to use the CER output data?

MS. BLOOM: They should be using all the data.

DR. NETON: Right.

MS. BLOOM: I looked at one thing -- it wasn't one that was done, but I did notice as I went through the cards and the CER data that -- that it is important to look at it all so you're sure what you're reading.

DR. NETON: Right. And I -- I think that's true. I went and looked at selected cases, certainly not a representative sample but four or five, and where there was a DOE submittal, it did match what was on the CER database, but the dose reconstructors are supposed to use all the records that are available and they shouldn't a priori assume that the CER database is the -- is it, because there honestly could be more data in there than in the CER. Or conversely, there's data that might not match. I mean I --

MR. GRIFFON: Right.

DR. NETON: -- I don't know they're going to that extent, though. I mean I think preferentially they should use the data that's in the DOE submittal because that's why we go to the extent to ask the DOE. You know, every case that we ever got, if it's a DOE facility we'll say -- we'll ask them to submit the original record that

they have on the person. I was pretty insistent on that early on because I thought the DOE had an obligation to provide us what they have and not just rely on these certain epi databases but...

MR. GRIFFON: Okay.

DR. ROESSLER: When Arjun writes his report after you give him this information, will we be able to get a copy of that before the Board meeting?

DR. MAKHIJANI: Yeah. (Unintelligible) schedule, as I've discussed it with John Mauro, is somewhere I guess around the 20th -- or 18th I will have a draft for internal review and check, around the 20th, and we hope to have a -- a version for the Board meeting to you latest by the first of July, so it would be before the Board meeting --

DR. ROESSLER: Before we go.

DR. MAKHIJANI: -- but not much before. I -- I'll try to get it done as soon as I -- as much as I can before that but given (unintelligible) --

DR. ROESSLER: Well, I've kind of interrupted Mark's train of thought, then I have a question probably for Paul. What is the plan for the Board meeting -- not so much whether we travel on

the 4th of July or not but once we get there what is the agenda and how -- how are we going to address --

DR. ZIEMER: Well -- and -- and actually I've not had a chance to -- I've got to discuss this with Lew and look at the time frame. I only learned, as you did, that the time frame was finalized for St. Louis just -- I guess yesterday.

DR. ROESSLER: But we are going to obviously take up the Mallinckrodt question.

DR. ZIEMER: Oh, yes. Oh, yeah.

DR. ROESSLER: -- and then will there be other things -- what -- on what day will that be and --

DR. ZIEMER: I don't --

DR. ROESSLER: You don't know that yet.

DR. ZIEMER: I -- I do not know the answer to that.

MR. GRIFFON: I think we --

DR. ZIEMER: The -- the Mallinckrodt thing has got to be -- we -- we're going --

DR. ROESSLER: That's why we're going to be in St. --

DR. ZIEMER: We're going to have to have time to hear from the petitioners again, and from the

public again. All of those things have to happen. We're -- I'm sure we're going to hear from Congressional delegation folks that'll be there again, so --

MR. GRIFFON: I think we do need a -- a chance for subcommittee -- we were talking about this earlier --

DR. ZIEMER: (Unintelligible) Mark and I were talking --

MR. GRIFFON: -- meeting.

DR. ZIEMER: -- about the subcommittee and if -- if we can work it out in terms of the schedule, we probably would -- if we need a subcommittee meeting, we'll probably do that the first afternoon and then use the next two days for the --

DR. ROESSLER: Okay. But it wouldn't be before the first afternoon, the subcommittee meeting? It would be, at the earliest, the --

DR. ZIEMER: Because of the holiday it's very difficult for -- I can't get there before middle of -- before noon. I don't think Mark will be able to, or not too much before noon. I know others are not going to be --

DR. ROESSLER: Because we're being asked to make

our travel arrangements and I just --

MR. GRIFFON: Yeah.

DR. ZIEMER: Right.

DR. ROESSLER: -- wondered what to -- okay.

DR. ZIEMER: So I'm -- I'm being somewhat vague, but it -- it remains to be fleshed out and --

DR. ROESSLER: I think you've answered --

DR. ROESSLER: Yeah.

DR. ROESSLER: -- the question I had on it.

DR. MAKHIJANI: Dr. Ziemer, since I'm the only one here from SC&A -- Joe is not here -- I -- I should ask on his behalf if -- do you plan to have Y-12 on the agenda? Because I know Joe is, you know, working pretty hard --

DR. ZIEMER: I -- I think --

DR. MAKHIJANI: -- on that.

DR. ZIEMER: I think we're going to determine -- we need to make sure that we are able to do closure on Mallinckrodt. We have to do closure on the first 20 cases. They've been carried along for a while. I think we would like to get the first round of the next 18 on the agenda. We have the issue of addressing the -- the procedures review. I suspect that -- I -- I'm not sure where we'll be on Y-12. I'm -- I'm sure

NIOSH would like to push that forward and --

DR. NETON: We're proceeding as if we would --

DR. ZIEMER: Yeah.

DR. NETON: -- we will do the evaluation of Y-12 at the next meeting but --

DR. ZIEMER: Right.

DR. NETON: -- I don't set the agenda, but I know from my perspective, the technical end, we are moving forward with the Y-12 evaluation.

MR. GRIFFON: And I think we asked SC&A to expedite that for that reason because we thought we --

DR. NETON: Right.

MR. GRIFFON: -- yeah, be an overage.

DR. MAKHIJANI: People are kind of going flat-out and maybe they don't need to, and if they don't need to actually, it would be nice if they knew or if they -- but I -- I -- I know that -- that -- I just got an e-mail from Joe this morning or last night, both planning a schedule review, production --

DR. NETON: Part -- part of the issue was that -- and we had talked about this in another setting, I forget where, that the Y-12 evaluation report covers a very early period only of Y-12. So if

the profile review is being conducted for information related to the evaluation for it, then it's a very finite, specific time period and, you know, if SC&A is really having trouble because they're trying to do the entire document, then maybe they need to --

MR. GRIFFON: Do part of that --

DR. NETON: Yeah.

MR. GRIFFON: -- do that part first.

DR. NETON: I think there may have been some communications to that effect. I don't know, I'm not --

DR. MAKHIJANI: I don't know if SC&A is having trouble or not, I'm just saying that I'm not involved intimately at this stage. I'm not involved at this stage.

DR. ZIEMER: I think Lew's been coordinating that with John --

DR. NETON: Yeah, I think so.

DR. ZIEMER: -- but insofar as we can have -- what -- what we don't want to have is a situation similar to what developed in Iowa where we think we're ready to go and there's something else out there that needs to be addressed. And if -- I think if NIOSH believes we're ready to go and

SC&A -- SC&A has had a chance to do a review and -- and also that in that review there are not major issues hanging out there that would prevent us from coming to closure, because that could -- that --

MR. GRIFFON: Yeah.

DR. ZIEMER: -- also becomes an issue. So we'd have -- we'd have to have a -- hopefully you would have a chance to -- to get feedback again before you came to the Board with that, and I know -- I don't know how that's going as far as Joe is concerned.

DR. NETON: Well, I -- I just spoke to Stu earlier this afternoon, and -- and Joe was actively trying to put together a conference call with us. And I believe --

DR. ZIEMER: So you could in fact do that.

DR. NETON: -- I left Stu with the impression that we could accommodate that call next week sometime --

DR. ZIEMER: Then it sounds like --

DR. NETON: -- probably early next week.

DR. ZIEMER: -- we'll be ready to go (unintelligible).

DR. MAKHIJANI: Well, Dr. Ziemer, actually the --

this conference call is to answer the questions. It's not to look at a draft.

DR. NETON: Right.

DR. MAKHIJANI: So we are --

DR. ZIEMER: We're not that --

DR. MAKHIJANI: -- we're not at the draft stage yet.

DR. NETON: All right. Thank you.

DR. ZIEMER: So part -- part of the answer to that may depend on where SC&A ends up, also.

DR. MAKHIJANI: No, I think -- I think Joe was planning to --

DR. ZIEMER: Yeah.

DR. MAKHIJANI: -- submit something. I just wanted to clarify, in view of what you said, whether Y-12 was going to be discussed.

MR. GRIFFON: Yeah. I think our intent is to have it on there as long as we're -- we're -- everybody is --

DR. NETON: My understanding is that the portion or the years that the petition is being evaluated, there is nothing in the profile, so it should be a pretty simple review.

DR. ZIEMER: It would be pretty straightforward then.

DR. NETON: I -- I would think. The profile is essentially silent because there is no information in that time period. So one could conclude from that what they want but --

DR. ZIEMER: Yeah. I understand what you're saying.

MR. GRIFFON: Can I -- just a couple more things on the database question. I mean I think you have -- I guess it would be useful for me at the meeting to -- I mean obviously at this point you can't do a sampling and val-- you know, any kind of sampling validation method, but you have some cases or claims in your hand that have these records and, you know, you're saying that that's the procedure, that you would normally go to those records. You also have the database printout. Maybe -- maybe you can report back to us on were there any discrepancies when that was done. You know, you looked at this many cases and -- I don't know if the DR people would keep that kind of information necessarily, but even if you did it for a handful of those --

DR. NETON: Well, I mean what you're saying is if we go through and look where we have some pretty voluminous DOE submittals and -- and pore through

those things and then go look at the CER reports and -- and determine are there inconsistencies or not.

MR. GRIFFON: Yeah.

DR. NETON: I think that's -- that's doable.

MR. GRIFFON: And I think Arjun and -- and I, to a lesser extent, but I think Arjun's done some of that, so --

DR. MAKHIJANI: Very little, but --

MR. GRIFFON: Yeah.

DR. MAKHIJANI: -- what little I have --

MR. GRIFFON: I don't have as much access to raw data.

DR. NETON: It looked to be -- and -- and maybe --

MR. GRIFFON: It looks okay, what I've seen so far, you know.

DR. NETON: Maybe some of that description that I -- I just forwarded you guys also might -- might help in the --

MR. GRIFFON: Yeah, that would be good, too.

DR. NETON: -- mechanics. It's -- it's -- essentially addresses the mechanics of how they went about --

MR. GRIFFON: Assembling the data.

DR. NETON: -- they inherited this dataset and then they went about assembling it, and much of it speaks to how they came up I think with job titles and such.

DR. MAKHIJANI: Actually -- actually there was one -- one discrepancy that I found. I checked two files. One was with Mark yesterday when I was sitting in Stu's office. And I didn't find any discrepancy in numbers but I found an issue with the dates. The original --

MR. GRIFFON: Yeah.

DR. MAKHIJANI: -- record had lots of dates crossed out. It was quite a messy record. And then we see -- our record had this person in lots of different locations but with the same set of dates, which didn't correspond to the original record and I don't know what happened there, whether the original record was written over by whoever compiled a -- I don't know what happened to that piece --

DR. NETON: (Unintelligible)

DR. MAKHIJANI: -- of data. I'll tell you that case number.

MR. GRIFFON: Is that case (unintelligible)?

DR. MAKHIJANI: No, that's not --

MR. GRIFFON: Don't tell us the number, but if you could write it up there --

DR. NETON: Yeah, you can just provide me that number, I'd love -- I'd like to check it out.

DR. MAKHIJANI: I -- I will provide you that number.

DR. NETON: Okay.

MR. GRIFFON: And then there -- there's -- you know -- in -- in looking at this, the database data that I've seen so far, there's just a couple outstanding questions which I think you -- you raised the one, which was the airborne concentrations being zeroes from '53 to '55. Almost -- maybe not all of them but a lot of that --

DR. NETON: Many, most --

MR. GRIFFON: Yeah.

DR. NETON: -- if not all of them.

MR. GRIFFON: Right. And what happened -- you know, what happened there. And there's another question I had. Maybe there's a good reason for this, but I -- I don't know it. In the film data, 19-- there's -- there's a bunch of entries for 1976 and many of them are -- are real high data points -- 22, 23, 19, 18 rem penetrating. A

lot of them also have monitoring months in excess of 52. I don't understand that.

MS. BLOOM: Monitoring weeks.

MR. GRIFFON: Monitoring weeks. I'm sorry, monitoring weeks in excess of 52 and --

DR. NETON: (Unintelligible)

MR. GRIFFON: -- and there's a gap between '66 and '76 and I -- I -- I was -- I don't know if there -- if there was some kind of clean-up process in '76 or if this was -- I -- I guess I just --

DR. NETON: Yeah --

MR. GRIFFON: -- would ask you --

DR. NETON: -- I need -- I need -- I'll look into that.

MR. GRIFFON: -- is there any explanation to that.

DR. NETON: I really don't know.

MR. GRIFFON: And then the last thing I really had, and you can look at those cases probably, is this -- the laboratory validation question and whether we -- you know, because this is an outstanding question that was raised at the last meeting, and I'm wondering if we're going to have any more information. I think you asked Janet to

go look under the Christmas tree a little more or whatever, but --

DR. NETON: Right. I --

MR. GRIFFON: Yeah.

DR. NETON: -- I'm hopeful we're going to find something. I mean Janet says that she didn't find anything but I -- I don't -- I'm not sure she was looking from that exact perspective. And maybe she was, but we're going -- we're going to go back and --

MR. GRIFFON: Maybe there's something in --

DR. NETON: -- look at these dates --

MR. GRIFFON: -- some of the more generic HASL audit records or something that might --

DR. NETON: -- right, exactly. There may --

MR. GRIFFON: -- the case or --

DR. NETON: -- be something in the EML documentation --

MR. GRIFFON: Yeah.

DR. NETON: -- I don't know, but --

MR. GRIFFON: Right.

DR. NETON: -- we will look wherever we can because I mean it sounds like it's -- it's going to be an important issue.

MR. GRIFFON: I'm not -- I'm not trying to add

work, but these are some -- I mean part -- part of my harping on this is this, this question for the public of the independence of this. And, you know, it's -- it doesn't go without notice to many -- many people in the public that ORAU did the epi study as well as -- as they're doing the dose reconstruction. So this question of -- or need to sort of independently -- independently validate against raw data I think is even more important for that reason.

DR. NETON: That's fair.

MR. GRIFFON: Yeah.

DR. NETON: We -- we'll look at it. I think part of the reason ORAU was a strong contender when they got the contract was because they had access to this data.

MR. GRIFFON: I know.

DR. NETON: But I do understand what you're saying that --

MR. GRIFFON: Yeah, it's a double-edged --

DR. ZIEMER: Jim, I'd like to raise a few questions, looking forward. I won't be here tomorrow. You'll be discussing external dose, and I don't want the answer the questions but I would like to know if you had the answers to the

questions. It seemed to me that most of these on the list of eight -- a lot of them are simply straightforward do you have this or have you found this or that.

DR. NETON: Right.

DR. ZIEMER: But have you had a chance to look at these and --

DR. NETON: Right.

DR. ZIEMER: -- and you do have answers -- one way or the other. I'm not asking you what the answers are, but have you -- have you been able to address all of these issues or are there some that you have found it difficult to wrap your hands around?

DR. NETON: Most of these we have some answer to --

DR. ZIEMER: Okay.

DR. NETON: I think with the exception of maybe number 3, which is -- is in process. Now we're not -- I don't know that we're going to have the exact answer and --

DR. ZIEMER: But you're --

DR. NETON: -- we won't have an answer tomorrow.

DR. ZIEMER: -- but you're addressing it.

DR. NETON: But the approach would be available

to be discussed and -- and what-not. Otherwise I -- we have answers for most of these. A couple of them we have questions on because the questions don't appear consistent with the logic of, you know, the nonlinearity issue and optical density. I mean we have calibration curves that account for that. We're not clear on -- on the exact issue.

DR. ZIEMER: Yeah, I would have assumed that, too, but --

DR. NETON: Yeah, when Hans is here --

DR. ZIEMER: -- we need to resolve that because --

MR. GRIFFON: That's Hans's specialty.

DR. NETON: Right, uh-huh.

DR. ZIEMER: -- optical density curves in fact are nonlinear --

DR. NETON: Yeah. I mean that's the reason they're called curves.

DR. ZIEMER: Right, right.

DR. NETON: You know, I'm not -- I'm not sure why -- why that issue is -- is there, and the same issue with the high -- highly variable response to energies less than 100 keV. It's well-documented film over-responds --

DR. ZIEMER: Right.

DR. NETON: -- at very low energies and that's accounted for with the calibration.

DR. ZIEMER: So you'll have --

DR. NETON: Yeah, so we're going to discuss those issues. I just wanted to have someone with a little more knowledge of it (unintelligible) myself.

DR. MAKHIJANI: Jim, to the extent that I know -- I've discussed this with Hans obviously, to some extent. To the extent that I know, the nonlinearity question is that we only -- we don't have original, you know, optical density data. We just have the reading. And the other question of whether the reading was properly done making the nonlinearity occult because apparently in his -- in his view that they -- they may not have done it properly (unintelligible).

DR. NETON: And -- Greg Macievic, who -- who is -- got his Ph.D. in external dosimetry -- did his dissertation on external dosimetry issues and worked at Landauer for a number of years is really, really good with this stuff and I -- I'd be better -- it'd be better if he were to address --

DR. MAKHIJANI: Yes.
DR. ROESSLER: What's his last name?
DR. NETON: Macievic, M-a-c-i-e-v-i-c. At least I think he did his Ph.D. in external dosimetry. I know he's -- he's very well versed --
DR. ROESSLER: (Unintelligible)
DR. NETON: -- and he and Tim Taulbee are two people that we rely on for external dosimetry issues and both Greg and Tim are out today. That's unfortunate, but Greg will be here tomorrow. And he's -- he's pretty well versed in these issues so -- but I think the answer then, I think we can provide some -- some discussion for all of these.
DR. MAKHIJANI: Okay.
MR. GRIFFON: Can -- can I ask you one thing before, because I'm -- I'm heading out --
DR. NETON: Yeah, sure.
MR. GRIFFON: -- in a few minutes. But -- but the database you gave me, I appreciate that, but could I get the same database with names on it? Just in the next month I'm -- I want to do some --
DR. NETON: I think so. Well --
MR. GRIFFON: I mean it's privacy. I understand

that, but we --

DR. NETON: Yeah, it's privacy.

MR. GRIFFON: -- have access --

DR. NETON: Yeah, right. You guys have access to that. Yeah, I think -- do you want a cross-link? I mean I'm having a guy work on cross-linking it anyways, so I can give you another database that you'd have to -- you know, I've got Social Security numbers -- how does this work. You've got to go to two different databases to match them all --

MR. GRIFFON: (Unintelligible) databases, oh, it's not...

MS. BLOOM: It doesn't exist as one yet.

MR. GRIFFON: Doesn't have the name and (unintelligible).

DR. NETON: I can tell you who we have claims for and then Socials, but then it's got to be cross-linked. I can -- I'll get you something.

MR. GRIFFON: Okay. All right.

DR. NETON: And I don't know if it's better for you, but I'm having our guy convert it into a Excel -- Excel format, as well, because I -- you can't do much with Axys as far as the -- at least I can't. I'm not good with that so --

MS. BLOOM: Is it small enough to go into Excel?
DR. NETON: Oh, yeah. Excel -- Excel has 40,000 lines.
MR. GRIFFON: 40,000 lines or 65 --
DR. NETON: Sixty-five or something like that, yeah -- some octal number. It's probably 64.
MR. GRIFFON: I usually use SAS over top of Axys so really I --
DR. NETON: Well, actually -- and that's -- matter of fact, the guy I've got working on this is a SAS guy so he's doing it all in SAS but -- so I can at least do something and feel good about it, I'm having it put into Excel for me. Some of these Z-score plots and stuff are very easy to do in Excel. SAS would do it, but it takes some manipulation.
MR. GRIFFON: Right. If he -- if he --
DR. NETON: I'll see --
MR. GRIFFON: -- have them link quickly I mean if it's --
DR. NETON: Well, no. This will be a week or --
MR. GRIFFON: Okay.
DR. NETON: -- matter of fact, it should be here now.
MR. GRIFFON: Okay.

DR. NETON: That's sad. He only works three days a week -- well, two days -- two days something. I'm trying to get him to be here more time.

MR. GRIFFON: All right. If it looks like it's not going to be in -- you know, very timely, just send me --

DR. NETON: I'll just send you the whole thing. Right.

MR. GRIFFON: Okay. Now did you have --

DR. MAKHIJANI: Yeah, I have --

MR. GRIFFON: -- those cases yet --

DR. MAKHIJANI: Yeah. Let me -- let me start with Mr. B.

DR. NETON: Okay.

DR. MAKHIJANI: He worked at Mallinckrodt and then went to Weldon Spring.

DR. NETON: Uh-huh.

DR. MAKHIJANI: And he was at first a -- you know, in the production, electrician, and so on. He had one of these roving job descriptions and he was monitored. He had film badge data and so on. And then he became an office (unintelligible) and -- at Weldon Spring. He -- he worked in the office building there and did not actually go into the production areas other

than once in a while, walking through the production areas or something like that. And I verified this with him very carefully, and his -- the time he stopped -- and you know, the -- the Weldon -- as I understand it, the Weldon Spring office building was fairly separated from the -- from the production areas, much more so than -- than in -- in downtown. And I've seen a picture of the downtown site from the period (unintelligible) and he -- his urine data -- urinalysis data from the time he was in the office are pretty remarkable because not only does he have significant urine concentrations, but they also go up for a period, as much as a year after. I think the highest urine sample is (unintelligible). So this -- the question of environmental doses kind of came up in an indirect way. I can't now lay my hands on another example of this. I had but I don't think I made notes at the time. I must have been just kind of going through stuff and I noticed something and I didn't stop to make notes. But there was a worker who was also one of these roving workers who was assigned to office work for a period in the middle of his work at the

downtown site and also had nonzero -- you know, significant urine data, but I don't remember the numbers on that. And so the question came to mind is, you know, there's an assumption that people who worked in the offices and who were not -- who were generally not monitored and who were nonproduction workers have low doses. And that kind of -- it threw that -- you know, raised questions in my mind about environment doses at both sites.

DR. NETON: Well, this guy has 711 pages of DOE --

DR. MAKHIJANI: Yes. It's the hugest DOE file, and I think you will find --

DR. NETON: You would pick this one for me to look at.

DR. MAKHIJANI: No, but I think he has the other file. He has the other -- I went through it. I didn't go through it all. It's -- it's actually at the end.

DR. NETON: I didn't see -- I didn't see the PER file. See the only one here is a DOE response. There's no (unintelligible).

DR. MAKHIJANI: Then it -- then it must be toward -- it must be toward the end.

DR. NETON: I've got everything that should be in here.

DR. MAKHIJANI: No, no. On that 711-page file --

DR. NETON: Oh, I see.

DR. MAKHIJANI: -- it's toward the end. And I maybe can pull the page number for you.

DR. ZIEMER: Well, in any event in a case like that, that dose still gets accounted for even if he's working in the office. Right?

DR. MAKHIJANI: Oh, yeah. Dr. Ziemer, his -- his dose calculation is not at issue. The thing that kind of -- and he had no idea why I was asking him these question at -- so -- so that his response would not be biased by that. I met him when I went to St. Louis and then I -- this was just a follow-up call after I looked at his case.

MR. GRIFFON: I guess my first question for that one would be why did they continue to monitor him if the practice was not to monitor the office workers, too. You know, that's --

DR. ZIEMER: Right.

DR. NETON: Well, my -- my question is -- I've got to look at the dose reconstruction, but did we -- we --we should have used his urine data --

DR. MAKHIJANI: I don't believe it's complete.

DR. NETON: What's complete?
DR. MAKHIJANI: His dose reconstruction.
DR. NETON: It has to be because it's -- oh, I see what you're saying. I just assume --
DR. MAKHIJANI: I don't believe those numbers have been done.
DR. NETON: Oh, okay. You're right, it's not done.
DR. ROESSLER: But that's not the point as it is why did he have that -- is that what you're asking, why did he have a positive urine --
DR. MAKHIJANI: Yes --
DR. ROESSLER: -- value when he's working...
DR. MAKHIJANI: -- if he wasn't -- well after he started working in the office --
DR. ROESSLER: What do you mean by well after?
MR. GRIFFON: A year (unintelligible), more than a year.
DR. MAKHIJANI: More than a year.
MR. GRIFFON: Yeah, more than one year.
DR. NETON: But this was not at -- at Mallinckrodt, it was at Weldon Springs.
UNIDENTIFIED: What kind of (unintelligible).
DR. ZIEMER: (Unintelligible) had a body burden to start with.

MR. GRIFFON: (Unintelligible) didn't seem like it could have just been (unintelligible).

DR. MAKHIJANI: But it went out looking (unintelligible).

DR. ZIEMER: Oh, I've seen -- I've seen people's excretion go up.

DR. NETON: Yeah. I mean theoretically, if you look at the plutonium levels --

DR. ZIEMER: After -- after a single exposure. I mean it --

DR. NETON: Yeah. No, but actually if you look at the plutonium curves -- I don't know about uranium, but many years after exposure there is an increase, and I don't know what's driving that in the -- in the (unintelligible).

DR. ROESSLER: It's coming out of the bone for some reason.

DR. ZIEMER: Well, there's -- there 's -- it's recompartmentalizing or -- or it's --

DR. NETON: Yeah, maybe --

DR. ZIEMER: -- changing its chemical (unintelligible).

DR. NETON: -- all these compartments converted at one point to where they -- because it actually does, the intake retention fraction goes up at

some point -- not a lot --

MR. GRIFFON: Yeah, for a little while.

DR. NETON: For a little while and then it drops right down. But that -- that might not be the issue here.

MR. GRIFFON: Yeah.

DR. NETON: I guess without looking through all 700 pages to see what this guy did --

DR. MAKHIJANI: No, no. This is toward the end --

DR. NETON: -- because I just happened to flip through there and I see he was a night maintenance supervisor or something listed on there. I don't know whether that was --

MS. BLOOM: Could you write the name on that one?

MR. GRIFFON: Do you have a name? Yeah.

DR. NETON: Yeah, I got it here.

MS. BLOOM: Or actually, can you plug back into that, or no?

DR. NETON: I suppose I could but then it would bother Ray. Yeah. I think --

DR. MAKHIJANI: It -- it just -- this is -- I don't have answer to this. It just raised --

DR. NETON: Right. It's a good question.

DR. MAKHIJANI: It raised a question in my mind.

I did write down the numbers for this one and then I came across another one. It may be the same explanation for both of them.

DR. NETON: Let me see what this guy claimed. Mallinckrodt Chemical downtown St. Louis, electrician, worked in all areas with uranium (unintelligible), downtown maintenance supervisor Weldon Springs. I mean that's not --

DR. MAKHIJANI: And then -- no, no. It was for the subsequent job title of data -- data something.

DR. NETON: Oh, yeah, but see he went to Weldon Springs and he was a maintenance supervisor --

DR. MAKHIJANI: Right.

DR. NETON: -- in and out of all areas, which would explain positive bioassay --

DR. MAKHIJANI: Right. That was after '62.

DR. NETON: Right. In later years analyzed exposure levels and worked with computer-generated exposure notices to employees, worked inside electrical furnaces, exposed to contaminated dust.

DR. MAKHIJANI: Yeah, that was --

DR. NETON: That's something separate. Right.

DR. MAKHIJANI: So this was -- this was the data

processing/data analysis part of his job from '62 on.

DR. NETON: Right.

DR. MAKHIJANI: And...

DR. NETON: So from '62 I don't -- I'd have to look at the urine data and see what it means by quite variable, but it's possible that if he was exposed from '57 to '62 at Weldon Springs --

MR. GRIFFON: I guess not.

DR. NETON: -- there's no good way, unfortunately, to get at these.

DR. ROESSLER: He could be having positive urine for quite some time.

DR. NETON: Right, it just depends on how variable these values are.

DR. MAKHIJANI: Well, is it okay to say what these values were? I have them.

DR. NETON: Yeah, why not. We're not -- yeah, I think --

DR. MAKHIJANI: His -- his -- at the start of his data processing job, he had 14 micrograms per liter and then the range of -- of values during his data processing was 4 to 25 micrograms, and the highest value of 25, if I -- I didn't write down the date here -- if I remember correctly it

was sometime in 1963. He went to office work in mid-1962 and --

MS. BLOOM: And the values were lower than that when he was working in the production areas typically?

DR. MAKHIJANI: I didn't -- I didn't write down his -- in my notes the production values, but his termination urine sample from the production time was 14, and then a year after he started office -- in the next year it was -- the peak was at 25 in his office period, so it was quite a big jump. It was not a small -- it wasn't like a --

DR. NETON: Well --

DR. MAKHIJANI: -- what you might expect.

MS. BLOOM: I don't know about --

DR. NETON: It could -- it could be any number of things. I mean it's not uncommon for people to change locations. I don't know if the guy moved and he's got a well with uranium, natural uranium in it. I've seen this happen at -- at Fernald and Argonne National Laboratory. I had one guy who was positive all the time after his brother sent him this special water from someplace out west and he drank it. We analyzed it; it was like 1000 micrograms per liter uranium. It was

some health water. It was a brackish-looking thing. So I'm not saying that that's the answer here, but there's any -- you know, there's a --

DR. ROESSLER: Also medications -- I'm not so sure about uranium, but medications can do that --

DR. NETON: Can affect --

MR. ALLEN: Act like a chelation.

DR. ROESSLER: I don't know.

MS. BLOOM: Plutonium --

DR. ROESSLER: Really?

MS. BLOOM: -- there was a study that somebody started drinking a lot of cranberry juice.

DR. NETON: It's possible he's had a body burden and something changed but -- but you raise a valid issue, is this -- is this in any way related to his office work and it seems --

DR. MAKHIJANI: Yeah.

DR. NETON: -- not likely, but if the office happened to be in the middle of the controlled area somehow -- I mean I don't know where these offices are located.

DR. MAKHIJANI: It was in a separate building at -- at Weldon Spring, and the reason I kind of thought from Weldon Spring to downtown is in

downtown -- (unintelligible) I asked, you know, and he said it was two or three city blocks from production building. And so in downtown clearly you have production areas that were much closer, you had --

DR. NETON: Yeah.

DR. MAKHIJANI: -- you had stuff outside that were --

DR. ROESSLER: Right.

DR. MAKHIJANI: -- contaminated from the '40s and was a much more -- messier situation, and so definitely raised a question about --

DR. NETON: Yeah, I really don't --

DR. MAKHIJANI: -- and it's just question. I don't have a hypothesis to offer.

DR. ROESSLER: Uh-huh.

DR. MAKHIJANI: Well, you know, it was a question of whether it was environmental dose (unintelligible).

MR. ALLEN: There's any number of things it could be without being environmental dose in the -- the office there. I mean...

DR. NETON: Well, in this particular instance, I think -- I think the dose reconstruction would be done using his data.

DR. MAKHIJANI: Oh, here. I can tell you where they are. It was -- exposure data are early on, age 40s, 50s and so on.

DR. NETON: External exposure -- here we go. Yeah, I got it -- '54 to '61 (unintelligible) external.

DR. MAKHIJANI: Somewhere, but I can't remember. I wish I'd written the page number down.

DR. ZIEMER: So the generic question is whether or not there are contamination levels at Weldon Springs that might --

MR. ALLEN: This is off-site?

DR. MAKHIJANI: Or, you know, in the -- in the streets, in the offices, in areas right adjacent to production areas where, you know, clerks and typists and --

MR. GRIFFON: Administrative areas --

DR. MAKHIJANI: -- administrative areas, since in -- in downtown the administrative areas were close to the -- close to the production area.

DR. NETON: It's suspicious that he was monitored --

MR. GRIFFON: Right.

DR. ZIEMER: Yeah.

DR. NETON: -- being in a -- in a --

MR. GRIFFON: That's what makes me --
DR. NETON: -- administrative area.
DR. ZIEMER: Well, unless they -- unless they were basing that on finding earlier positive results and --
DR. NETON: Right. He could have just --
MS. BLOOM: Follow-up.
DR. NETON: Yeah.
DR. ZIEMER: Nowadays people would continue to follow someone like that (unintelligible).
DR. NETON: Oh, yeah.
MS. BLOOM: Uh-huh. Those aren't very large results for that time period, though, 'cause...
DR. ZIEMER: Well, I --
MR. GRIFFON: That wouldn't trigger follow-up sampling necessarily.
DR. MAKHIJANI: In any case it's (unintelligible) --
DR. NETON: Yeah, it's --
DR. MAKHIJANI: -- question.
MS. BLOOM: Curious.
DR. ZIEMER: Unless he was still having to roam around in the other areas --
DR. NETON: Yeah, and maybe he went to -- what is it he was doing, dose records -- records or

something like that. I don't know whether he -- he went and got film badge result-- here we go, '59...

DR. MAKHIJANI: There's a lot of those pages that are repeat...

DR. NETON: Yeah, they are. I've noticed that. There's -- I don't know if that's the scanner or just...

MR. GRIFFON: While you're looking through the data, I had another question that just -- that Cindy brought to my attention -- just the trigger level, if there was a trigger level at Mallinckrodt for returning for a follow-up bioassay, because I saw a number sample -- and I couldn't determine -- and just looking at the raw records, it looked as though it was maybe .03 or something because then they'd be sampled a couple days later where they're usually quarterly or even annually. But there -- I think there was some kind of trigger. If they exceeded a certain value, they'd do -- they'd go back to the (unintelligible).

MS. BLOOM: I don't recall a specific one from Mallinckrodt --

MR. GRIFFON: Yeah.

MS. BLOOM: -- but I do think there was discussion from some sites about some level that they thought (unintelligible).

DR. NETON: Well, there was some --

MS. BLOOM: (Unintelligible)

DR. NETON: I think -- I think it depends on what you're working with. I know at Fernald at one point we had a trigger level was based on kidney damage. If you happened to be working with the very soluble uranium and your result exceeded X -- I don't remember what that was.

MR. GRIFFON: Yeah.

DR. NETON: I want to say it was like .05, 50 micrograms or something per liter, they would -- it would trigger a protein albumin ureo* test, and that was based on some default calculation we did and showed that, you know, if it was really soluble uranium this could have accumulated so much X at the no-effect -- above the no-effect level of the kidney.

MR. GRIFFON: Right.

DR. NETON: I -- I don't know. There was actually some NRC guidance I think at one point, an NRC -- but that was not until like '87 time frame that talked about -- I don't remember.

MS. BLOOM: I do recall seeing something in the '50s, but I don't know that it was generically --
MR. GRIFFON: Yeah. I know I've seen it at other sites. I wasn't sure what the practice was --
MS. BLOOM: I'll see if I can find that.
DR. NETON: We can follow up on this, but --
DR. MAKHIJANI: Yeah. All right.
DR. NETON: -- yeah, that's a good, you know --
DR. MAKHIJANI: Now take Case A --
(Whereupon, Dr. Ziemer retired from the meeting room.)
DR. NETON: Just let me make a note here. Okay. So Case A?
DR. MAKHIJANI: Case A.
DR. NETON: Okay.
DR. MAKHIJANI: This person started in 1950 so had no internal or external monitoring data till '55. He had a renal cell carcinoma. His wife knew of incident but had no detail, so this is a survivor -- also no urinalysis data (unintelligible) and a high reading of 58. This is obviously a relative dose.
DR. NETON: Right.
DR. MAKHIJANI: The -- the DOE response, if you'll open that and go to page 42 is what my

notes indicate (unintelligible).

DR. NETON: Okay. There's some urine data starting '60/'61 time frame.

DR. MAKHIJANI: (Unintelligible) downtown and Weldon Spring. His 58 would be (unintelligible).

DR. NETON: This is what I was talking about. It may be -- if he has no data at Mallinckrodt, we're getting (unintelligible) urine data --

DR. MAKHIJANI: No, he had data at Mallinckrodt, but not for the first five years.

DR. NETON: Right, but -- I don't know, Dave, if you could build up some chronic scenario that would actually be chronic high and then come back -- continue the chronic -- there'd be two chronic exposure periods, I guess. How would that work?

MR. ALLEN: I'm not sure what you're asking.

DR. NETON: Well, you've got a gap of -- you have a gap of three years of data but you have samples down in here later on. Could you construct a chronic model that would fill in the early gaps in these --

MR. ALLEN: Yeah, and the -- the bigger the gap, the higher this chronic --

MR. GRIFFON: Right.

MR. ALLEN: -- but then that means the shorter

that chronic period, so you end up with lesser intake. In general you take it out to where it's close to the monitoring period of your -- your highest intake and there's not a lot, if I recall -- a huge difference in the --

DR. NETON: Right. But that's my point is --

MR. ALLEN: You're getting one thicker urinalysis sample, you know, or a set of them -- it -- it fairly well locks you in on the intake.

DR. NETON: Yeah, but that's my point. You'd have to have two chronic scenarios in there to do that, right? The first one large enough to get you down to the first data point, build up, and then to sustain that --

MR. ALLEN: Yeah, I'm just saying if you take a chronic that builds up to that data point, that's one thing. But you're saying you want to build up higher and then let it come down? That'd be your worst case.

DR. NETON: Right. That's what I'm saying.

MS. BLOOM: Uh-huh.

DR. NETON: You build up a chronic to get you to that first point because you really don't know anything about this and so you build up this large chronic and --

MR. ALLEN: The -- yeah, I'm saying --
DR. NETON: Yeah.
MR. ALLEN: -- it all depends on that -- you've got the start date locked in pretty much --
DR. NETON: Right, right.
MR. ALLEN: -- so it all depends on that gap between that first urinalysis and the end of the chronic.
DR. MAKHIJANI: No, the beginning of the chronic wouldn't it? Isn't that what -- I'm sorry.
MR. ALLEN: That -- that time period you know. You know the beginning of employment, you know the date of urinalysis.
MS. BLOOM: Right.
DR. MAKHIJANI: The beginning of employment to the first urinalysis, five years.
MR. ALLEN: Okay. So you -- you got that five years you know. The question is, if you assume that he's exposed from day one chronically --
MR. GRIFFON: Yeah, so --
DR. NETON: So you've got to do something like this to bring it down to there?
MR. ALLEN: Right.
DR. NETON: But then this would have to start coming in -- I'm not sure what that would --

MR. ALLEN: What I was just trying to say is if you -- you got that curve you're looking at right there, but the part that's unknown is the end date for that chronic exposure.

MS. BLOOM: That chronic intake so it --

DR. NETON: Right, right. Yeah, right.

MS. BLOOM: -- so it just squishes --

MR. ALLEN: If you adjust that you find out it doesn't make -- it does make a difference, but it's not as big as you would think because you have competing effects there --

DR. NETON: Right.

MR. ALLEN: -- because if you say it was a four-year chronic intake and then he was sampled a year after that, you know, for your five-year period, you get an intake for that four-year period. If, on the other hand, you assume he was only exposed for that first year of employment and then, you know, it got way up there and it came down for that urinalysis, it looks like a much bigger intake. But in reality, since it's only a year, it comes out near the same.

DR. MAKHIJANI: Yeah, so that's (unintelligible) --

MR. ALLEN: (Unintelligible)

DR. MAKHIJANI: -- it seems you've got two unknowns so you can't really determine the peak. But what you're saying is the peak doesn't matter?

MR. ALLEN: It's the area in the curve that matters, not the peak. And the area in the curve ends up being -- since you have those competing factors there, the area in the curve ends up being similar. You know, I'd have to run some numbers and they're not --

MR. GRIFFON: And -- and the extreme of that is if you (unintelligible) --

DR. MAKHIJANI: I'm not convinced about that.

MR. GRIFFON: -- acute exposure on day one before the five years, I think he's still -- you have a very small curve --

MR. ALLEN: Right, but the next acute is steep.

MR. GRIFFON: -- but very small, and then it tapers down.

DR. MAKHIJANI: So these are your data points here?

MR. ALLEN: Right.

DR. MAKHIJANI: And if you assume a chronic intake that looks like what this person might have had during the period of monitoring you'd

have something like this, right?
MS. BLOOM: You'd start it to, yeah.
MR. ALLEN: Well, it would build up --
MR. GRIFFON: Yeah.
DR. NETON: Well, that would be -- but that you can't demonstrate is the truth.
DR. MAKHIJANI: No, you can't, so what I'm saying is if you actually have -- if you use the second example that Dave just talked about, the heavy exposure in the first year, reaching a big peak and then going down, then the area under the curve would be much bigger than -- than this in the case of chronic (unintelligible) --
MR. ALLEN: But -- but the intake ends at the peak of that thing. That's how it's sort of coming down, right?
MS. BLOOM: Yeah, you have to have that stop.
DR. MAKHIJANI: (Unintelligible) the end of the peak --
MR. ALLEN: So you've got an intake per day for a shorter period of time, you multiply it together.
DR. MAKHIJANI: Oh, I --
MR. ALLEN: The intakes end up being similar.
DR. MAKHIJANI: The intake, that's right. So this is the curve of the urine -- expected urine

--

MR. ALLEN: Right.

DR. MAKHIJANI: -- not (unintelligible, but the integrated intake.

DR. NETON: Right.

MR. ALLEN: Yeah, and it's -- like I said, it's not exact. There's a hundred scenarios you can run --

DR. MAKHIJANI: Yes.

MR. ALLEN: -- and get different answers, but it's -- they are competing factors there.

DR. MAKHIJANI: Okay. But it's like the previous thing that we talked about with -- with --

MS. BLOOM: With the little acutes and the chronics.

DR. NETON: There are -- I guess the bottom line is there are things you can do and work with that dataset to bracket this person's exposure, given his monitoring history.

MR. ALLEN: Right. And you can get different answers, but there's some bounding amount there. It's just a variable around some mean.

DR. NETON: And actually I haven't looked at this case a little closer, I'm not sure why it's not done.

DR. MAKHIJANI: External --
MS. BLOOM: Is it more than 5,000?
DR. MAKHIJANI: This person might get --
DR. NETON: Well, I don't know. Well --
DR. MAKHIJANI: Well, I don't want to comment.
DR. NETON: I don't know what the result's going to be, but there appeared to be a fair amount of data to work with here is what I was saying, and -- and there's a lot of reasons cases are done (unintelligible).
MR. GRIFFON: Cindy's fault.
DR. NETON: I don't know about externals. Did he have any?
DR. MAKHIJANI: No. (Unintelligible) there's a blank, maybe the data were lost for the first five years or something.
DR. NETON: We don't -- we don't want to talk about the job title here, but I think -- well, again, if we knew the job title here and we could position this person somewhere, we've got numbers for external based on plant that we could -- we could do. I suspect, given this -- this dataset as looking at it, the predicted intakes could be fairly large -- the data that we're working with here. (Unintelligible)

DR. MAKHIJANI: Okay. All right. Now, I can't find my notes on Case C, so --

MR. ALLEN: There's also a survivor case there.

DR. MAKHIJANI: I had that somewhere.

(Pause)

DR. MAKHIJANI: Okay. Let me make an attempt to find my notes. Why did I put that up? Oh, this -- this -- this thing about work hours comes up a lot, and I think -- it's reasonably clear that at downtown a 2,000-hour work year is not a good default assumption. It really isn't, because almost no one we talked to fits that profile and it's a source of aggravation because almost no one fits that profile. Everybody worked six days and I found there were people who said they were sleeping at work. You know, when there was clean up or rush things, they went to the dispensary. And this came up in -- in different accounts, independent accounts that the dispensary --

DR. ROESSLER: Mark, are you going to call in --

MR. GRIFFON: Yeah, I was going to ask if -- can I call in in the morning? (Unintelligible) since I think we're going to have no Boards representing tomorrow. Right? And so yeah, I'll call in. Yeah.

(Whereupon, a recess was held from 4:18 p.m. to 4:22 p.m., during which Mr. Griffon retired from the meeting room.)

DR. MAKHIJANI: I cannot find -- oh, yes. This --this work, this -- one of the things that I had down in that person's notes, and also throughout my notes, is the people did seem to work like 48, 50, 55-hour weeks. Overtime was very common, six days a week was very common. And if there were like a default assumption of, you know, a six-day week at least -- some. And I think this will also only come up when you're actually using air monitoring data --

DR. NETON: Right.

DR. MAKHIJANI: -- so I know it will come up so -- but it's -- it's not accurate and a source of aggravation. So if it's corrected, it will be very helpful.

DR. NETON: Okay.

DR. MAKHIJANI: Oh, I had a -- those records I was not able to find -- maybe I got his name down wrong -- who had a -- an incident reported of -- of one of these digester tanks boiling over and he had stuff lined up. He had burns all over his body and wound up in the hospital. I don't know

if you had it. I didn't see a record of an incident like that and --

DR. NETON: You mean in the profile itself?

DR. MAKHIJANI: No, or -- I could not find his records so I did not know -- I'll try -- I'll get back to you about that. I'll make a note to --

MS. BLOOM: There was a place on the Mallinckrodt O drive and -- I believe that's on the O drive for Mallinckrodt and I believe this is in the dosimetry files, and I did run across a uranium burn incident that they were following very closely. They were collecting urine samples. I did this over the weekend so I'm pretty sure it was Mallinckrodt that I was looking at, and it would have been in one of those site images in the dosimetry files. And that may be the same person if this was a fairly major incident.

DR. MAKHIJANI: It seemed to have been a very major incident and I didn't see reference to it. And I mean -- I think in terms of burns, there was only this one person involved so there wouldn't be a need for it to be in (unintelligible) --

MS. BLOOM: Yeah. No, this was one individual --

DR. MAKHIJANI: -- for a file.

MS. BLOOM: -- they were in the hospital. They'd gone to the hospital afterwards and they'd collected a lot of urine data.

DR. MAKHIJANI: Okay. I -- I think I must have gotten his spelling -- name -- the spelling of his name wrong because I could not find -- and I'm -- I'm pretty sure he said he was a claimant, so there's some -- some disconnect there. But maybe --

MS. BLOOM: Did it start with that letter? That's what I recall. I'm not sure that that's it.

MR. ALLEN: I'm not sure the first letter of the last --

DR. MAKHIJANI: That's what I have.

MR. ALLEN: -- name (unintelligible) Privacy Act.

DR. MAKHIJANI: But I could not -- I could not find -- I could not find anything like under that name.

MS. BLOOM: It's not a name I recall.

DR. MAKHIJANI: I -- I didn't do permutations of the spelling. I just have a call in to --

MS. BLOOM: Okay.

DR. MAKHIJANI: -- try to figure it out and I'll -- I'll maybe just communicate it with -- with

Jim, or should I cc you? If you'll give me your card I --

DR. NETON: CC Cindy too, but yeah, send it to me and cc Cindy.

DR. MAKHIJANI: Okay. Actually maybe I'll just regroup today. My brain is shutting down.

DR. ROESSLER: My body is shutting down.

DR. MAKHIJANI: I need to regroup and I'll do that this evening.

DR. NETON: May I?

DR. MAKHIJANI: You didn't find anything under that name.

DR. NETON: There's -- there's two people under that name, but neither of them worked at Weldon Springs.

DR. MAKHIJANI: Yeah. At Mallinckrodt you mean?

MR. ALLEN: I can cull the table with everybody's and sort it and get anything close.

DR. NETON: Well, it's -- like I say, I don't know. It's a pretty simple name --

DR. MAKHIJANI: Yeah, it is.

MR. ALLEN: Oh, is it? Okay. Never mind.

DR. NETON: It's not like --

DR. MAKHIJANI: Yeah. No, I think -- I think I must have done something -- I must have gotten

something mixed up.

MR. ALLEN: I'll see what I can -- see if I can find (unintelligible).

DR. NETON: All right. Dave's pretty good with... You'd think out of 18,000 names there'd be more matches. There's almost 19,000 people in the database now.

DR. MAKHIJANI: Nineteen thousand? Is that the number of claims?

DR. NETON: About. It's 18,900-something. We have a...

I'm going to agree with Arjun's assertion that we're tired and maybe this would be a good stopping point for the day and --

DR. MAKHIJANI: Yeah.

DR. NETON: We'll reconvene tomorrow at 8:30.

DR. MAKHIJANI: Yeah, that's fine.

DR. NETON: Right now we're -- well, we have slides to go over the external dosimetry, but I'm sure --

DR. MAKHIJANI: Yeah.

DR. NETON: -- there will be other things to talk about but...

DR. MAKHIJANI: Well, yeah. What I'd like to do is just to go over -- go over -- I'm going to go

over our reviews. I have both of them and just make sure, you know, I expect that I could call you up and ask you questions --

DR. NETON: Oh, sure. Yeah.

DR. MAKHIJANI: -- but just since we have a court reporter here I wanted to make sure I covered all the big issues that we'd raised.

DR. NETON: That's -- that's fine.

DR. MAKHIJANI: Yeah. I think we may not need -- we may not need all day tomorrow.

DR. NETON: All right. Well, that sounds good.

DR. ROESSLER: Are we done with Ray?

DR. NETON: Yeah.

(Whereupon,

C E R T I F I C A T E OF COURT REPORTER

STATE OF GEORGIA

COUNTY OF FULTON

I, Steven Ray Green, Certified Merit Court Reporter, do hereby certify that I reported the above and foregoing on the day of June 1, 2005; and it is a true and accurate transcript of the testimony captioned herein.

I further certify that I am neither kin nor counsel to any of the parties herein, nor have any interest in the cause named herein.

WITNESS my hand and official seal this the 20th day of July, 2005.

_____

STEVEN RAY GREEN, CCR

CERTIFIED MERIT COURT REPORTER

CERTIFICATE NUMBER: A-2102