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

FERNALD

The verbatim transcript of the Working Group Meeting of the Advisory Board on Radiation and Worker Health held in Hebron, Kentucky, on March 26, 2008.

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C O N T E N T S

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TRANSCRIPT LEGEND

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-- (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.

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SHARFI, MUTTY, ORAU

P R O C E E D I N G S

(9:00 a.m.)

WELCOME AND OPENING COMMENTS

DR. LEW WADE, DFO

DR. WADE: Good morning. This is the work group conference room. This is a meeting of the work group on Fernald's site profile and SEC petition. My name is Lew Wade, and I'm filling in for Christine Branche who's the Designated Federal Official for the Advisory Board, and Christine is away on other business. In fact, yesterday she was visiting the Nevada Test Site to broaden her experience in that issue related to the program.

This is a work group that's ably chaired by Brad Clawson, members Griffon, Ziemer, Presley and Schofield. In the room here are Clawson, Griffon, Ziemer and Schofield. Is Mr. Presley on the line?

(no response)

DR. WADE: Is Robert Presley on the line?

(no response)

DR. WADE: Are there any other Board members who are participating by telephone?

(no response)

DR. WADE: Any other Board members participating by telephone?

(no response)

DR. WADE: Well, the good news is we don't have a quorum of the Board, so the work group can continue with its deliberations.

Let's do some introductions, and we'll go around the table here. We'll start with members of the NIOSH/ORAU team, then members of the SC&A team. Then we'll look at petitioners, claimants, workers who are involved in the call and would like to be identified. We'll look for members of Congress or their representatives, other federal government employees, and then anyone who wants to be on the record.

Around the table here we'll just go around the room, and then when we go out into the telephone we'll go by those categories. I would ask that ORAU/NIOSH folks, SC&A folks, Board members would identify whether or not they have conflicts relative to this particular site. That's the Fernald site. So we'll begin.

Again, I'm Lew Wade. I work for NIOSH.

DR. NETON: I'm Jim Neton. I'm with NIOSH, and I'm conflicted at Fernald.

MR. CHEW: Mel Chew, I work for O-R-A-U team. I am not conflicted.

MR. ROLFES: Mark Rolfes with NIOSH. I have no conflicts.

MR. SHARFI: Mutty Sharfi, the ORAU team, no conflicts.

MR. RICH: Bryce Rich, O-R-A-U team, no conflict.

DR. BEHLING: Hans Behling, SC&A, no conflict.

DR. MAURO: John Mauro, SC&A, no conflict.

MR. GRIFFON: Mark Griffon with the Advisory Board, no conflict.

MR. CLAWSON: Brad Clawson from the Advisory Board, no conflict.

MS. HOWELL: Emily Howell, HHS.

MR. SCHOFIELD: Phillip Schofield from the Board, no conflict.

DR. ZIEMER: Paul Ziemer from the Board, no conflict.

DR. WADE: And then in the room if you could shout out for the microphone.

MR. HILL: Stephen Hill from Congressman Chabot’s office.

MS. BALDRIDGE: Sandra Baldridge, petitioner.

MR. BEATTY: Ray Beatty, former worker, assisting Sandra.

MS. HOFF: Jennifer Hoff, ORAU team, no conflicts.

MS. KENT: Karen Kent, ORAU team, no conflicts.

DR. WADE: Let’s go out onto the telephone then and ask for other members of the NIOSH/ORAU team to identify themselves.

MR. FAUST (by Telephone): Leo Faust, ORAU team.

DR. WADE: Leo, could you tell us if conflicts?

MR. FAUST (by Telephone): No conflicts.

DR. WADE: Thank you.

MR. MORRIS (by Telephone): Robert Morris, ORAU team, no conflict.

DR. WADE: Other members of the NIOSH/ORAU team?

(no response)

DR. WADE: How about SC&A folks?

MS. BEHLING (by Telephone): This is Kathy Behling, SC&A, no conflict.

DR. WADE: Always a pleasure to have you with us, Kathy.

MS. BEHLING (by Telephone): Thank you.

DR. WADE: Others of the SC&A team?

(no response)

DR. WADE: How about other federal employees who are working on this call?

MS. HOMOKI-TITUS (by Telephone): Liz Homoki-Titus with HHS.

MR. KOTSCH (by Telephone): Jeff Kotsch with Labor.

DR. WADE: Thank you, Jeff, for being with us.

Other feds?

(no response)

DR. WADE: How about other workers, petitioners, claimants, their representatives?

(no response)

DR. WADE: Members of Congress or their representatives?

MS. HILL: This is Brook Hill with Senator Sherrod Brown’s office.

DR. WADE: Thank you for being with us. Can you hear us okay?

MS. HILL: Yes.

DR. WADE: Other members of Congress or their representatives?

(no response)

DR. WADE: Is there anyone else on the call who would like to be identified for the record?

DR. MAKHIJANI (by Telephone): Yes, this is Arjun Makhijani of SC&A, no conflicts.

DR. WADE: Good morning, Arjun.

MS. BEACH (by Telephone): And this is Josie Beach --

DR. MAKHIJANI (by Telephone): I'm sorry, I have a conflict.

DR. WADE: We still are glad to have you with us.

Josie Beach, you with us?

MS. BEACH (by Telephone): And Josie Beach, no conflicts.

DR. WADE: We're glad to have you, Josie. We worry about quorum on work groups, but you do not bring us to a quorum, so please participate as you would like.

Anyone else who would like to be identified for the record?

(no response)

DR. WADE: A little thing about phone etiquette, you know, if you are not actively engaged, then mute the phone. If you are speaking, speak into a handset if at all possible and disdain the use of speaker phones. They collect all kinds of background noise. Be mindful of the noise in your environment that might be not disturbing to you, it could be awfully disturbing to people on the call.

We do have examples of people typing and all manner of things, and dogs barking and we did have one fellow snoring. So it would be good to be mindful of those situations. Dr. Branche has pointed out that if you don’t have the ability to mute your phone, you can hit star six which will mute the phone. And then to get it unmuted you hit star six again and apparently that works.

So with that, Brad, it’s yours.

INTRODUCTION BY CHAIR

MR. CLAWSON: The last time that we met was

11/13, and we had numerous, we made it through the matrix, and we had a kind of a layover for a little while. So we're going to start back into the responses that SC&A requested from NIOSH. And I guess we'll just start from the front of the matrix and proceed forward.

Hans, where would you like to start on this one?

DR. BEHLING: I'm not sure this is my call. I guess you have a presentation that has some structure to it and rather than second guess you, what's on your computer, I will defer to Mark.

MR. CLAWSON: Okay, Mark. You know, that brings up something else. Has everybody got a copy of the matrix that Mark brought, and is there any other papers you need to hand out?

MS. HOWELL: Does that contain Privacy Act --

MR. ROLFES: It may contain Privacy Act so, Privacy Act information, so that's --

MS. HOWELL: We shouldn't.

MR. CLAWSON: Should we share it or not?

MR. ROLFES: We shouldn't.

MS. HOWELL: No.

MR. ROLFES: I apologize, Mr. Hill. We can't share that with you because of Privacy Act information.

MR. CLAWSON: It contains Privacy Act information.

MR. ROLFES: Yeah, we've got a couple of presentations just to --

MR. GRIFFON: But we'll get that cleared and make sure he gets a copy, right?

MR. ROLFES: Sure.

MR. GRIFFON: And I think we should try to clearly define what we're talking about in the matrix that some people can't see the matrix. So when we get to that point, you know.

MR. ROLFES: I was going to say I can project it on the screen, but if there's Privacy Act information in there I probably shouldn't do that sort of thing. Well, we do have a matrix. We made some updates. We also put together several presentations just to bring everyone up to speed on the work that NIOSH has completed.

A couple of the outstanding things, the main couple of issues that were outstanding were the thorium coworker model or the thorium intake model that we would be using for reconstructing historical intakes of thorium at Fernald. And the other was the reconstruction of recycled uranium and raffinates. So we do have a couple of presentations, and I also have a small, brief presentation on the comparison of bioassay data to the HIS-20 database. So we can go through those presentations, and I guess we can discuss additional details from the white paper following the presentation. That's probably the easiest way.

MR. GRIFFON: Do you have copies of the presentation?

MR. ROLFES: I did hand out copies of the presentations as well. If you didn't get one, I do have --

DR. WADE: This is Lew Wade. I'd like to say something for the record about the deliberation. Again, this is a work group meeting of the Federal Advisory Committee. Under the Federal Advisory Committee Act, work group meetings are normally not open to the public and transcripts are not kept of those meetings. This is to allow for boards and members of boards to do the everyday work that needs to be done as they prepare for publicly attended board meetings.

This board, I think much to their credit, has allowed for work group meetings to be open to the public, transcripts are kept and shared and made public. It creates a problem though in that material is being prepared in near realtime for these deliberations, and the deliberations are happening in public. We can’t share Privacy Act information with the public until it’s cleared.

It takes time for a document to be cleared, and that creates the dilemma we face. We don’t want to limit these meetings. We want to make them open to the public, but at times these deliberations discuss Privacy Act information that can’t be shared with the public. The record of this meeting will be posted on the website. All documents discussed will eventually be cleared, but sometimes things are brought before this body that haven’t been cleared, and therefore, can’t be shared with the public.

“Briefing on the Use of Daily Weighted Exposure Reports for the Estimation of Chronic Intake Rates”

MR. ROLFES: Okay, so I believe we can get into our presentation here. And the first one that will start will be the “Briefing on the Use of Daily Weighted Exposure Reports for the Estimation of Chronic Intake Rates.” And if you excuse me for just a second, we’ll get this projected up here.

This is the “Fernald Working Group Briefing on the Use of Daily Weighted Exposure Reports for the Estimation of Chronic Daily Intake Rates.”

MR. GRIFFON: Just one more second. I didn’t get copies. Can someone make a couple of extra copies? And I think we can give out these copies, right, of the presentation?

MS. HOWELL: No, I’m sorry. I have to interrupt. We have not seen this. We have not seen the matrix.

MR. GRIFFON: But it’s being projected.

MS. HOWELL: I’m going to have to tell you to please block the projector. We can’t do this. You’ve got to get us stuff ahead of time.

DR. WADE: Then give me copies and I'll copy it for the work group members.

DR. ZIEMER: And just for the record, Mark, this presentation will follow the white paper that was on the O drive. Is that correct?

MR. ROLFES: Correct. This is just a summarization of the white paper that was produced.

DR. ZIEMER: I just want to make sure it matches up with what we've got.

DR. WADE: I'm going to go make copies. How many copies are needed for people around the table?

DR. ZIEMER: One other comment, Mr. Chairman. On the hard copy that's distributed, the tables aren't readable, so you may need to go to your O drive to see them, since they're not going to be projected. We can't --

MR. ROLFES: I apologize. On the handouts some of the bottom slides are cut off.

DR. ZIEMER: No, I'm not talking about the cut off. They're not readable anyway; the tables are not readable.

MR. ROLFES: We'll do our best to explain that. I apologize for any inconvenience.

DR. ZIEMER: But if you can access the O drive here, which you can, you can pull them up.

MR. CLAWSON: Where do you want to go from there, Mark?

MR. ROLFES: I guess we can wait a couple minutes.

Would you like for us to wait, Lew?

DR. WADE: No, you can continue.

MR. ROLFES: We will go ahead and go through, I will go through the slides, and I apologize for not having it projected up on the screen.

MR. GRIFFON: Can you tell the name of the file? I'm looking for that presentation.

MR. ROLFES: This presentation is not --

DR. ZIEMER: White paper on FMPC.

MR. GRIFFON: Oh, it's not on there. So the white paper's --

DR. ZIEMER: The white paper is.

MR. ROLFES: That's why I was giving a presentation. I apologize. This was a late, last minute presentation.

DR. ZIEMER: It's like the last thing in the

Fernald file.

MR. GRIFFON: I got the white paper.

MR. ROLFES: The white papers are available.

We initiated a data capture for Fernald to go back and re-review some of the information on air sampling, on bioassay data. We had requested about 110 boxes of records, both for additional thorium air monitoring data, bioassay information. We went up to the Mountain View Federal Records Center and reviewed those boxes and probably ended up copying about 25 boxes of records at that time. We focused on a lot of the daily weighted exposure reports that were produced historically.

Anyway, the January 2008 data capture yielded hundreds of documents which included daily weighted exposure reports. We used these to define thorium inhalation and ingestion intakes prior to the use of chest counting in 1968. We also can use these to support our raffinate and recycled uranium exposure assumptions.

The daily weighted exposure reports, the initial one at Fernald was put together by the New York Operations Health and Safety Lab, HASL. They established the daily weighted exposure process in the 1940s and imprinted it on the AEC complex. HASL staff did the first daily weighted exposure assessment in 1953 at Fernald. The method was proceduralized and applied by Fernald staff and formal reports were prepared for use by facility management.

Daily weighted exposure reports are similar in concept to the modern time-weighted averages used by industrial hygiene personnel. Every daily weighted exposure report was similar. It was typewritten. It included data sheets. I do have a couple of documents as well that I can pass around. These are a couple of examples of the daily weighted exposure reports. They do contain Privacy Act information, however.

I will get to a couple of tables that we’ve extracted from these reports, but in Table 1, the average daily weighted exposure for each job description in the facility is documented, the number of workers employed in each job description, and an average daily weighted exposure for the entire facility.

Table 2 includes the average of the air dust sample concentrations for a specific operation or area. There's also recommendations listed, discussed and tracked.

MR. CLAWSON: Mark.

MR. ROLFES: Yes, Paul.

DR. ZIEMER: Your Table 1 that you're referring to is not the Table 1 in the report. It's in the slides.

MR. ROLFES: It should be in the slides.

DR. ZIEMER: Yeah, I see it now.

MR. ROLFES: It should be in the slides that you have, and it's towards the end of the presentation.

Also, the appendices to the Daily Weighted Exposure Reports show each job evaluation report. The job evaluation reports, the industrial hygiene personnel created time and test diaries for each job. A full eight and a half hours per day was assessed for exposures. Each task is sampled using both breathing zone and general area air sampling. High exposure tasks were sampled on several different days. Common areas were sampled often.

The average concentration was established for each task. The time times concentration for each task is summed and then divided by the total time to give an average exposure in multiples of the maximum allowable concentration, the MAC. This is an example of Table 1 which just has various job descriptions and the number of employees that were working in that job description, and also a daily weighted exposure in multiples of the MAC.

The next slide is another job exposure --

Yes, Paul.

DR. ZIEMER: Is it okay to ask questions as we go?

MR. ROLFES: I'm sure. We can go through more detail as well after.

DR. ZIEMER: The eight and a half hour issue, did you determine that that's the actual time in the workplace versus the length of the workday? Was there, what I'm getting at is some places have an eight and a half hour day, but they work eight hours and there's a lunch break.

MR. ROLFES: Correct, and if you take a look at this next slide here for the job exposure evaluation for the chemical area process, if you take a look, there's some breathing zone air sampling results for the dumping of thorium nitrate tetrahydrate into dissolving tanks. These are breathing zone samples that were taken for, let's see, there were three samples that were taken, and it took 60 minutes to complete this task per shift.

But also, if you take a look down towards the bottom of this slide, there are some general area air monitoring data following this individual to the washroom, to the smoking area, to the locker room, to the cafeteria, and also traveling between plants. So it's almost like a time and motion study what is being done here.

DR. ZIEMER: Okay, you're including for that period that they're in the lunchroom, that value.

MR. ROLFES: Correct. That was recorded.

DR. ZIEMER: That's part of the eight and a half hour --

MR. ROLFES: Correct.

DR. MAURO: And the MAC is 70 dpm per minute per cubic meter, and it’s a gross alpha count on an air sample presumed to be thorium that you’re looking at.

MR. ROLFES: Correct. And if you take a look at those two, the two Plant 9, the daily weighted exposure reports, it does describe a little bit of a process information that’s going on during the air sampling. That is correct. It’s 70 dpm in the earlier days, but it did change to 100 dpm in the more recent time periods.

DR. MAURO: I don’t know whether everyone else might, this might be helpful or not, but in a way what we’re doing now is that there are certain concerns that we expressed in our review that went toward thorium issues. And obviously, to a certain degree the work, the original work that you folks did that was in your site profile, the original site profile, and perhaps in the evaluation report, and we commented on that certain areas were deficient. In effect what I’m hearing now is that the material you’re covering now is additional material that has come in, as I understand it now, after those discussions that in effect attempt to fill those holes.

MR. ROLFES: Correct.

DR. MAURO: I guess in a way it might be helpful to point out that, let's say this is what we had before, and these were the issues. And this is what we have now and why we believe what we have now helps to resolve those issues. If everyone agrees with that strategy, certainly we ^.

MR. ROLFES: Because usually we have enough information based on uranium bioassay data, that's usually a pretty good indicator of an individual's exposure. When the Technical Basis Document was initially developed, we were under a timeline so that we could provide claimant favorable, scientifically defensible answers to claimants in a reasonable amount of time. We had put a default exposure per year 1,050 MAC hours of exposure to thorium for any individual who had indicated that they had worked with thorium.

However, we also did say if we do have additional bioassay data for thorium for that individual, we would use that as well. So we certainly realized that there could have been higher concentrations of thorium that the individual was exposed to and lower concentrations. However, in the interest of time so that we could produce dose reconstructions that were defensible at the time, that we felt we had defaulted to that 1,050 MAC hours.

Now we certainly acknowledge that there could have been higher exposures, could have been lower exposures. So we went back and revisited our living document, our site profile, to make sure that if we did have higher exposures or lower exposures, that we properly accounted for those. So that's essentially what we've done with these daily weighted exposure reports now.

DR. MAKHIJANI (by Telephone): Mark, this is Arjun. These are uranium exposures, right?

MR. ROLFES: No, that's incorrect. These are for thorium.

DR. MAKHIJANI (by Telephone): But the Plant 9 table that I'm looking at is a thorium exposure table?

MR. ROLFES: That's correct. It's extracted from, I believe, the one that we're on right now is from -- well, actually, if you take a look, it says dumping TNT into the dissolving tank. That is thorium nitrate tetrahydrate.

DR. MAKHIJANI (by Telephone): Okay, I guess I'm looking at your white paper.

MR. ROLFES: Okay, I'm going through a presentation right now that's approximately 17 slides.

DR. MAKHIJANI (by Telephone): Okay.

DR. BEHLING: Mark, let me ask you. A few minutes ago you made mention of the fact that some of the air samples were general air, others were BZA. Which one are you referring to here, Mark?

MR. ROLFES: I'm sorry. What's that, Hans?

DR. BEHLING: What slide are you referring to?

MR. ROLFES: I apologize. I am --

DR. BEHLING: And I'm looking at your white paper. Am I looking at Table 2?

DR. MAKHIJANI (by Telephone): Can somebody e-mail me that presentation, please?

MR. ROLFES: I don't have e-mail access, and I don't know if we have anyone else that has it on their computer at the moment, Arjun.

MR. CLAWSON: The slide presentation?

MR. ROLFES: Uh-huh.

MR. RICH: I can get that.

MR. ROLFES: Okay, we can take care of that, Arjun.

DR. MAKHIJANI (by Telephone): Thank you.

MS. HOMOKI-TITUS (by Telephone): This is Liz Homoki-Titus. While you're taking care of that for Arjun, would you mind putting me on that e-mail as well, please?

MR. RICH: Who is that?

DR. WADE: Liz Homoki-Titus.

MR. RICH: Do you want to get all those e-mail addresses?

DR. WADE: Do we have an e-mail address for Liz?

MS. HOWELL: zah6 -- is that right, Liz, zah6?

MS. HOMOKI-TITUS (by Telephone): zah9.

MS. HOWELL: Nine.

MS. HOMOKI-TITUS (by Telephone): Yeah, thank you.

MR. ROLFES: Could we get yours as well?

MS. HOWELL: E-P-H-2 @ C-D-C.G-O-V for myself and Liz.

DR. WADE: Do you have something from Arjun or do you need Arjun's?

DR. MAKHIJANI (by Telephone): My e-mail address is Arjun, A-R-J-U-N, @ I-E-E-R.O-R-G.

MR. ROLFES: We're going to have Mel send out the copies of the presentations and also at this point a comparison as well and then a copy of the matrix if you'd send that for me as well, please, Mel.

DR. BEHLING: You didn't answer my question.

MR. ROLFES: Yes, Hans.

DR. BEHLING: Table 2, in your white paper you make mention of the fact that some of these assessments of air concentration evaluations were done based on GA air sampling versus BZA. I don't see that differentiation in my table here, or am I looking at the wrong table? You mentioned that certain areas like the cafeteria would have been GA samples?

MR. ROLFES: Correct. If you take a look at slide number seven --

DR. BEHLING: Okay, I'm sorry, I see here. I see it.

MR. ROLFES: Just for the record, the top three were breathing zone samples and the bottom seven were general area air monitoring samples.

MR. MORRIS (by Telephone): Mark, this is Bob Morris.

MR. ROLFES: Yes, Bob.

MR. MORRIS (by Telephone): I think Paul and Hans may be confused by that first or second slide where you showed that, where we mentioned Table 1 and Table 2 for the first time. Those are, Table 1 and Table 2 are common through every year and every facility, and across the AEC complex as far as HASL was concerned. You could go to a 1955 DWE report and Table 1 meant the same thing as it did in 1967 in a DWE report, similarly with Table 2. So don't get those confused. That is a common trait of every DWE report is the Table 1 and Table 2 notations.

MR. ROLFES: Thank you, Bob.

Okay, I'll move on to slide eight. The Daily Weighted Exposure reports were done in many plants for many years. Sometimes hundreds of job descriptions were evaluated year after year. The dates for these Daily

Weighted Exposure reports range from 1953 through 1969.

DR. NETON: Mark, when you say plants, you're strictly referring to Fernald plants?

MR. ROLFES: Fernald plants, correct. That is correct. There's at least 160 Daily Weighted Exposure reports that have been recovered.

If you take a look on slide number nine, that will give you an idea of the time period for which a Daily Weighted Exposure report was found and the corresponding plant at Fernald. We have Daily Weighted Exposure reports for various portions of Plant 6. We have the pilot plant, Plant 1, Plant 2, Plant 3, Plant 4, Plant 5, Plant 7 for the time that it was operating, Plant 8, Plant 9.

We also have exposure studies that were done in the laundry, the technical laboratory. We also have non-productions of areas in buildings, general maintenance and storage areas, the decontamination building and the scrap plant.

There are a range of exposures in a facility. We are in the process of transforming each average daily weighted exposure to the geometric mean of a lognormal distribution representing each employee. We're combining all those daily weighted exposure results and fitting a lognormal distribution. We can assign an employee to a low, medium or high exposure potential group.

The low exposure potential group would be the 16^{th} percentile assigned as a constant or a point estimate. The medium exposure class we would assign the 50^{th} percentile with a geometric standard deviation. In the high exposure class we would use the 95^{th} percentile as a constant.

For guidance on exposure potential grouping, individuals that would have had low exposure potential were typically clerks, secretaries and administrators. Individuals in medium exposure classes are typically laborers, construction trades workers, maintenance individuals, drivers, foremen and anyone who is not in either the low or the high exposure class. The high exposure class would be chemical operators, operator helpers, machine operators and helpers, loaders and helpers.

To calculate the chronic daily inhalation rate, the inhalation rate is equal to the daily weighted exposure times the MAC times the breathing rate times the time times the fraction of five divided by seven. The daily weighted exposure corresponds to low, medium or high values for the years and for the facility at Fernald. The breathing rate is the ICRP light worker breathing rate of 1.2 cubic meters per hour. The time is eight and a half hours per day, and the five divided by seven adjusts for a five day work week scenario out of 365 days for a chronic intake scenario.

The calculation of a chronic ingestion rate would be based on information from OCAS OTIB-0009. Mode one would be the respiratory tract clearance built into the biokinetic model. Mode two is based on the airborne dust falling into a drinking cup, and Mode three is based on airborne dust falling onto surfaces and then transferred to the hand and the subsequent, inadvertent ingestion. This ingestion intake rate simplifies to the daily weighted exposure times the MAC times the time times a constant times the five divided by seven.

In summary, the daily weighted exposure data refines the intake rates that would be calculated solely from air sampling data. The time weighted task information was reported during the work. High exposure tasks were monitored and assessed. So we believe that dose reconstruction is possible for thorium work at Fernald.

I've also included a, I believe I included this in the handouts as well. It's a thorium processing at Fernald timetable. Does everyone have that in their notes or anyone? There's a thorium processing at Fernald slide, slide 15. I do see it on Jim's copy here. Okay, it is in there.

I apologize. We do have this on the O drive. This is a little bit larger. You'll be able to see it there, but this basically indicates the various plants and time periods at Fernald that thorium was processed. And it also shows the quantities, when available, of how much thorium was processed in that given plant in that given year.

An alternate method that could be used as well for assessing thorium intakes, the employee and job description, if they are well matched, we could use the daily weighted exposure or the job description as the best estimate. We would assume a geometric standard deviation of three and could calculate a chronic daily inhalation and ingestion rate from that information.

The GSD of three is based upon an Adams and Strom Health Physics Journal article from 2008 which studied uncertainties with daily weighted exposure data from Atomic Weapons Employer sites. They found that 89 percent of the geometric standard deviations were between 1.25 and 3.0.

Eight percent had a GSD greater than three but less than four, and only three percent had a GSD greater than four. This came up with an average GSD of 2.1. So we feel that the GSD of 3.0 is claimant favorable. A GSD of three is also specified in the construction trades worker Technical Information Bulletin and also in the internal dose reconstruction Technical Information Bulletin-0060.

And that is the end of the slideshow, and if there are questions within the white paper that was produced, we can certainly discuss those at this time.

DR. BEHLING: Let me ask you a few questions with regard to Table 1 in your white paper. Am I correct in assuming that the Figure 1 is data for a number of people who have various job functions that in Figure 2 you have an expansion of Figure 1? And the question is the wet area helper. So we have a wet area helper as a job description, and in Figure 1 we see that he has a daily weighted exposure of 46.9 MAC. And on the next Figure 2 we have a delineation of how that number came to be.

Now we also realize that there were three BZ samples, and were also seven GA samples. We talked about obviously the problem with GA samples. I think we went through a lot of data involving an analysis that is ^ that showed that as many as, you could have as much as seventy-fold difference lower value in general air sample as opposed to BZA sample. And to what extent can you --

UNIDENTIFIED SPEAKER (by Telephone): Could you speak up? None of this is coming through on the phone.

DR. BEHLING: I'm going to have to speak toward the speaker rather than --

UNIDENTIFIED SPEAKER (by Telephone): Good, I hope you --

DR. BEHLING: -- the person's that presenting this.

My question concerns a number of issues that were raised in our previous discussion, namely, the reliability of general air samples. And in the case that is being demonstrated here in the white paper in Figure 2, if you have that white paper, we derive a daily weighted exposure value of 46.9 MAC and realize that was derived on the basis of three breathing zone air samples and seven general air samples.

And we do know that general air samples are far from reliable as a general rule goes. And we've shown data that relates to a study at one of the DOE facilities back in the 1960s that the general air samples, especially at a location where it's very critical near the maximum permissible air concentration, can be low on average by a factor of 70. And we do know that, for instance, in this particular example that's being shown here that a good portion of his daily weighted exposure is based on general air sample.

And recognizing the fact that these general air samples are statistically speaking always going to come up on the low side, what do we do to accommodate that particular issue?

MR. ROLFES: If you take a look at the three BZ samples, it is the BZ samples where the high air concentrations are documented. The lower air concentrations are typically associated with the general area air monitoring data.

The impact that the difference if there was any uncertainty associated with the general area air monitoring data, it would not have as much of an influence as would the BZ data. The BZ data are certainly more representative of the higher exposures associated with the process that is going on where high exposures would, in fact, occur.

DR. BEHLING: Not true. If you look at the chemical area upper deck and you look at your right-hand column of time times concentration, you see obviously a significant, and it's basically 50-50. If you look at the dumping recycle oxide, you realize that the two are virtually identical, 82,404 -- no, 824,400 versus 778 ^. So in essence the two are split nearly equal.

MR. ROLFES: There may be uncertainties associated with general area air monitoring data; however, you do need to remember that we are assuming that the individual was not wearing respiratory protection. So by wearing a respirator, a protection factor of a thousand could certainly be applied for an individual who was wearing a respirator. We're not correcting for any intakes based on non-respirable-type particles as well. So there are uncertainties --

DR. BEHLING: Well, I have to disagree with you. A thousand is usually reserved for a very special respirator. Fifty is probably a common --

MR. ROLFES: A factor of 50 as well, sure.

DR. BEHLING: -- protection factor, and we do know on the documentation I've seen, that respirators were either most of the time disregarded. And when they were used, they were filthy dirty and contaminated. So I don't believe that we should even consider the buffer of a respirator.

DR. NETON: And we're not.

DR. BEHLING: Yeah, I'm just commenting --

DR. NETON: I think, Hans, you're pointing out some good observations that general area samples are fraught with some uncertainty. But I think the fact is there are a large number of samples there, and whether or not they can be tweaked, if necessary, to come up with a bounding estimate is really the issue.

I'm not going to quibble with you that there are some areas maybe where -- I think cafeteria samples are pretty low representative. The further away you get away from generation, the source generator, it's a general area. But if there are issues where they use general area samples in fairly close proximity to the source, we can certainly work to accommodate those differences.

MR. RICH: Let me just say just one thing about these time-weighted averages, Hans. These were done by the Health and Safety group in cooperation with management, and they did look at where the individual was spending their time.

And a good number of these operations or the job assignments, they were working in general areas as opposed to working on a piece of equipment where the source of the activity was being generated. And so as a consequence, the general area air samples constituted a breathing zone sample, if you will, for people working in certain areas in a general area.

MR. ROLFES: I have a picture here as well that shows a general area air sampler to the individual's --

MR. RICH: That's a breathing zone sample.

MR. ROLFES: Well, there's also a general area air sample off to the side of the machine as well.

MR. RICH: Yes, yes.

MR. ROLFES: But that's an example of both breathing zone and general area air sampling.

You can see a general area air sample right at the station the individual is working at, and you can also see a breathing zone air sampler as well.

And the breathing zone sample was taken, an individual, an industrial hygienist, would have collected a breathing zone sample as close as possible to the individual's breathing area, to his face, without interfering with the operations that were done. If you take a look, there is also a general area air sample result that is running.

DR. BEHLING: Let me get some understanding of how strong these statistics are here. In Figure 2 we realize that this was done in 1955 in Plant 9, and I'm looking at Table 1 which verifies that there's a dot in that slot and none in 1955. Now, is this an air sample that was essentially done on a single day? Were these assessments done -- when we talk about daily-weighted average exposures for any given year, is this an effort that was done on a certain day where people come through for this area, and they do this? Obviously, it's a very time consuming --

MR. RICH: Yes, it is. It represented a number --

DR. BEHLING: -- and I would assume, I mean, someone has to stand there with a stopwatch. Someone has to stand there with an air sampler. And so I would imagine that when we talk about daily weighted average exposures, we're dealing with a single day for this particular class of workers. Is that a reasonable assumption?

MR. ROLFES: I'd have to take a look back in the source report to determine that. Maybe Bob Morris on the line would also be able to --

MR. GRIFFON: There are some interesting things in the details. When you look, for instance, at the furnace operator, one of the higher exposed jobs, I mean, a lot of the tasks they do, like Hans said, they have it down to the minute. So they're drawing BZAs by the minute which are very time consuming I'm sure.

The other thing interesting to me in that particular job is you have the age-old problem of -- I mean, you're talking general area versus BZA, you have the BZA question and the worker making their own exposure environment.

And I think it's pointed out pretty well in here, you've got two samples for one of the particular tasks range from 130 dpm per meter cubed to 7,250. And you're getting an average of, in the middle. So if you're the dirty worker, this average, you know -- well anyway, it points that issue out. I'm not saying there's not data there.

MR. RICH: And the BZs do not represent a single set of samples.

MR. GRIFFON: Excuse me?

MR. RICH: These individual studies do not represent a single set of samples. There were a number of studies that they did to define a specific job.

MR. GRIFFON: But this worksheet looks like it says two-member shift, one shift per day, two men per day is the details of that.

MR. RICH: That's the job supervisor's assignment of how, what the typical employee spends in those jobs.

MR. GRIFFON: So when this says a low and a high, and it says number of samples, two, I can't assume the low was one person and the high is the other? Or it could have just been --

MR. RICH: That could be so, yes.

MR. GRIFFON: Okay, I'd assume it would. I don't know any other way to interpret it.

DR. BEHLING: Well, I think most of these are of very, very short duration. I think the average duration was a three-minute sample on average. And I think that in most instances we're talking about successive samples.

You're at a location. You've got a worker, and he's doing something. And you take a three-minute sample. You may wait a few minutes, and then you take a second one. And we do know from looking at the data, which I've shown throughout the report, that there's a tremendous variability in both location and time.

And we've shown that to a certain -- and I include this on the datasheets in my report -- that shows, as you show here, two samples. One is 100-and-some-odd, and the other one is 7,000, and then from that you try to establish an average value. And most are oftentimes likely samples drawn within minutes of each other.

MR. GRIFFON: You're getting this average on two people on one day.

DR. BEHLING: Or maybe just one person at two different locations.

MR. GRIFFON: The one thing you glean from this is I think they were trying to find the dirtiest operations and clean up things. That's good. And then you can certainly see which, were the dirtier jobs relatively.

DR. NETON: We're applying the 95th percentile, the distribution of all --

MR. GRIFFON: How we use the data is the question.

DR. NETON: The 95th percentile is being applied and a GSD is assigned at the 50th percentile, and I'm assuming it's a GSD of the distribution. So there is some --

MR. GRIFFON: Yeah, right now I'm just reacting to the study. I haven't seen how you're applying it.

DR. BEHLING: And then I also wondered to what extent when you have an industrial hygienist standing next to a worker, and you know very well that there's the issue of, well, I'm being monitored; I'm being watched. And there's clearly an attempt on the part of all workers to minimize the exposure at least when they're observed so that again the question is to what extent --

DR. NETON: I don't know how much you can minimize their exposure. They're standing there grinding a piece of uranium metal, Hans. I mean, I don't buy that.

DR. BEHLING: If you look at the report that I wrote, and there was a description in one instance where I believe it was a forklift operator. And again, there was a world of difference between one person being monitored and watched and being very careful about dumping things into a 55-gallon drum as opposed to another. And of course, the level of effort that would potentially minimize that exposure will potentially change the air concentrations by orders of magnitude depending on how careful that one person as opposed to somebody else. So again, we're talking about a moment in time, a day and a year, and again, over a brief period of time that multiple samples may be taken during a given operation. And drawing conclusions --

DR. NETON: Again, the 95^{th} percentile for every single day the guy performed that job in the plant I think is pretty valid.

MR. MORRIS (by Telephone): Mark, can I chime in for a minute? This is Bob.

MR. ROLFES: Yes, Bob, go ahead, please.

MR. MORRIS (by Telephone): I've got a few issues that I wasn't able to jump in on the conversation because it moves without a break there, so a few things I'll add. First of all, we have a procedure on file that I can provide if you'd like me to that shows that most of the air sampling was not three minutes but 30 minutes. That was the typical procedure that they had that they followed.

Secondly, if you recall, we're not using the average value for setting the facility distribution data. We're using that data with a GSD, we're fitting it to get the lognormal of a distribution that that would fit with a GSD of three. So we're already taking account a large spread of data into that, into the individual task analysis. And that gets propagated then further into the facility GSDs.

In fact, when we've done some test cases it looks like the facility GSDs end up being about a five and a half or five to five and a half GSD. So these are not small uncertainties that we're taking account of. They're big uncertainties, and it shows up in the final numbers.

The third thing I'd like to point out is that since some of the DWE reports -- I couldn't tell you which ones at this moment because I've never actually tried to look at this as a study topic -- but in some of the DWE reports, there are contemporary assessments of the average uranium concentrations that people in uranium areas -- when the DWE report was concerning a uranium area, they've also tabulated the contemporary uranium samples for the people that were in the facility in the same document.

And my recollection is -- I certainly wouldn't want to be held to this -- but my recollection is that the uranium bioassay results always, always were much lower than what would have been predicted by the daily weighted exposures.

MR. RICH: That’s true.

MR. MORRIS (by Telephone): So there are some empirical reasons to believe that without regard to what you think about how dirty respirators were or that people never wore them. In fact, they were cleaned. There was a cleaning program for respirators, and people did wear them, and there were airline respirators in use. And that probably accounts for a lot of the fact that we can get an empirical observation of protection.

DR. MAKHIJANI (by Telephone): May I ask a question? This is Arjun. How are you accounting for the inter-day variability since even on the same day in the same location the variation in air samples is so huge?

MR. MORRIS (by Telephone): This is still under discussion inside OCAS, but let me tell you what the Oak Ridge team proposed to OCAS. And that is that that lognormal distribution that I described to you for each, representing, for example, the wet area helper that's in this dataset. It's assigned as a GSD of three with a lognormal that correlates to the average for that person. And then that is sampled with a Monte Carlo code so it represents the uncertainty, that factor of three.

So in theory then, if you sample 365 days, you get 365 different values for this worker. Our Monte Carlo analysis actually tries to simulate that. The uncertainty then gets propagated into the whole group of data that represents the whole facility, and that's what we then end up with GSDs in five, five-and-a-half range for.

DR. MAKHIJANI (by Telephone): So, Bob, a Monte Carlo analysis cannot substitute for data. It can only represent the data that you have, and if you don't have an idea about inter-day variability relative to the same day variability, a Monte Carlo analysis is not going to help you. It's just going to give you a sampling from the data that you have.

MR. MORRIS (by Telephone): I don't think you understand.

DR. MAKHIJANI (by Telephone): Let me finish my --

MR. MORRIS (by Telephone): ^ these were multiple day air sampling events. For example --

DR. MAKHIJANI (by Telephone): We were talking over each other so if you can start over.

MR. MORRIS (by Telephone): These are multiple day air sampling events. Their dumping TNT into a dissolving tank was probably done on three different days. The dumping of recycled oxide into a pre-dryer was probably done on eight different days.

DR. MAKHIJANI (by Telephone): But my question does not relate to the period of the set over which the air sampling was carried out. My question relates to the relationship of the air samples that were taken to the air samples that would have been present on the days when no samples were taken.

And the reason for worrying about that is within one sampling period you have enormous orders of magnitude of variation in the same location and the same job at the same time or in the same sampling period. How are you going to establish the relationship of that to the times when no samples were taken? And how do you know the sampling was done on representative days? I guess that's a short way of asking that question.

MR. MORRIS (by Telephone): Well, I think you could ask that question to the American Congress of Government Industrial Hygienists. Why do they think that that sampling method is an appropriate approach for contemporary today? There's an industrial hygienist going out today using that sampling method. And the answer would be because we think this is a representative snapshot.

DR. MAKHIJANI (by Telephone): It has been my understanding of this program from the time I looked at these years ago is that this was being done to improve industrial hygiene conditions and not for the purpose to which it is being applied. Now, it's possible the data is collected for one purpose, and it could be applied to some other purpose, but you have to establish that applicability. It doesn't mean when you have data that says air concentrations that you can automatically apply it to individual dose calculations whatever percentile you're using. You have to establish the relevance of that data.

MR. MORRIS (by Telephone): Well, back to my point is that that's why they fit data to lognormal distributions, is to incorporate the top end of those tails. Your point precisely was that this was a program intended for industrial hygiene improvement. That means they went after the worst part of the plant with more vigor than others, and, in fact --

DR. MAKHIJANI (by Telephone): You don't know that. That's completely incorrect. This is a misrepresentation of a documented Fernald history. They did these for the purpose, but there's no evidence. You have to establish that the industrial hygiene measures were actually implemented, and this was a problem that Fernald management confronted with the AEC repeatedly. When they asked for these things, they were often told there was no money. That's why you see, you know, you see very high air concentrations appearing and disappearing from time to time, varying from one job to another well into the production period, not just in the mid-‘50s. This went on in the ‘60s also, for example, and --

MR. MORRIS (by Telephone): Hold on. Let me respond to that point.

DR. MAKHIJANI (by Telephone): -- if I remember correctly, 1970s.

MR. MORRIS (by Telephone): Let me respond to that, please. Don’t keep --

DR. MAKHIJANI (by Telephone): Well, you have to let me finish my statement. I’m not done yet.

MR. MORRIS (by Telephone): Well, you ^ you need to stop after that question. You’ve raised the question. You need to stop and answer it.

DR. MAKHIJANI (by Telephone): Okay, go ahead.

MR. MORRIS (by Telephone): At this point whether or not the ^ funded the improvement that was requested or not is really not relevant to the issue. The point is data was still collected, and it still represented obviously bad situations.

MR. ROLFES: Bob, this is Mark Rolfes, and

I'd like to add if you do take a look at the source documents, the Daily Weighted Exposure reports themselves, it is documented within the report for the purpose of the studies that were conducted. I'll just read from this.

Let's see, this is the Feed Materials Processing Center thorium Plant 9, occupational exposure to airborne contaminants. It's HASL FMPC-9. The purpose of this document, the purpose, the survey was made with the following objectives in mind: to evaluate the average daily weighted exposure of FMPC Plant 9 personnel to radioactive dust; two, to provide data for the dust exposure history of personnel; three, to evaluate the effectiveness of plant dust control equipment; and four, to provide a basis for recommending additional controls or procedures.

DR. MAURO: May I jump in and ask what I always like to think of as a commonsense question because I heard your 95th percentile argument. That always is very compelling to me. What I'm hearing, and correct me if I'm wrong, is that daily time-weighted averages were estimated, given day -- let's say we're in 1959, and there's an interest that says, okay, here we are in 1959, and there are certain types of operations going on in a given building.

And let's say you say, well, we have a category of work going on in the building. Now, I'm going to go in there, and I'm going to collect these samples and come up with a daily time-weighted average which reflects exposures that a given category of worker experienced on that day in that room.

And everyone says, and if it's done correctly according to standard practice, you've got a pretty good idea of what the intake, uranium or thorium intake experienced by the worker was that day in that room. And I would say, yeah, if they did it the correct way, and these folks know how to do that, I'd say we've got that day down pretty good.

What I'm also hearing is that, but wait a minute. Let's say we've got that day down pretty good, but we realize from day to day and even if we did that day over again, let's say we went right back in and froze time and went back in, actually could go back and do it again. It’ll be somewhat different just because you picked a different two minutes when you took that, or three minutes or 30 minutes.

Now what I’m hearing is though, no, but we have a lot of those days. In other words during that year, there may be five, six, seven, eight times where we randomly went in and did this. So now all of a sudden, no, it’s not just one day. We’ve got n days.

Now we have those n days, and we take a look at it, and we say, well, gee, on this day the daily time-weighted averaged a certain amount of intake. Let’s just talk about how many atoms of thorium this person would, we estimate, took into his body on this day. How many atoms on this day and keep it really simple. And now we have five estimates, five separate estimates that if it was really randomly, this is what we get.

And let’s say it turns out as the concern is expressed, they’re all over the place. Let’s say they varied those different daily estimates. I don’t know how much they varied by, but let's say they varied by a factor of, okay, let's say those five different estimates varied by a factor of 100. I'm making this number up.

And we sit around the room and say, hmm, what do we do in a circumstance where on the five different days where we made our best estimates of what we believe were the real intakes, the number of atoms this person took in, depending on, you know, differed by a factor of 100.

And Jim's saying, well, you know, what we're going to do, we're going to take those numbers, and we're going to fit them to a lognormal distribution. And we're going to pluck off the upper 95^{th} percentile, and we're going to say that every single day that guy worked there, we're going to assign to him the number that came off that distribution at the upper 95^{th} percentile.

MR. GRIFFON: I don't think you're assigning the 95^{th} all the time, are you?

DR. NETON: The highest exposed worker. I mean, for a worker who was likely to be --

DR. MAURO: Right, right, I understand.

There are certain worker categories that that's unreasonable.

DR. NETON: And that's also in the discussion, right?

DR. MAURO: But if he's in the, we're saying, no, this is the worker that worked in this room every day doing this job in that building, and he's that worker. And we do have data for five days out of the year. And what I'm hearing is that to make sure, because we recognize the variability is so great -- and the data will tell us how variable that data is.

Now, if that's what I'm hearing, and you pick the upper 95^{th} percentile, and we're going to give it to him every day, I would have to say that, well, gee, that sounds like it's a pretty reasonable thing, but I'm willing to hear Arjun or Hans say why that might not be, and if that's, in fact, what you're saying you did.

DR. BEHLING: Let me just give you some numbers here because we're just talking about the variability. I'm looking on page 59 of my report, and it's Attachment 4.3-1e. And it talks about comparable weighted exposures of Plant 9 personnel, and the dates in question are May 17th through October 31st as one period of this assessment. And it's followed by a second set on November 4th through November 23rd. So we're talking about a one month difference. And it's given by location.

And John just said what are the potential variabilities for a daily weighted average. For the wet area here for the earlier period in May to October the daily weighted average was 215.1 MAC and a couple months later it was down to 2.74. We're talking in there a hundred-fold difference.

DR. MAURO: I guessed it.

DR. BEHLING: And the same thing for the reduction area, 233 versus 3.49, for the arc furnace 473 versus 23. So we're talking monumental differences over a very short period of time.

DR. ZIEMER: Can I make an observation, Mr. Chairman? First of all the reason for sampling is exactly to find out what you're describing. The fact that there's variability says nothing about that sampling is not representative or is poor or anything else.

It says, in fact, the operations may lead to very variable concentrations which it may include some sampling error, may include some differences in operation. All of those things come into play, but that's precisely what you want to know. If you're going to do bounding, you want to know what that spread is.

DR. BEHLING: I agree, but that was my initial questions of how much of these numbers that, for instance, for the wet area, the 46.9 MAC hours for the helper, for the three helpers defined in Figure 2, how many datasets represent that number? That's the question.

DR. ZIEMER: Now, unless you only did this once.

DR. BEHLING: Exactly.

DR. ZIEMER: Unless you only did it once out of a hundred times, that's like you're bagging marbles where you're drawing one and describing, so obviously, it's a statistical issue.

DR. BEHLING: I understand that.

DR. ZIEMER: But as long as you've done, and if you didn't do that well, then you're uncertainty gets greater, and you spread that out and pick from the upper end, it sort of, in the way we know, it sort of helps, it gives you a worse answer than if you know that very tightly.

If you got the same results every time and squeezed it down, you'd know that number very well. You'd have a tight distribution. But, in fact, you want to know about that variability. That's an important thing.

And, Arjun, I'm not sure unless there's some indication that people have selectively chosen days to get particular results, and I don't think they have evidence of that, you have to assume statistically that there's some kind of a representation of the distribution regardless of which days you chose.

They may not be, I think you can always argue there are some day in there that's different, but that's the whole reason we do, we don't do 100 percent sampling. It's like our dose reconstruction sampling. I think someone could argue that we've missed the right doses, or we're not representative. But you statistically say, well, I'm sampling at least enough to get a picture of this to bound something.

But maybe I missed the point you were making on that, Arjun. Could you clarify that?

DR. MAKHIJANI (by Telephone): Dr. Ziemer, I agree with what you are saying, that you don't have to sample a hundred percent. You don't have to sample anything close to a hundred percent in order to have a good picture. But what you do have to know is what the days that you sample, how representative are they of the whole picture --

DR. ZIEMER: And I don't think you always know that.

DR. MAKHIJANI (by Telephone): -- it relates to the representativeness question.

DR. ZIEMER: You only know that by doing the sampling, right?

DR. MAURO: I would argue that. In other words let's say we're all sitting around a table. We're about to design this program. And we say, listen, we all recognize from day to day things really change a lot. And we know that. We've been living with it. And we want to go in there and get an idea of how different is it.

So what I'm hearing is that there were some n number of days that they went in, and they went ahead and took the sample to say how often is it really high, how often is it low. In the end you've got a set of data. As far as I'm concerned, I look at it real simple. I've got n days over 365 days where I have an estimate of the number of atoms of thorium this person inhaled. And it goes from a low to a high.

And let's say it's, I'm just picking five days. I don't know how many days you've got. And I would say, listen, what do I do with that now? We're sitting around the table. What do we do with this? Can we somehow use that information to predict with a degree of confidence that we can estimate what the intake was for that worker or people like him who did a similar job during that year?

And what I'm hearing is that we're going to pick the high end. We could pick the highest number. Now, in my mind if we pick the highest number out of five numbers, I’m not quite sure statistically what that means, but it probably pushes you up pretty high up the distribution.

In other words to say, well, we only have five numbers, and we want to make sure we’re being claimant favorable. Maybe we’re going to pick the highest number or it may be based on the spread, you know, you can pick a number that’s higher than the highest number. There’s only five measurements, and we are talking about 200 days.

So I guess if I’m thinking about this correctly, if people were listening to what I’m saying and say, yeah, I hear what you’re saying, how many days of these kinds of estimates do you have for a given category of worker for a given year? And when you have those number of days, out of those numbers, in fact it would be nice to have them in front of me. Here they are. What did you pick? What are you going to pick? Are you going to pick the highest number? Are you going to pick a number that’s higher than the highest number?

That’s where, you know, how I’m looking at this.

DR. BEHLING: Yeah, let me pose a question here --

MR. ROLFES: Just a second, I want to answer Dr. Mauro’s question.

For thorium we have approximately 3,000 air samples for thorium over the operating history of Fernald during this SEC evaluation. So that data has been provided to the Advisory Board. It’s on the O drive and also the source documents that all of those air samples were pulled from are also on the O drive. So they are available for review.

MR. GRIFFON: I mean, that didn’t answer his question. I’m looking for an answer to the question.

DR. BEHLING: What’s the question? I am a wet area helper. I worked at Fernald in 1955. Am I recently going to assume that what you’re going to do is to go to this table that you have here in Figure 1 and say, yeah, you’re a wet area operator, wet area helper, and we’re going to assign you 46.9 MACs?

DR. NETON: There’s no point to this

discussion.

DR. BEHLING: This is the point because on the next page I have one daily weighted average for that number.

DR. NETON: It's going to be the daily weight, the distribution of the daily weighted averages for the facility. And he would be assigned, I don't know whether it would be the 50^{th} percentile or the 95^{th} percentile of the daily weighted average of the distribution for that entire facility.

MR. GRIFFON: Can I get back to, there's a couple detailed questions. I'd like the answers to John's questions first of all. But also in the details of this when you say the distribution, does that include these daily weighted averages from these reports, these daily weighted estimates?

DR. NETON: Yes.

MR. GRIFFON: Or does it include each worker's estimate? Because, I mean, that's the point I was making with the furnace operator. It looked like -- and we know this from field experience -- we have one worker that was getting a lot less exposure. You make your own exposure in that kind of environment. One worker was getting a lot lower levels in the BZA than the other person. And then you have an average that, you know, you've got 107,000 and you have an average of 3,000, this is now, is the 3,000 point going into your distribution or is the 7,000? You know, is the other worker --

MR. ROLFES: I don't know, good point.

MR. GRIFFON: That could drastically change that upper bound of your distribution.

MR. MORRIS (by Telephone): What we do, Mark, in this case is we take the, there is an identity for a lognormal distribution that you can use to take an average in a GSD and convert to a geometric mean. We are assuming based on Strom and David's data of Health Physics Journal, 2008, that the GSD is three in all cases.

DR. NETON: Bob, this is Jim. I think you might have missed the question. The question really was did we use the individual data for each worker or did we use the average for the class of workers?

MR. MORRIS (by Telephone): Individual, that wet area helper is represented as, so since there’s three wet area helpers, then that represents three points on the facility curve.

DR. NETON: Every individual worker that was sampled is in the distribution.

MR. GRIFFON: Okay, I’d like to crosswalk that because I’m still a little unclear that I think the study that I looked at -- I didn’t look at both those in detail, but the one mentioned, 19, I think it said 19 job categories, were looked at. And the only DWE that’s recorded is the DWE average. So the only breakdown you see is like high and low, and then they have average. And then the sum at the bottom is the only DWE recorded. In other words, they didn’t tally for each person. I was wondering where did you get those numbers from.

MR. MORRIS (by Telephone): It would be remarkably labor intensive to try to figure out a fitted distribution for each individual path.

MR. GRIFFON: Okay, so you didn’t do that. That’s what I’m asking.

MR. MORRIS (by Telephone): That’s right.

So we're rolling it up at the bottom of that Figure 2 which is the job exposure evaluation form.

MR. GRIFFON: Which is based on job, not on individual worker. I'm not criticizing, I'm --

MR. MORRIS (by Telephone): That's correct, Mark. You got it right.

DR. NETON: I think we're kind of getting into the weeds of the analysis here trying to --

MR. GRIFFON: I mean, my point there is that when you have two workers that range in one task -- I'll admit it. It was like a five-minute task or a three-minute task or whatever, but the ranges are drastic --

DR. NETON: I agree. We have a wide range here, and I think that's --

MR. MORRIS (by Telephone): As long as you identify the distribution even if it contains multiple workers, you can still compile a facility --

MR. GRIFFON: I just want to understand what the data is. That's all I'm trying to understand.

DR. NETON: I think what needs to happen here though is that we need to, if we haven't already, present this exact analysis that we've done for SC&A to react to. I mean, right now we're here trying to flesh out this in some scientific detail, and all we're saying right now I think is we have 3,000 data points of thorium at Fernald, we believe there's sufficient information here to generate bounding analyses for thorium exposures.

DR. MAURO: Notwithstanding the ^ samples.

MS. BALDRIDGE: Can I say something about the percentage that's used to find class whether it's 16, 50 or 95. Is it based on the facilities that they were working in?

DR. NETON: No, the job category, type of job.

MS. BALDRIDGE: Are the records available to show who was performing each task and the different times? When you go from 50 percent to 95 percent, how do you classify someone who would fall into the realm of other possibly... My father did inspections at times during the 12 years he was at Fernald, but he also was classified technical, and he did chemical testing. So does that put him in the 50 percent range, or does that put him in the 95 percent range?

DR. NETON: I can't respond to that specific example. But what I can say is when we do those groupings, if there is any ambiguity at all, the person will be put in the higher group.

MS. BALDRIDGE: And the same for maintenance. Were they doing general maintenance? Were they doing repair on a specific piece of equipment that would have involved clearing dust to get to what they were working on? Does that put them in the 50 or does that put them in the 95?

DR. NETON: That's a very good question, and we do struggle with that. And like I said, in the instance where there's some doubt as to where the person fits, it would be given the higher exposure category.

MS. BALDRIDGE: Okay, and also at the point of at a given time. You know, this petition covers 38 years. There were a lot of generalities put out there. Well, we did this. Well, what is the window for that particular safety implementation period? Was that only done after 1980? You know, if that's the case, there are 28 years of workers prior to 1980 who weren't protected under that particular procedure. How are these things?

And my final question or statement is why did it take the SEC filing to motivate NIOSH to go to the Mount and go through those 12 boxes to find the thorium data that had been stored there since who knows when?

DR. NETON: In answer to your third question, I think Mark sort of addressed it at the very beginning.

MR. ROLFES: Yeah, the Mountain View data weren't actually at Mountain View. They were stored at a separate federal records center, the Dayton Federal Records Center, and were brought to Mountain View for review.

We were essentially using, I had previously given an introduction that we had defaulted to what we believed was a claimant favorable and scientifically defensible thorium intake model. If an individual had indicated that they were exposed to thorium, in our initial site profile we had said we would use a default of 1,050 MAC hours or consider individual bioassay data for thorium.

We wanted to make sure that we were able to get timely decisions out but also committed to reinvestigating any issues based upon new data that came in. This isn't the only time that we have gone back and done a data capture for Fernald. We've done several data captures both prior to the SEC and throughout the SEC discussions that have been going on.

Also, with review of individuals' bioassay data, we do sometimes find records that indicate another process that was ongoing. That triggers an internal look for us to go back and say, well, there's something else that we didn't know about. We need to go find out more information so that we can properly account for it.

MS. BALDRIDGE: So the point is when this whole process started back in 2001 with the enactment of the EEOICPA, and people were about gathering their information and submitting their claims, we are now in 2008 and the decisions that were made at NIOSH to use default information rather than even -- I'll use my father's case. I was looking through his old records. I asked and I provided some that I brought today. Who was doing the correlating?

You know, my father was hired in December of '51. He worked the entire year of 1952 before Plant 6 ever opened. That's where he was exposed in 1952 to the UF-6 which puts him in the pilot plant, but that exposure was not considered in his dose reconstruction. So right now our claim is locked up in the Department of Labor.

They won't move forward. They won't move backward until the site profile is revised and all this information can be resubmitted and NIOSH requesting cases back so that the information that was available but not applied because defaults were chosen rather than calculations have not only my father's claim tied up now here, what, six years, but a lot of other people who this data could apply to.

MR. ROLFES: Sure, I certainly understand,

and that was done as an efficiency method early on so that we could provide a claimant favorable response.

MS. BALDRIDGE: The intent was not what happened.

MR. ROLFES: I certainly understand. That is one of the issues that we've dealt with, and it's certainly one of the things that I hear from workers when I go to public meetings. That is one of the concerns that I've heard from workers. So it's not just a concern that you've expressed. Other workers have, in fact, expressed.

We certainly have committed to taking a look back at any claims that were previously turned down. We continue to do investigations and reviews on every site profile. We are committed to re-evaluating any previously denied claims when new information does become available.

MS. BALDRIDGE: But it's conditional subject to the revision of the site profile.

DR. NETON: But keep in mind on the claims that we rework, the vast majority do not change their compensation decision, overwhelmingly.

MS. BALDRIDGE: Well, it would depend on the basis for the request to review.

DR. WADE: But see, the program has always struggled between two competing values. In time, we're giving people timely answers and being complete, and those values sometimes butt against each other. In retrospect I'm sure it can be found that errors in judgment might have been made. But you have to understand the times that those decisions were made and the purpose. And certainly the agency commiserates with anyone who's been adversely affected, but we'd like you to try and understand why that was done.

MS. BALDRIDGE: In hindsight I would have chosen accuracy over timeliness.

DR. WADE: And in some other cases when we did that it might have been shown to be wrong as well. So we do understand.

I'd like to offer an observation as sort of an interested listener of all the discussions we had so maybe NIOSH can address some of the issues because there was lots of discussion and lots of important issues raised, and then we moved on. I think there are four fundamental questions that need to be raised and answered relative to what we've talked about.

First of all, you've got to spend some time sort of scoping out the process that's being investigated, how many years, what was going on, what the geographical extent was. Once you do that then you start to look at the makeup of the dataset, the size of the sample that's being taken to try and represent that process. And statistics will guide you as to whether or not your sample size is adequate. And if it is, then what you do with that sample size in terms of its inherent variability.

The other thing that I heard raised was we need to be sure that the purpose the data is being put to is coincident with the purpose that the data was collected for. And if not, then you have to create a reason, a bridge, why any deviation there is acceptable.

And the last thing you have to struggle with is this question of was the sampling biased in any way. You have these issues of were people shutting down the process that was being evaluated on sampling days. You have to look for bias, and if there's reason for bias, you have to consider that statistically if you can. But you have to consider this.

But I think all of those points were raised. I think all those points are valid. I think those points really need to be addressed back to the assemblage at some point.

MR. ROLFES: Certainly a lot of those issues may be addressed in some of the source documents in the exposure study reports themselves.

DR. ZIEMER: I just want to make an observation, Lew, as kind of react to your fourth point. And that is that none of the data we used was collected for the purpose for which it's being used today. None of it.

DR. WADE: But then you need to intellectually look at that and decide it's acceptable to use the data.

DR. ZIEMER: But that's exactly what NIOSH has been working on and their contractors, and what we struggle with. And what the Board is saying are we doing that right. All of this data was collected for workplace control. Now it is being used to establish eligibility for compensation, two very different objectives. Now, we know that in a sense the data is there, and the question we struggle with is are we using it properly and correctly and making the proper inferences. That's the real struggle.

DR. WADE: Or at least not using it improperly.

DR. ZIEMER: We're not using it improperly. I just wanted to clarify it because none of it was originally collected for this purpose.

DR. WADE: But Mark read a fairly compelling list as to the purpose of the analysis that sort of gave me comfort in terms of the use of the data. But those things need to be explored.

MR. GRIFFON: Back to John's questions. I'd love to have an answer to those, like how many days, when we were talking about this earlier, how many days was it sampled over.

MR. ROLFES: That was why I was pointing out on the ^ report.

DR. MAURO: Would you indulge me for a minute? If someone showed up and handed me a truckload of data and said, listen, we're trying to get a handle on the intake these people might have gotten ^.

DR. ZIEMER: Talk loud enough so the people can hear you.

DR. MAURO: I'll speak from here. What I was saying, all right, I've got this data. What I would do is I would create a table. I'd say, okay, I've got data that captures a certain number, n years, one through ten, ten years of data I have. And I also have data that says, well, we can sort the data into different categories of workers or maybe buildings.

I'd say this is what I want to know. For year number one, worker category or building number one, how many days do I have an estimate of a time-weighted average? Is it one day in that year for that worker? Fifty? So what I'm really saying is if you tell me that -- and you could fill in this table.

This is what I would do. I would say,

well, I've got 50 days' worth of data in year one for category worker one, 50 days of the data. I'd say not bad, or ten or four. And then I'd go to my statistician. I'd say, listen, assuming that this is what we have, what do you do with that? And if I saw those numbers, and I would say they're all filled out, and some are ten, some are 12, some are 30.

I would say I've got a rich database from which I could build distributions for each one and then make judgments for people who were in this category in that year what intake I would assign to that worker. Now I don't know if that's what you did, and I can't tell from the conversation we had. Because that would be what I would be shooting for.

Now, it may turn out that the data is such that it won't allow me to do that because I think that maybe you can't, and maybe all you can do is work with a rollup because in the end maybe you just have a rollup of data. In other words you have a number of dates. You've got 500 days, but you can't sort them this way. You can't sort them.

All I know is I’ve got a list of 500 numbers that capture what the concentration, the intake, was in each day. And we really can’t sort them by year, and we can’t sort them by worker category. Now, the question becomes, but we do know we now have a sampling of what the intake was for a certain number of days that in theory can we go from there to now we have a real person who worked in a real year at a real location can somehow we take that big collection of data and somehow assign a claimant favorable, scientifically valid intake to that worker.

I guess my first question is does that exist? Can that be built? Or am I thinking right about this? In other words, that’s how I’m thinking right now.

DR. NETON: I probably shouldn’t speak because I haven’t read the report, but I don’t think we have this level of granularity built into the process. I think we’re hitting this with a bigger sledgehammer which is you have a lognormal distribution generator of all these worker categories, not even categories, just worker job types I guess or whatever they are.

And so you generate from low to high the possible exposure scenario for all of the daily weighted exposure averages that were generated.

MR. GRIFFON: By how many days? I mean, I saw one study that looked like two days of sampling. How many days?

MR. RICH: Could I make just a couple of statements? Number one, the DWE reports which are a time-weighted study that was religiously done pretty much from the start of the operations and carried on for a number of years, so they carry a wealth of study information directed specifically at defining the worker exposure in the plant.

In the case of thorium operations, the sheer volume, the sheer mass, that went through the plant was orders of magnitude less than the uranium so it was more campaign oriented. They averaged about a metric ton of thorium per day, and that’s just a big can of it. Sometimes it was a little more than that, but sometimes less, but for this reason then, you would expect the sampling to be done to define the thorium exposure to be not continuous as it would be in a uranium operation.

So the granularity of your results are going to be different in a thorium operation than it would be in a uranium operation because they were running metric tons per day after day after day. Now the other point is --

MR. GRIFFON: Well, given that I assume you're going to tell me a low number of days or else you wouldn't have set it up this way.

MR. RICH: And the DWEs were done on the days that they were processing to define the exposure to people in those thorium operations. So it would be directed to the times when the maximum exposure would be expected.

Now the other thing is that the DWE reports that is a wealth of data that defines not only thorium but uranium exposures. And with the uranium we have a confirmatory bioassay analysis in uranium data which, as Bob indicated, demonstrates that the analysis based on air sampling data is always higher than you would get through bioassay.

So we have confidence that the analysis that we would use with the thorium data will provide a higher dose, and particularly since we are applying the levels that we get in average exposure levels for the whole year as opposed to knowing that they were not exposed for the whole year. So there's a conservatism built in that alone so we should keep these in mind.

We've attempted every way we can to maximize, make sure, that we did not underestimate the exposure to individuals and particularly in the thorium. Because in the early days we were limited, they were limited, the industry was limited in what they could determine from a bioassay data. And by the way, we did recover some information related to the effort that they went to to develop urinalysis for thorium at Fernald and stimulating at the University of Rochester and elsewhere. As a matter of fact, they did some thermoneutron analysis of thorium and uranium in an attempt to develop a new technique.

MR. CHEW: Bryce, I think we have a couple of slides which we can show John. I think

John --

MR. GRIFFON: Wait, wait, just one second, just one second, Mel.

I agree with all, I mean, I don't disagree with anything you said, Bryce. I still haven't heard -- I just wanted a simple answer. How many days and what years were these studies done? Because then we can kind of compare it with the thorium history at the site if it hit the peak times, if it hit the, you know. I mean, that's important.

MR. ROLFES: I did point out --

MR. GRIFFON: Just the facts. I'm not judging them. I'm just, you know.

MR. ROLFES: I did point out that roughly 3,000 thorium air sample results have been catalogued in a MicroSoft Excel spreadsheet. Those have been provided to the Advisory Board on the O drive.

MR. GRIFFON: Yeah, I have those, and one question --

DR. MAURO: ^ is TWA.

MR. ROLFES: ^

MR. GRIFFON: But those aren't DWE samples, are they?

MR. ROLFES: These are supporting samples for the daily weighted exposure results.

MR. GRIFFON: Are they used in this lognormal distribution that Jim's talking about? It sounds like you're not using that.

MR. ROLFES: The daily weighted exposure result reports were the basis for the distribution.

MR. GRIFFON: Okay, so how many days of daily weighted exposure, I mean, a simple question really.

MR. ROLFES: I'm sorry?

MR. GRIFFON: How many days were these studies done on?

MR. ROLFES: I would have to go back to the document and count all 3,000 sample results, but there's samples --

DR. MAURO: So you didn't come at it that way.

MR. GRIFFON: Those 3,000 samples were only associated with the time-weighted studies? I don't think so.

MR. ROLFES: No, not necessarily. No, there are certainly samples in this Excel spreadsheet that would have been supporting the daily weighted exposure reports and also other air sample results likely. I haven't done any --

MR. GRIFFON: Is it more than just these two reports that were circulated? Are those just examples or are they --

MR. ROLFES: These are examples. And if you recall, on pages nine and 15 of our slides, we've identified --

MR. CLAWSON: What page is it?

MR. ROLFES: This is page nine. This spans from 1952 through 1969. Every time there's a dot in that table, there's a daily weighted exposure report from all the plants that are listed there. And this is what I went through for Plant 1, Plant 2, Plant 3, Plant 4, Plant 5, Plant 6 --

DR. MAURO: The dot is. Could you give us number of days where you have daily weighted average?

MR. RICH: The data is available.

DR. MAURO: And when we have that, we're done.

MR. CLAWSON: Excuse me. Everybody's talking over each other, and we need to be able to be a little bit correct and polite to each other, so please...

MR. ROLFES: Yeah, this is also the other slide. Now you can cross-compare this slide to the one that Mark has there. That's the slide that has the daily weighted exposure results documented on it for each plant by year. This slide has the thorium process that was conducted by each plant by year.

Look at the two together, John. I think --

MR. GRIFFON: And then the last question and then I'll be quiet. What -- I think I just lost my question. I was looking at this data.

DR. ZIEMER: Well, this is partially to respond to John. It's not the number of days per year compared to 365 days. It's the number compared to the --

DR. MAURO: Operations, operation dates.

DR. ZIEMER: But they did those like five times and sampled three --

MR. GRIFFON: I've got my question now. This DWE data which you're using for the coworker model, I believe, is that in a spreadsheet anywhere? I don't know where that is.

MR. ROLFES: It probably has not been entered yet.

MR. GRIFFON: Because that could easily be sorted, and you can look at these, how many --

UNIDENTIFIED SPEAKER: ^

MR. GRIFFON: -- the concept, right?

MR. MORRIS (by Telephone): Mark, this is Bob.

MR. CLAWSON: Excuse me. We've got somebody on the phone.

MR. MORRIS (by Telephone): Mark, this is Bob.

MR. ROLFES: Yes, Bob.

MR. MORRIS (by Telephone): I'd like to go directly to this current, the idea that John raised about trying to make this an exercise and define the uncertainty.

I think that's what your point was, wasn't it, John?

DR. MAURO: Yes.

MR. MORRIS (by Telephone): Well, let me just tell you, maybe you missed when I was talking about the Adams and Strom report of 2008 in Health Physics Journal. The title of that peer reviewed report is “Uncertainty and Variability in Historical Time-Weighted Average Exposure Data”. I think they really went to the heart of exactly the question that you’re trying to ask.

DR. MAURO: Okay, but, I mean, you see, the currency in my mind, the currency, is these daily time-weighted average. There’s our currency. And do we have a rich currency here that would allow us to do the wonderful things we’d like to be able to do? And right now I’m hearing that, well, I don’t think you have the numbers. In other words I see the dots. I see the dots.

MR. MORRIS (by Telephone): Do you have in your hand an example of the Plant 9, 1955 report?

MR. CLAWSON: Yes, we do.

MR. MORRIS (by Telephone): That’s what, 50 or 60 pages? I don’t remember exactly any more. But every one of those dots represents a report that’s between 30 and a hundred pages long, all typed.

DR. MAURO: From which we could fill a table and that’s ^.

UNIDENTIFIED SPEAKER: ^ DWE report.

MR. GRIFFON: It's a DWE report.

MR. RICH: ^ the report is not this single page. It's a 30-page report in which summaries have the information on it.

DR. MAURO: So has that been processed and the numbers where the dots are, is that what you're going toward?

MR. MORRIS (by Telephone): That's right. We don't want to invest a large effort into that until we understand that this is going to be an acceptable technique.

DR. MAURO: Well, I guess, I'm just one person offering my perspective. It seems to me you fill those numbers in, and it's not one that's in each one of those little boxes, but it's --

MR. MORRIS (by Telephone): It's one report in each box, John.

DR. MAURO: -- a substantial number. You've got something.

MR. RICH: And then bearing in mind again if you have --

DR. MAKHIJANI (by Telephone): This is Arjun. Could I ask a question about these samples to follow up on what Mark Griffon was saying? How do we establish the relationship of the air samples and the daily weighted average process with the other air samples that were not taken for the same purposes or with the same method?

MR. MORRIS (by Telephone): Arjun, this is Bob. I think we lost that line.

DR. MAKHIJANI (by Telephone): Sorry?

MR. MORRIS (by Telephone): I think we've lost the line. Nobody's talking in the background.

MR. GRIFFON: No, we're here.

DR. ZIEMER: We're pondering.

DR. MAKHIJANI (by Telephone): It's you and me.

MR. MORRIS (by Telephone): You and I can talk, but I think they're going to have to dial us in again.

MS. HOMOKI-TITUS (by Telephone): Let's get a message to somebody in the room to tell them it sounds like they --

DR. WADE: We are here.

DR. ZIEMER: We heard you.

DR. WADE: The question is being pondered.

MR. CLAWSON: And who’s going to answer that one?

MR. ROLFES: There could be a mix of both air samples from the daily weighted exposure reports and from time periods when a daily exposure report was not prepared. We feel that the daily weighted exposure reports would certainly have a much better idea of the true exposures that were incurred by the employees in that time period.

MR. SHARFI: I think he wants to walk through those 3,000 samples in the spreadsheet. How can you separate those out?

MR. ROLFES: Well, there are dates on the air samples, so it would take a little bit to compare the exposure studies to the 3,000 roughly air samples that are documented.

DR. MAKHIJANI (by Telephone): No, no, I wasn’t asking about a comparison. And I understand what these daily weighted average exposure studies were. It’s reasonably clear how they’re done. They’re quite well documented. The other air samples which appear in various kinds of Fernald documents, it’s not very clear why those samples were done, when they were done, what their relationship was to these daily weighted averages.

So my question is not how you sort them into two bins, daily weighted average samples versus other samples, but whether these two sets of data belong in the same distribution or not. We've confronted this problem before as to how do you put data points in the same distribution or are they two different distributions? And what's the technical process of doing that?

DR. WADE: Arjun, this is Lew. You're question was understood. Now we'll have someone answer your question.

MR. ROLFES: I don't believe we would be doing that, Arjun. These would be two separate datasets. There may be some repeated information in this Excel spreadsheet, but we are going to be using the daily weighted exposure results for the distribution that we're referring to.

MR. MORRIS (by Telephone): Mark, the only other data, air sample data, that I'm aware of, there were three kinds of air samples taken, breathing zone, general area. I think the third was called process. I'm not sure if that's the right term they used. But the point of the third air sample was to get not something that represented an exposure to a worker but to represent what was inside a fume hood, or what was coming right off of a grinder.

And those are not used in daily weighted exposure calculations. They were really focused on process improvements. So except for those process controls, the process samples, I think every sample that was either breathing zone or general area in my experience with this data from Fernald is represented in a DWE report.

DR. WADE: Did you understand that, Arjun?

DR. MAKHIJANI (by Telephone): Yeah.

DR. WADE: Okay, thank you.

MR. CLAWSON: Could I just add one question then? I know this may be real simple, but one of the things that I'm not understanding is, as this says in this paper and what I'm going from is the occupational exposure paper that you had there. It says, "During the period of

May 12^{th} and 13^{th}," so that's telling me right there that only on May 12^{th} and 13^{th} of 1954 these daily weighted averages were performed. Is that --

MR. ROLFES: I'd have to take a look at the document.

MR. CLAWSON: One of my things is, is 1954, and this is in Plant 4, you get down here to the bottom part, and they're only sampling 19 employees.

MR. ROLFES: Correct.

MR. CLAWSON: And of the 19 employees studied four, 21 percent, of exposure concentration greater than the acceptable maximum level of concentration was over. And that goes to the furnace operator and to the grinder.

But then I go back here to the papers that I pull up, and it says a survey was actually done in 1953.

MR. ROLFES: Okay, I have to pull that up once again.

MR. CLAWSON: I'll have you look at this, but something that's interesting to me is we're saying that we've got 3,000 samples, and we've got basically about 14 places that we're pulling samples from. To me it's looking like we've got two days a year that we may pull a sample.

And my issue is, as we've already said, thorium wasn't being produced every day. We need to really look at what we're getting into on that because also there's, it also calls out there many different facilities. Ingots were rolled and fabricated in Plant 6. However, countless grinding inspection slugs were completed in Plant 9.

My synopsis on this is basically we need to sit down and really look at these processes of how it was done and how we're trying implement it. Because, as it was already put out to us, we're using this for something totally different than it was designed for. And we're going to have to sit down and really study this, and SC&A's going to have to be able to have the opportunity to be able to look at that.

DR. WADE: Can I offer you just a process consideration? At some point the work group will say to NIOSH we would like to see certain things done or certain data prepared and presented. And then NIOSH can decide whether it's going to do that or not. SC&A is advising the work group.

It's happening in real time. You have to consider that. And at some point the work group has to offer its suggestion to NIOSH as to what the work group wants to see. It doesn't have to happen right now, but you need to keep that in mind.

MR. CLAWSON: And we need to do that.

MR. BEATTY: If I could just make a comment. This is Ray Beatty, former worker. As a former worker I'd like to reiterate something that Brad said there. And I heard the word campaign a little earlier in someone else's comments. And it sounds like data was collected like during thorium processing, but keep something else in mind.

Just because their campaign had ended, residual effects were still around. There was still the potential for exposure even in mixed waste, even in the latter years in remediation. There was no campaign per se except in the silos, Number 3 Silo, when it was decommissioned and dismantled thorium-based product there, a campaign.

So they had more specific maybe monitoring for the campaign. Bear in mind though when all the building products and the silo products came together in gross contamination, mixed contamination, the thorium residual was still there. So we've got to take that into consideration.

MR. ROLFES: I did want to clarify a little bit. Silo 3 contents were really not very much Thorium-232. That was more Thorium-230 which was a by-product of uranium or one of the progeny in the chain, decay chain, of U-238. That's a little bit different. We can address that in a recycled uranium and raffinate white paper.

MR. RICH: It would be accommodated in the fact that we're assuming a ^.

MR. SHARFI: I mean, those campaigns are short, and we're assigning DWEs for these shorter campaigns, but we're assigning them 365 days a year assuming the campaign occurred every day of the year.

MR. RICH: It's an overestimate.

DR. WADE: But the campaign, maybe try and put some specificity to Brad's point. Again, you're looking at a physical process. Maybe it involved the processing of thorium. There are various parameters that define the extent of that. It might be time. It might be the number of buildings. It might be the type of workers. It might be variability within that process. So you can define this physical process through n dimensions.

And then you're going to offer a representative sampling of that. Your job is to show that the sampling is indeed representative as it deals with each of those n dimensions. And those are the kinds of numbers you need to bring to this group and say here it is. And they can then judge whether it's adequate.

You have these wild cards that I tried to introduce before which are purpose and bias. You need to consider them as appropriate. And so that's what Brad is asking for. He hasn't put parameters on it yet, but that's what you're kind of asking.

MR. CLAWSON: That's what I'm kind of getting --

MR. MORRIS (by Telephone): I think we have done that, and I think it's in the detail of the white paper.

DR. WADE: That's fine.

MR. MORRIS (by Telephone): I think we've already done what you've asked, Lew, and I think it's in the detail of the white paper.

MR. CLAWSON: Then we'll take that under advisement.

Go ahead, Sandra.

MS. BALDRIDGE: Quick question, so how are you addressing the exposure to thorium that occurred because Fernald was the national repository, and there was a document submitted in the petition which suggested they had been asked to be that repository back in 1959 even though it may not have been made or announced as the official repository until 1970, '72, whatever the site profile said. I mean, you had deterioration of containers, air distribution, were any of these monitoring sites, I think somebody said there were 14 at locations where thorium was being stored.

MR. ROLFES: Well, as far as contained thorium in a can that’s coming in and stored onsite, unless that can’s opened up, there really isn’t a significant potential for internal exposures.

MS. BALDRIDGE: But it was continuing --

MR. ROLFES: The exposure scenario that would be of importance there would be external exposures, penetrating radiation that escapes through the seal. That would be recorded by an individual’s whole-body badge or dosimeter that was used.

MS. BALDRIDGE: But they were talking about having to re-drum and re-drum in some cases up to four times because of the deterioration factor in the container. So there may have been exposure externally, thorium dust in the air, before the damage to the container was ever recognized.

DR. WADE: Okay, so let’s talk about the re-drumming and the potential contamination --

MR. SHARFI: The thorium has two separate kind of white papers. One covered post-’68 which at that point then you start having chest count data and other forms. I know in the ‘90s they started doing some thorium DAChour tracking and stuff like that, but it is reported in people's files. And this DWE's really only covering the pre-'70 work prior to the chest counts and stuff like that.

So we do have two separate issues here and two separate time periods and two separate types of monitoring that we are discussing. And I don't know if we want to be jumping back and forth between these two issues. The re-drumming I don't believe occurred until after the chest count data I think occurred, and that's a separate type of coworker analysis versus --

MR. RICH: There was re-drumming done periodically throughout the history of the storage operation, but that is covered through individual sampling and --

MR. CHEW: Plant 166 and --

MR. MORRIS (by Telephone): Plant 1 had a lot of that data. Plant 1 was sort of the more sampled --

MR. SHARFI: The group that we'd be assigning so it would be covered under the DWE for Plant 1. We'd assume they're thorium workers, and then we'd be assigning thorium intakes based off the building-specific --

DR. BEHLING: Let me raise another issue on the issue of special issues, but this goes beyond normal activities of processes, but activity levels that you normally associate with discrete events such as fires, explosions, ^ will raise air concentrations by orders of magnitude. And with rare exceptions were these incidences documented or reported within an individual file.

Obviously, the daily weighted exposure tables that you have shown do not account for any radiological incidents. And again, there could be significant high exposures that are poorly documented in behalf of individual workers who would have been affected. What would we do in --

MR. ROLFES: I did want to call your attention on the O drive. One of the documents that was provided to the Advisory Board is an investigation of the thorium blender incident. It was an incident that occurred in 1954.

DR. BEHLING: I'm familiar with all that because I used that for another purpose, but that was one incident. There were many, many incidents, and I talk about those in my report where you, where in some instances there was the fortunate presence of a hygienist who took air samples. And he took air samples just before the event, and then during the event. And we see this monumental increase in air concentrations.

And, of course, those are rare instances where someone was there to monitor the rise in air concentration. And it's transient, but the fact is they're not really reported in the individual files. They're not necessarily part of a person's exposure record, et cetera, and yet are potentially significant in terms of an exposure that is not captured by the daily weighted exposure data.

MR. ROLFES: That's true. There could be a separate report associated with that incident as I pointed out. It's very possible that it was an acute exposure for one day, but I feel that we have a pretty strong basis that our chronic exposure model and all the overestimating assumptions, any uncertainties that we have regarding air sampling data, exposure time, particle size, respiratory use, all those compounded uncertainties are to the benefit of the claimant.

And I strongly believe that the chronic exposures that we're applying based on the daily weighted exposure results are going to result in claimant favorable overestimates of the actual internal exposures that were incurred by employees at the site.

DR. BEHLING: Let me just be sure I understand. If you're a person, let's just say you're assigned to Plant 1 in any one year. You're not going to, you're going to look at that person's file and say what is your job description. But then rather than use the job description, you're going to simply assign him to either a high, medium or low category. Is that correct? And then for that year you're going to look at the lognormal distribution in daily weighted exposures, and then you will assign the 95^{th} percentile value for the individual. Am I correct?

DR. NETON: That was one of the proposals.

DR. BEHLING: So you have a lognormal distribution for the entire Plant 1. You categorize the worker based on job --

DR. NETON: For the year.

DR. BEHLING: For the year.

DR. NETON: For the entire facility or just --

DR. BEHLING: For the entire plant.

MR. ROLFES: By plant.

DR. BEHLING: By plant. Plant by year. And then you will take that job description and determine whether or not he's high, medium or low. And then assign him that value at the 95th percentile with no uncertainty if he turns out to be an H classification.

DR. NETON: For the entire year.

DR. BEHLING: For the entire year. So that's pretty much, and then for the next year you get another lognormal distribution. And if he keeps that same job, he's also H, and we do the same thing. So that's basically the sum total.

DR. NETON: That's an approach that was described.

MR. GRIFFON: Yeah, that's an approach that was described.

DR. NETON: There's other approaches discussed here, but --

MR. GRIFFON: I guess I've got a couple questions about the white paper. I don't know that our answers, Bob said to look, it's all in the white paper. I don't see descriptive statistics. Sort of the thing I've been looking for in the white paper.

DR. NETON: I think we need to produce some --

MR. GRIFFON: Anyway, I mean, I agree there's good detail in there, but the other thing in the white paper it says on page five I think it is, when job matching is possible, a more accurate dose reconstruction with less uncertainty is likely to result. What is that, because that strays from the concept that we've been talking about. Is that just another option?

DR. NETON: In my opinion that's another option that was put on the table. But I suspect at the end of the day we'll, that would be difficult to do.

MR. GRIFFON: It makes me a little more ^

and ^ job variability is what I was talking about.

DR. NETON: I don't want to speak with a definitive product here, but I would suspect based on past history that we would end up with a distribution as Hans --

DR. BEHLING: Yeah, and then we had raised recently issues regarding roving maintenance people, labor pool people and their classification in terms of high, medium or low for people who have a highly variable exposure for not only in one plant but multiple plants.

DR. NETON: That's another variable detail.

DR. WADE: Let the chairman speak.

MR. CLAWSON: This is rousing, but I think everybody needs to have a comfort break. If I could call for a comfort break and we'll come back in 15 minutes.

DR. WADE: We're going to break for 15 minutes. We're not going to break the phone line. So we're just going to put the phone on mute. Enjoy your break.

(Whereupon, the working group took a break from 11:00 a.m. until 11:20 a.m.)

DR. WADE: This is the work group conference room. Let me use Kathy as a barometer.

Kathy, are you with us?

MS. BEHLING (by Telephone): With you.

DR. WADE: Very good. We'll begin. I'd like to just make a general comment on procedure. A very productive discussion, but we were getting a little sloppy in terms of talking over each other and sidebars, and Brad has asked if I would police that a little bit so I will do that ruthlessly.

So it is important that we understand people's question, and that we answer the question. We give them the ability to react once. And I know all of the rest of the stuff is built upon just exuberance over the discussion and the desire to participate in it. And I think that's wonderful, but a little bit of discipline would be in order, and I'd like to do that.

Mel had mentioned to me that he wanted to say something.

MR. CHEW: Thanks, Lew. Mark and John, I think during the break we all were quite excited about the amount of data we have now seen on thorium for the first time as much as just the kind of information that’s very valuable. I’d just like to publicly acknowledge a team of people who spent their effort and their time and the tenacity to go after the information at the centers. And Bill Canal*, Mark Ross* was part of that team, Karen Kent behind me here, Cheryl Kirkwood, Carla Fletcher. Cheryl was the one from the Task 8 that set it up. Gail Jewett* and Laurie Kuykendahl*. We’d just like to publicly acknowledge and thank them for spending the time and the effort to go after the information. Thank you very much.

DR. WADE: Saying thank you is good for the soul, so thank you for doing that.

And, Brad, you wanted to begin with some charges.

MR. CLAWSON: Yes, Mark has written up some charges, and I’d like him to go forth with that.

MR. GRIFFON: I may have some additional tasks for the group. I don’t want to truncate the conversation completely, but I think we do want to move through our matrix. And I think we’re at a point where we’ve kind of beat this one around from all sides. I'd just propose that we have, the first action would be for NIOSH to develop and post the spreadsheet with the DWE data on it, and also along with the proposed coworker model.

MR. ROLFES: The coworker model is available already.

MR. GRIFFON: The coworker model using that data? I mean, how do you --

MR. MORRIS (by Telephone): You're talking about the chest count data.

MR. ROLFES: Yeah, the chest count data, yeah.

MR. GRIFFON: So I'm talking about the proposed approach for using --

MR. ROLFES: Okay, my apologies.

MR. GRIFFON: -- so the spreadsheet with the data. And I think some of those, this will help. I don't think we need to make a secondary task of filling in that table although it might be useful in summary fashion to see how many days or samples, you know, John wants that table filled in badly. But, I mean, I think if we have a spreadsheet with all the data, we can sort by plant by date and it sort of falls out for us. So that's one action item is the spreadsheet and the coworker models posted or developed and posted. I guess you'd still have to get the --

MR. MORRIS (by Telephone): Can we talk about that for a second?

MR. GRIFFON: Sure.

MR. MORRIS (by Telephone): That's a significant amount of work and, I mean, it's a lot of work to handle all these hundred or more DWE reports each with a hundred or more samples, job descriptions in them. And so I think that we need to know that that's going to be a useful tool before we really invest a great deal of effort into populating every one of them.

DR. BEHLING: Could I make a suggestion here in terms of maybe compromising? And that is to identify each of the plants where thorium was processed and then perhaps provide some measure of the lognormal distribution that would define what is for each year. So you have Plant 1 and for the four years where you have thorium processed, you would have a value that would be assigned to the H, to the M, to the L worker.

And then perhaps what I would like to do is go back to the 3,000 air samples myself and see to what extent do these numbers that we are looking at in terms of DWE, how do they match up to some of the air sampling data. It would be nice for me to know what an H worker in the pilot plant would be getting for a given year. And then perhaps go through some of the documents that are on the O drive that identify air monitoring data and sort of say is this reasonably the 95th percentile value for a worker in that facility for that year. Is that something that could be done? Simply each plant by year and give values that would define the air concentration for H, M and L.

MR. SHARFI: Well, I think our concern is doing every plant every year in a timely manner. And if we then choose not to do it, we've shifted a lot of resources to something we're not going to use. So maybe doing one plant right now for you to look at, and if we agree in this process, we can continue to work the rest but if you want all plants all years, we’re not talking about a two week process.

MR. GRIFFON: Are you, I mean, this sounds like a proposal. Are you proposing a plant-specific distribution, year specific, plant specific?

DR. BEHLING: Well, that’s what they’re doing.

MR. GRIFFON: You are?

MR. SHARFI: Every, yes.

MR. GRIFFON: Well, that might be very telling, but then how do I know if you’re, I think the plant you choose then should have the least data. Then we can say, you know. I mean, you have to pick the plant --

MR. RICH: Mark, just one question.

MR. GRIFFON: I guess one of the questions is, is there enough data by year to sort of --

MR. RICH: There’s a wide range of total quantities processed by individual plants. So I would suggest that we look at the plant that processed more materials as opposed to the least materials.

MR. GRIFFON: So if we look at the plant that, so then for us to evaluate it, I have to say, okay, this looks like a lot of sampling by year by this plant. This looks great. And then I see all the full dataset come in, and I realize Plant 1 has one sample in ’52, none in ’53, you know. I mean, I can’t answer my question though.

MR. SHARFI: We continue on the process, but to get you something to work with in a timely manner --

MR. GRIFFON: Yeah, but if you just present the best picture, how do we judge whether all workers in the plant can be bounded? That’s the problem.

MR. SHARFI: I’m not saying there’s any plants the better picture than the other.

MR. GRIFFON: A picture in terms of more data, data robustness.

MR. RICH: And it could very well be processed ^, too. For example, 1954 to ’56, Plant 9 daily campaign. And they had a bunch of scrap left over which they then processed in a muffle furnace in Plant 6 in ’60, no, ’56. And that Plant 6 process was ^ they didn’t burn the material in that plant. So Plant 6 will show up. That’s for a very brief time, and it’s in a process that was relatively well contained.

MR. GRIFFON: I guess we're still not right at actions, but I mean, one of the problems I have with this entire, you know, I'm going back to sort of Jim's, some of the overarching comments about the 95th and if you had certain types of jobs you would probably be assigned the 95th, other types of jobs probably just the full distribution --

DR. BEHLING: No, 50th.

MR. GRIFFON: -- 50th percentile, right, right. But now you're talking about plant specific. And then you go down this path of how do you know who was in and out of those, you know there is, you have workers assigned to one plant but they went in the other, you know. It's up to you I guess.

MR. RICH: See, that's a default saying we're going to use 365 day a year exposure based on the maximum exposure that we see in the distribution appears to be very conservative in my mind.

MR. GRIFFON: But the overall distribution, not just one plant.

DR. WADE: Paul has a comment.

DR. ZIEMER: Well, I just have a thought here because it appears that in a sense this is also preliminary for NIOSH and the contractor. I kind of like the suggestion of taking maybe the plant that did a lot of stuff, had a lot of campaigns or whatever, and looking at that. Because I think you're saying let's not do the whole thing as a proposal and then throw it out at the end after we've done all this work. Let's start with one and look at that and see if this is an approach that will work. If we say, yeah, it looks like it'll work, it seems to me at some point, and then you're going to go through other plants over a period of time. But if you get to one where you yourself say we can't use this. There's not enough data or whatever, that will show up, and you will have to do a different approach anyway. You'll say it's either not representative or we do not have enough samples to, or whatever it may be. But you're saying let's --

MR. GRIFFON: Well, people have already weighed in. That's the problem. We're supposed to be evaluating whether all members of the class can be bounded.

DR. ZIEMER: But we won't really in a sense know the real answer to that until it's already, until you get it all done.

MR. GRIFFON: But there is a proof of principle component to our review.

DR. ZIEMER: Yeah, yeah.

MR. GRIFFON: If you're saying by building to us now but then six months, you know, as you're looking at this does it shift? So okay, we're just going to include everyone because we couldn't, really our data in Plant 1 or whatever was insufficient. So we decided to roll it all together and go to the full distribution now or --

MR. FAUST (by Telephone): This is Leo.

MR. GRIFFON: -- going to be evaluating I guess.

MR. FAUST (by Telephone): This is Leo. Can't you do that by job category and pick the one or two highest exposures by job category? And then you'd have it maximized anyway.

MR. GRIFFON: You're proposing. I'm not.

MR. SHARFI: I think we need to send the Board something more timely. I mean, if you want the entire thing processed, and we can do that. It's obvious it takes more time to provide you a full-blown report for every building every year, the annual statistical analysis, and the NBR data --

MR. GRIFFON: When I offered the action, I didn't understand. I thought it was going to be one distribution, not multiple distributions by plant.

DR. WADE: Let me ask you a question. That work will eventually be done?

MR. SHARFI: Yes, yes, it's not going to stop the process.

DR. WADE: So let's talk a little bit about --

MR. GRIFFON: Let's do -- I can compromise to that I guess.

DR. ZIEMER: Well, for example, if they do the first plant, and we say this still doesn't, this is not the direction you want to go anyway, then you can stop it early on.

DR. WADE: But if you say I like that, we need the rest, are you proposing, Mark, that the work group wouldn't be able to offer its final position on the SEC until it saw the rest?

MR. GRIFFON: Well, that would be, I mean, I don't know until I see the first.

DR. WADE: So let's say Mark's --

UNIDENTIFIED SPEAKER: ^

MR. GRIFFON: Well, it's a catch-22.

DR. ZIEMER: I think you need to see one and then say, okay, shall we keep going in this direction. You may want to see second and third --

MR. GRIFFON: If you present the plant with the most data and stuff, which I think is where you're heading, then that sort of could by some be perceived as presenting a rosy picture on this. But I can --

DR. ZIEMER: I'm not sure we even know --

MR. SHARFI: I'm just trying to provide you a smaller snapshot as we work so we're not giving you, you're not waiting on us to provide everything in a --

MR. GRIFFON: Here's maybe a compromise is that we do, I could agree with that. Select a plant and do that, what you proposed, you know, by year, the model, and along with that -- and you may have this already done, Mark.

I don't know, but if you can post all those DWE reports. Are they already up there? In one location. Maybe they're up there somewhere, but somewhere we can find them.

MR. ROLFES: When we scan things, those were all scanned and uploaded onto an O drive to be sorted out. Every one of those documents has to be reviewed by a health physicist and characterized correctly and renamed so that is put into the site research database with a reference ID number.

MR. GRIFFON: But can that be an action that --

MR. SHARFI: They're in temporary files right now.

MR. ROLFES: Correct, they're temporary files on the ORAU server.

MR. GRIFFON: I'd like to propose that as an action.

MR. ROLFES: Now if we find when we post, we're going to have a mirror image of the site research database essentially for Fernald because you know the volume of records that we've already got on the O drive for the Advisory Board. Ultimately, we're going to have every document from the site research database on the O drive. So I'll put everything that --

MR. GRIFFON: Yeah, I understand, but I also think we can always eliminate those at the end of the SEC review process. You know, you can move them. I understand. The only thing I would ask is if they can be put in, you know, in the AB document under the Fernald section maybe with some, in a separate folder so we can easily find them.

MR. ROLFES: We can do that. I think there's around 160 of those reports.

MR. GRIFFON: One hundred and sixty of them? Okay. So nobody's going to read through all of them, but we'll look at a sampling of others maybe.

DR. WADE: Any more action items? We should talk time a little bit.

MR. GRIFFON: Yeah, the only other action on that I think would be for SC&A to review, once this is posted, to review these, you know, for SC&A to review what's posted as far as the spreadsheet and proposed coworker model. And I understand, for one plant at this point it would be for one selected plant, but have SC&A review that before we meet again.

DR. WADE: So let’s put a timeline on when we might expect you to deliver to the Board that one plant representation.

MR. SHARFI: Can I get back to you on that?

DR. WADE: That’s fine.

MR. GRIFFON: All right, so posting the spreadsheet for one selected plant, the DWE data and along with the coworker data, right? And when I say that I mean the annual distributions that you’re going to use for that.

DR. BEHLING: And understand what the 95^{th}, the 50^{th} and the 16^{th} percentile is.

MR. GRIFFON: Yeah, how they’ll be assigned. How they’ll be used, right. And then post the DWE reports on --

MR. MORRIS (by Telephone): Do you also want an example dose reconstruction based on that data?

DR. BEHLING: No, not --

MULTIPLE SPEAKERS: ^

DR. WADE: So after lunch you’ll come back with a timeline. If after lunch you want to come back and say I think it would be more representative for you to look at something, then say that, and then they can consider. Right now it's one plant all year. You could think about that and...

MR. MORRIS (by Telephone): We're instructed to do one year, all plants.

DR. WADE: Sense of the work group, one plant, one year?

MR. GRIFFON: No, one year all plants.

DR. WADE: And you'll come back with a sense of how long it will take you to do that.

MR. SHARFI: Do you want to look at the process history and then give us a year?

MR. GRIFFON: Maybe we can come back after lunch and do that.

MR. SHARFI: We'll talk about what kind of resources we need to do this, but we'll let you guys choose what year, that way --

MR. GRIFFON: Yeah, one year all plants sounds like a good idea.

DR. WADE: One year, all plants. Mark will speak to you about the year. You'll speak about when we might expect those results, and the world will be a better place.

MR. CLAWSON: Did we also cover how this is going to be implemented?

DR. WADE: Someone's got to pick --

DR. ZIEMER: Well, NIOSH would have the ball on the first tasking and then SC&A would not be able to do anything until it got that, right?

MR. CLAWSON: Well, I was wondering if we were going to cover how they were going to implement that because it still wasn't clear to me after our discussion what process that they were going to use to be able to implement this information.

MR. GRIFFON: Mutty, I'm not sure if I --

MR. SHARFI: How you assign it?

MR. CLAWSON: How you assign, yeah, the dose to the 95 percentile or the 50 percentile.

MR. GRIFFON: Yeah, we asked for a description of that, Hans did.

DR. BEHLING: Well, it's pretty much spelled out because back here in the appendix you have all different buildings and --

MR. GRIFFON: Well, it's not spelled out; it's contradicted in the white paper that I just read from --

MR. CLAWSON: That's my problem.

MR. GRIFFON: -- I mean, a final statement on that.

DR. WADE: Some final statement.

MR. SHARFI: Attachment A was kind of a rough, quick categorization. The process or data I think you'll be able to better look at, because I think these were just out of one report that we picked, high, medium, low. Even like the 16th percentile, that will be processed. That number may move to the low. We may have to shift that up.

MR. GRIFFON: Because it think it's important for us to know if you're going to still keep that position that if we have more data in the individual's file, we may try to do job-specific analysis.

MR. SHARFI: Yeah, the 16th and the little limited data that we have looked at so far was bounding for what we call low positions. Now as we look at more data that might not be true. We might find people in certain buildings, certain areas that we may need to push up to the 20th or something like that.

So we need to analyze the data right

now. This was our first, given the limited data we had looked at, the first good, basically our first good shot at this. And as we compile all the data, then it gives you a much better, make final numbers at where the low will be. The medium will always be the 50^{th}, and usually the high is always the 95^{th}.

DR. WADE: When you submit the one year all plants, then give us your statement at that point.

MR. GRIFFON: Right, right, that’s fine. Yeah, we’ll leave it at that. I mean, I’m just going back to this. The white paper, the statement I read out before it said, “when job matching is possible, a more accurate dose reconstruction with less uncertainty is likely to result.” What does that mean in terms of --

MR. SHARFI: If you truly can say someone was a wet worker the entire time, you would go to that specific --

MR. GRIFFON: See, that’s what I want to know. If you’re proposing that, that’s fine, but put that down.

MR. SHARFI: -- but I don’t think that

that's something that we could, I don't think you ever have that kind of detailed data that someone was always a wet worker. They didn't go around, didn't change jobs, didn't move around. It would be very hard to get into the very job-specific, title time that they're --

MR. GRIFFON: I mean, let us know if it's even on the table. That's what I want to know.

DR. NETON: We want to re-think that. We'll come back to you with more --

MR. GRIFFON: Make that in the statement. That's fine.

DR. WADE: Talk about that amongst yourselves.

MR. GRIFFON: Yes.

MR. CLAWSON: Do you want them to talk about this over lunch and so forth like that and come down to definitive --

MR. GRIFFON: I think the only question is if we want to pick a certain year or something, right? We can get back to you after lunch, but otherwise it's all plants for one year.

MR. SHARFI: Yes, the year's up to you, whichever year you prefer to see.

DR. MAURO: The benefit of doing all plants in one year is one of the questions is the richness of the granularity of the data. Now by doing all plants we may very well find out, you may very well find out there are certain buildings or plants where we really don't have lots of time-weighted average numbers.

DR. ZIEMER: At least for that year.

DR. MAURO: For that year. Which means that you're going to have to go to a fallback position for people that worked in that plant. And I think that that's why it's valuable.

MR. SHARFI: We're talking about thorium processing, right? We're not looking for a uranium --

MR. GRIFFON: No, just thorium.

DR. MAURO: That's why I think because there's no doubt in my mind you're going to find that there are certain buildings you're just not going to have the richness of data that you have for other buildings. And you will need a fallback position on how to deal with that circumstance.

DR. WADE: You've got some thorium

processing ^. You can look at that and you can make your recommendations.

MR. GRIFFON: Obviously, there’s a doubt in someone’s mind because they’re proposing to do it by building by year. So there’s no doubt in your mind, but there must, you know, they must believe --

DR. MAURO: And it goes the other way, too.

MR. GRIFFON: Anyway, we’ve talked this --

DR. WADE: We’ve got this covered.

MR. GRIFFON: Yeah, we’ve got it.

DR. WADE: Mr. Chairman, what would you have us do now?

MR. CLAWSON: Lunch. Why don’t we break for that? We will be able to come back with the information. That will give us a chance to sit down and discuss with SC&A and be able to --

MR. GRIFFON: And maybe try to get back to our matrix and see where we are.

MR. CLAWSON: Where we’re at on that.

DR. WADE: Paul?

DR. ZIEMER: Brad, can you just give us some indication of what will be on the agenda after lunch besides finishing up this task? Are we going to have a presentation on the recycled uranium?

MR. CLAWSON: We've actually got to get back --

DR. ZIEMER: Is that on the --

MR. ROLFES: I guess how we'd like to proceed --

MR. CLAWSON: Well, what I have planned kind of on the agenda was to be able to go through the matrix. I didn't know about the recycled uranium. But --

MR. GRIFFON: If we go back to the matrix, the first item is the R-U so we can probably start there.

MR. ROLFES: Yeah, at the last Board meeting that we had I believe that the two outstanding issues that we really had in discussion were the thorium coworker model white paper and the recycled uranium raffinates white paper.

MR. GRIFFON: I know and the data integrity stuff. And I think you got on that, too.

MR. ROLFES: I also have a presentation on that as well.

MR. GRIFFON: So start from the matrix, the first item is R-U.

MR. MORRIS (by Telephone): This is Bob. With regard to our fallback position when we don’t have data specifically good enough for a plant. We already covered that in our white paper. It’s at the end of Section Five. And it says just briefly, “in some instances it may be expedient to us a facility-specific exposure potential and intake rate as a site-wide default value.” That is an acceptable practice if the default value can be reasonably judged to bound exposures from other facilities.

DR. WADE: Brad, about how long do you want to let these people go to lunch?

MR. CLAWSON: Let’s meet back here at one.

DR. WADE: Okay, we’re going to now break the phone line until one. That gives you an hour and 15 minutes to eat and recharge your batteries, and we’ll be back at one. Thank you.

(Whereupon, the work group recessed for lunch from 11:45 a.m. until 1:00 p.m.)

DR. WADE: We’re going to start again. I would ask if there are any Board members who are on the call, if you’d please identify yourself.

MR. FAUST (by Telephone): Leo Faust.

DR. WADE: Okay, Leo, I'm asking for members of the Advisory Board specifically.

DR. ZIEMER: Josie. Josie was on earlier.

DR. WADE: Josie Beach?

(no response)

DR. WADE: Robert Presley?

(no response)

DR. WADE: Josie, are you with us?

(no response)

DR. WADE: Robert?

(no response)

DR. WADE: Okay, I'll assume there's no members of the Board on the phone so we're good with quorum.

Brad, it's all yours.

MR. CLAWSON: Before we left for lunch we were going to come back with a time period to be able to have the information processed through. And one of the things we wanted to come across with -- and if I say this right, please help me out -- but one of the things you've got this paper in front of you, one of the issues is, is if we're going into the later years, in ’66, we lost some of the facilities.

So what we’re requesting is two years, all plants, but it really would equate to what we previously said, but you look down here in ’55, you got this information here and none of the other plants down there. So if we wanted to fill out to be able to do ’55 and ’66, all plants all year for those two years.

MS. BALDRIDGE: Brad, that eliminates that pocket for thorium in six. It’s ’60 to July of ’63.

MR. CLAWSON: What pocket would that be?

MS. BALDRIDGE: The raffinates.

UNIDENTIFIED SPEAKER (by Telephone): Speak into the mikes.

DR. WADE: Okay, I will caution people. We’re having a slight offline discussion at the moment. We’ll be back, the Chairman will be back at the table in a moment. A petitioner had raised a question, and the Chairman is dealing with that question one-on-one.

DR. ZIEMER: While they’re dealing with that can I ask, Mark, this table is not in the white paper, is it?

MR. ROLFES: There's a separate thorium processing. Let me point it out on the O drive. It's out on the O drive. Let me get the document title for you.

DR. ZIEMER: Was it in the list of documents you sent us? I may have --

MR. ROLFES: It was identified in an e-mail.

DR. WADE: You have to watch the discussions. I realize you need to have discussions but maybe you can back away a little bit here.

DR. ZIEMER: Is it the thorium timeline paper?

MR. ROLFES: Yes, thorium timeline with A-A, and it's dated 2/29/08.

DR. WADE: I believe the time the Chairman is consulting with John Mauro, we'll allow that to happen.

MR. CLAWSON: I apologize for that side conversation, but Sandra brought up a very interesting point and part of the thing is that we're going to miss Plant 6 for its residue process in the sludge furnace if we --

UNIDENTIFIED SPEAKER (by Telephone): We really can't hear you. Could you speak up, please?

MR. CLAWSON: Yes. One of the issues is, is that if we go with the '55 and '66, we're going to miss the thorium residue process in the sludge furnaces. But that's also part of the raffinate issue that we're going to talk about now.

RAFFINATE ISSUE

Basically, for what we're trying to do for get to the information of the thorium, SC&A still feels that this would be the best approach we'd be able to have because the issue that you brought up in the Plant 6 is going to probably be brought up in the raffinate issues.

MS. BALDRIDGE: That's okay.

MR. CLAWSON: And if that's okay. You guys --

MR. RICH: That would not be a recycled uranium raffinate.

MS. BALDRIDGE: No, it's thorium residues.

DR. MAURO: I guess that's the question on the table. The approach that we just outlined by picking those two years, one of its limitations is it misses Plant 6 because there was --

DR. ZIEMER: Plant 5 I think misses.

DR. MAURO: I'm sorry. It's Plant 5. So now the question becomes what do you want to do about it?

MR. CLAWSON: That's a point for you guys that would end up doing this process. I don't, you know, we've already gone to two years, if we did a third year for just that plant, that's an option. But if we change any of the other years I don't think it's going to give us the better overall usage of this information.

DR. WADE: I know, but this is just the first step in a longer journey.

MR. CLAWSON: Right. So I guess the people that are having to do this --

Go ahead, John.

DR. MAURO: All I'm saying is we right now have -- think of it this way -- we have ten plant years. The question is should we make it 11 plant years so we can pick up Plant 5 for one particular year. I mean, that's the question.

MR. SHARFI: Whatever you want.

DR. NETON: That's not how we looked at the data. It doesn't seem to me to be an inordinate extra amount of work for ten plant years, ten percent difference approximately.

MS. BALDRIDGE: The point I would like to bring up is part of the reason I filed the SEC was because of the missed thorium processing in Plant 6 from '60 through July of '63. That was not included in the site profile.

DR. WADE: Point well made. Why don't you take that modification, and Brad I would suggest --

DR. ZIEMER: This is Plant 5 though.

DR. MAURO: There's one of our dilemmas. In the table there is nothing in that, in this Table 4.

MR. ROLFES: Well, there's Plant 6 does the sludge. The thorium sludge furnace is in Plant 6. It was uranium --

DR. MAURO: You do. You pick up Plant 6 and only for 1966. Is that a problem? That's the question. We do pick up Plant 6 here in 1966. Does that --

DR. BEHLING: It's outside the realm of the report.

DR. MAURO: It’s outside, oh.

DR. WADE: I would suggest, so we can move on, that we take the suggestion of the petitioner and add the 11th year.

DR. ZIEMER: It doesn’t cover Plant 6. That’s the point.

DR. WADE: Can’t we add Plant 6 for those particular years in question?

DR. BEHLING: Nineteen sixty-two or three or something.

MR. CLAWSON: I guess here would be my suggestion. I’ve already put out on the table that we do 1955 and ’66, and my further suggestion would be that we do Plant 6 for 1960. And that would cover your issue if I’m not mistaken.

MS. BALDRIDGE: All right.

MR. CLAWSON: And on the 1960 it’d be just that Plant.

DR. WADE: Now how does that track with the fact that there’s no entry in the matrix for Plant 6 for 1960?

DR. ZIEMER: No.

DR. NETON: There’s none.

DR. ZIEMER: There's no entry for Plant 6. That's the point I was making.

MR. ROLFES: We have no entry for Plant 6 --

DR. NETON: In 1960.

MR. ROLFES: -- in 1960. If there's a daily weighted exposure --

MR. SHARFI: There's a dot in 1960.

DR. WADE: Oh, there is, okay.

MR. ROLFES: There's a dot in 1960.

DR. ZIEMER: But there isn't on the other chart. There's nothing in --

MR. ROLFES: For 1960 in Plant 6 of the thorium residues processed in the sludge furnace we do have in this slide, it's right in this area here from 1959 through 1963. It shows thorium residues processed in sludge furnace. It's right here.

DR. BEHLING: It's also available in Table 1 of the white paper.

MR. CLAWSON: Right on this one, Paul.

MR. ROLFES: And there is a dot also on the other daily weighted exposure reports. It's on this other side as well.

DR. ZIEMER: That's Plant 5, Brad.

MR. CLAWSON: It is?

DR. ZIEMER: Yeah, that’s Plant 5.

DR. WADE: In the matrix anyway that we have that’s Plant 5.

MR. ROLFES: There’s an ANA on the side. That might be --

MR. GRIFFON: Where we get off, yeah. That’s Plant 6.

MR. ROLFES: Let me take a look. I think you’re looking at the ANA.

DR. ZIEMER: Yeah, yeah, yeah, you’re right.

MR. GRIFFON: Plant 6, it is, we’ve got it here.

DR. WADE: Okay, so Brad, if you could formulate your proposal then we can --

MR. CLAWSON: Okay, my proposal would be that we do years 1955 and ’66 and 19 --

DR. WADE: For all facilities.

MR. CLAWSON: -- all facilities, and 1960 for only Plant 6.

DR. NETON: Are we clear on what we’re doing in those years?

MR. GRIFFON: Well, I think that was my proposal before, right? All the data in the coworker models by year, right?

MR. CLAWSON: I just want to make sure --

DR. NETON: It's implemented.

MR. GRIFFON: Well, when I say coworker model, yeah, including how it's implemented.

DR. WADE: And then a response of sense of time or do you want to wait to do that?

DR. NETON: Well, we're a little reluctant for us to sign up for a time because there's many computing and conflicting issues out there tasking ORAU. So I would propose that we could get back to you within the next day or two through Mark or ^ to the Chair as to our proposed timeline. My gut feeling is -- I don't want to say -- but we do need to check it because there's a lot of things on the table right now, and I don't want to preempt somebody else --

MR. CLAWSON: Okay, they'll get back to --

DR. NETON: Mark, I'll work with Mark, and he can get back to you, the Chair, as to our proposed timeline.

DR. WADE: I'll accept it. It might be a month with an R in it for example?

MR. CLAWSON: Okay, we're going to proceed on with the raffinates.

I believe that you've got a

presentation, Mark, that you want to do.

MR. ROLFES: Yes. Everyone should have a copy of the handouts for the Advisory Board working group. This is a briefing on the reconstruction of dose from recycled uranium contaminants, FMPC Recycled Uranium. That was uranium that was recovered and purified from spent fuel and targets in a chemical processing plant.

They were returned to uranium processes within the Atomic Energy Commission and Department of Energy system. The recycled uranium contained trace amounts of transuranics such as plutonium, neptunium and fission products including strontium, yttrium, technesium, cesium and ruthenium. Also, activation products such as U-236.

So the bottom line is, are contaminants a concern for dose reconstruction? The presence of contaminants were well known from the start and were present in very low activities compared to uranium. We're referring to trace quantities of impurities. The limits for contaminants were set for the primary production sites, for chemical processing plants. Some uranium processes did concentrate the contaminants though. Bioassay for the contaminants was typically not performed.

The history of recycled uranium at Fernald. Fernald received the first major shipment of transuranic containing material. It was UF-6, which was delivered on the 13th of February, 1961. This signaled the major recycled uranium ramp-up. There were small receipts from Hanford and some of the gaseous diffusion plants as early as 1955.

The primary concern was plutonium which was contained, and it was the plutonium which was the focus of the recycled uranium limits and analyses at the chemical processing plants. More routine chemical analyses to determine neptunium and technesium were done in the 1980s. Routine gross beta and gamma count limits followed by gamma spectrometry was done in the early 1960s.

Comprehensive studies done by the Department of Energy in 2000 and 2003 provided the documentation of the recycled uranium mass flows and contaminant levels. The Ohio Field

Office report, the “Recycled Uranium Project Report,” included a specific study for the Fernald site. The reported mass flow discrepancies among the nine major reports, which covered 18 facilities, resulted in a three-year study by the Department of Energy Office of Security clarifying the primary mass and contaminant flows.

This next slide is just to show an example of the mass balance inconsistencies for Fernald receipts. Some of the comments on the right-hand side show that total uranium was reported rather than just the recycled uranium quantities. And I think maybe Bryce might --

I don’t know if you would like to add anything.

Or if anyone has any questions or would like to add anything, please stop me.

MR. RICH: Inconsistencies in mass flows were a consequence of the fact that within the DOE system and the accountability system there was not a category for recycled uranium. And as a consequence, the designation of recycled uranium was a little bit different at each site.

At Fernald, for example, the second category there, taken from the mass balance report for Fernald, they functionally counted all of their existing inventories as recycled uranium once they started receiving recycled uranium from Hanford. And this was fundamentally because the process involved blending recycled uranium with the existing inventories for a variety of reasons. It blended up to a higher enrichment and for other reasons.

In the third row in the same report, they did a complex-wide RU definition rollup, which was a difference in, discountability, and accountability designation. And you can see the difference there, 55,000 metric tons as opposed to 247,000. The DOE 2003 definition and rollup for all of the recycled uranium that came from the primary shipping sites to Fernald was 18,000. As Mark goes along, we’ll show you how this is accommodated and what we’ve done with these differences.

But functionally, the amount of recycled uranium that came from the primary sites was significantly lower by a factor of five or more, and what was being reported as recycled uranium. But again, functionally everything at Fernald was being treated as recycled uranium. That's point number one.

MR. ROLFES: Other recycled uranium contaminants. Controls and dose impact were concerned primarily on plutonium and neptunium with technesium being the primary fission product that was bounded in recycled uranium. Other isotopes were known to be present and controlled by gross gamma counting and later by gamma spectroscopy.

Other isotopes that were associated with gross counting limits just from DOE's report in 2000, this goes through the various isotopes the beta emitting radionuclides, gamma emitting radionuclides. We've got zirconium and niobium. As you can see there's a limit of 15 microcuries per pound of uranium which translates to 0.033 picocuries per microgram of uranium. The contamination levels were documented and controlled below these levels.

Some of the radioactive contaminants

in recycled uranium at Hanford, we have examples of the elements and isotopes that were encountered and also the observed range on a parts per billion or parts per million basis in comparison to uranium.

DR. MAKHIJANI (by Telephone): Mark, this is Arjun. Now, when we looked at Hanford, we didn't find '50s data on the details of neptunium and fission product content. Do we have '50s data from Hanford in terms of contamination controls?

MR. ROLFES: This is from a 2000 report from the Department of Energy.

MR. RICH: This is the Hanford Mass Balance Report.

MR. ROLFES: Okay, it's from the Hanford Mass Balance Report. And as far as I haven't been, I haven't reviewed some of the Hanford data. I've been focusing on the Fernald data.

DR. MAKHIJANI (by Telephone): But that would be derivative. I think the Fernald data were also from the '80s. It's my impression that the mass balance data are based primarily on sampling that was done in the '80s. And if that's wrong, I certainly would like that impression corrected so we can get the actual data from the '50s which I have not seen.

MR. ROLFES: Bryce, could you reiterate --

MR. RICH: The mass balance report was put together by the Hanford study which the Hanford Mass Balance Report is part of the 2000 report. It used data from, they've used historical data.

DR. MAKHIJANI (by Telephone): Only for plutonium, not for neptunium and technesium and the other things. That's what I was asking about.

MR. RICH: They had some data, not as much data. The fundamental, primary transuranic results were based on plutonium. But they also did, right from the start they did gross beta and gross alpha in comparison with the gross beta and gamma, I should have said gross beta and gross alpha survey. That's associated with a comparison of that from aged natural uranium. But you're right. The neptunium data was not rigorously analyzed or documented as the plutonium.

MR. ROLFES: The next slide just shows some of the processes and activities that could have potentially concentrated some of the recycled uranium constituents. This is just to point out we don't need to go through each of the processes and steps at this time.

The following slide is recycled uranium summary values by process subgroups. Once again, I don't think we need to go through the detail, but this is just to show some of the levels that were encountered in comparison to the uranium.

MR. RICH: Could I say just a word or two of additional description or information? Well, actually 13 subgroups, process subgroups of 14 -- no, more than that. If you count them up, there's probably 15 or 20 I guess -- process subgroups that they collected data for and did a statistical analysis of the plutonium and neptunium from historical data of these three primary isotopes of Plutonium-239, neptunium and technesium.

And this is in the Ohio, the Fernald Mass Balance Report. And these were the descriptions of processes bearing in mind the category subgroup number 11, the bottom one, of waste residues below the economic disposal limit.

DR. MAURO: Mark, would it be correct to say that this represents where you stand on the characteristics of the various types of raffinates, residues --

MR. RICH: This is not just raffinates.

DR. MAURO: It’s more than that though. Out of this which ones would you call a raffinate?

MR. RICH: Number 11.

DR. MAURO: The last one, so waste residue is what you refer to as raffinates?

MR. RICH: Yes.

MR. ROLFES: On to the next slide, under considerations for dose reconstruction we have extensive uranium bioassay data for essentially all workers at Fernald. As a result of the reconstruction of bounding levels of recycled uranium contaminants both in receipts and in concentration processes, it is possible to add a ratio of trace level contaminants to the intake of uranium which is determined from uranium bioassay. Thus, it is possible to account for internal exposures from unmonitored sources or unmonitored exposures to raffinates and recycled uranium contaminants.

To get more specifically into the raffinates, the raffinates by design were low in uranium and the trace contaminant ratios were obviously elevated. Hot raffinates came from higher grade pitchblende ores which contained more uranium mass than the other lower grade ores. But these did not contain recycled uranium contaminants.

For this scenario dose reconstructions will be performed with radon breath analyses. From processed uranium oxide from uranium mills -- processed uranium oxide from mills was further processed at Fernald. Raffinates from this source also had no recycled uranium contaminants and were low in uranium daughters such as radium.

Recycled uranium was from typically -- kept with typically chemically pure and was blended directly with the plant feed stock with a few exceptions. Recycled uranium contaminated plant process scrap, materials processed prior to reinsertion into plant streams and represented a small percentage of total recycled uranium plant flows in the range of ten percent.

Even with the reduced uranium and raffinates, the majority of activity on air samples was due to uranium. That was approximately 82 percent of the observed activity. Plutonium accounted for approximately 12 percent, and neptunium was about three percent.

Daily weighted exposure sampling indicated air activities in raffinate areas at least a factor of ten lower than in other plant areas. Workers were rotated in various process areas. No workers were assigned exclusively to the raffinate areas. Documented urine sampling results indicate results identified as raffinate locations equivalent to other areas. Default ratios to uranium bound the raffinate areas.

The default recycled uranium contaminant values that we are currently using, if you look and compare those to those documented on the previous slide where Bryce had pointed out the waste residues in subgroup 11, you'll see that our mass concentration of Plutonium-239 were defaulting higher to 100 parts per billion, 100 parts per billion for plutonium on a mass concentration -- excuse me, I said that wrong.

Let’s see here. We are defaulting to a 100 parts per billion plutonium concentration for every -- I just want to make sure I say this right --

Bryce?

MR. RICH: One hundred parts per billion.

MR. ROLFES: Correct. So basically, what we are doing here, we are using a higher recycled uranium contaminant default value for plutonium than what was documented in subgroup 11 from the waste residues.

MR. RICH: Other than the one category which would be the Paducah Gaseous Diffusion Plant ^.

MR. ROLFES: The default assumptions that NIOSH is using to maximize doses. We have maximized the mass flow of recycled uranium. We have maximized the contaminant quantities. Our default bounds all bootstrap mean process values with the exception of the short-term Paducah Gaseous Diffusion Plant tower shipment. Contaminant levels in most of the uranium exposures were two orders of magnitude lower than that which NIOSH is defaulting to for dose reconstructions.

The most hazardous isotopes are assumed for the other radionuclides. And the recycled uranium time period assumed, was assumed to have begun in 1955 although significant quantities did not start until 1961.

And that is a summarization of the recycled uranium and raffinates white paper that was put together. The entire white paper was provided to the Advisory Board. It's on the O drive as well so there's additional detailed information there.

DR. BEHLING: Can you clarify, you said an awful lot and I'm not sure I understood. You said that raffinate workers were rotated routinely, meaning that they were not always there on a full-time job for any length of time. And yet you say that you're going to link somehow the uranium excretion data with raffinates' contaminants.

And also you mentioned the use of radon exhalation. I guess I'm somewhat uncertain as to how these different things will blend. When you obviously take a urine sample for uranium for a worker who's been rotated, you may end up with a fairly high uranium excretion rate that may have limited relationship to the raffinates if, in fact, we're talking about a rotation of workers.

Also, where do we separate radium from radon exhalation from uranium excretion, urine excretion, as a way of trying to get a handle on contaminant raffinates?

MR. RICH: There are raffinates, and then there are raffinates and other raffinates, and you ^ different kind of raffinates. Hot raffinates, for example, as we've indicated, came from the pitchblende ores which were 60 or 70 percent uranium, and as a consequence, very high in radium and daughters. We got raffinates from Harshaw and available at two or three hundred millirem per hour. Nothing was done with them except slurried and transferred to Silo 1. However, the -- those were raffinates that came from the processing plant at Harshaw.

Fernald did process ore, and as a

consequence it had hot raffinates. And as a consequence they built a hot raffinate system behind a cement wall shielded for external radiation. None of that raffinate was recycled uranium. There was no transuranics in that raffinate stream. And in addition, there's another raffinate stream that came from processing yellowcake from uranium mills, and those barrels of uranium from the mills were not all uranium, 70 percent or so. And so they processed that again through a liquid extraction system in Plant 2 and 3.

And they were low in, they had no recycled uranium contaminants in that stream either. Now, the only recycled uranium raffinate stream that came through waste products that came from, for example, when they brought the recycled uranium in from Hanford, they blended it immediately because it was from a uranium standpoint pure. The trace quantities didn't provide any problem, but they did have some metals and other, well, they were ready to be blended.

So they ran them through the process to convert the metal, but that wound up about ten percent of that process local streams and needed to be reprocessed. That went in and blended and then was processed through the liquid extraction system. And that produced a raffinate stream that had some enhanced recycled uranium in it, relatively low in contaminants other than the fact that the ratio of contaminants to uranium were elevated to what, as indicated, to about 80 parts per million plutonium, using plutonium -- pardon me, or parts per billion. But we're defaulting at a hundred.

So any time you get people working with raffinates even in this stream would be, especially if they got any exposure to the raffinates, they would have a uranium burden that went with it. So the ratioing system still holds.

DR. BEHLING: I guess I just want to be sure that when you get a uranium bioassay, will it be earmarked that's a person who was working with the raffinates where you end up applying the default values?

MR. RICH: No, the only thing it would very conservatively applying in saying any time you get a uranium update, you're simply going to apply a hundred parts per billion for thorium and another part per billion neptunium and another part per billion technesium and strontium and all of these other recycled uranium contaminants.

DR. BEHLING: And that's regardless of where you worked?

MR. RICH: Regardless of where you worked.

DR. BEHLING: Okay, I missed that.

MR. RICH: That's every uranium -- and that's coming from the assumption that any uranium in the plant after 1955, and very conservative, that it gets blended and mixed, and as a consequence if you didn't know that any uranium exposure did not contain recycled uranium contaminants. So we're simply assigning a default, and a very conservative default by the way, that says anytime you get a uranium update, it's associated with recycled uranium contaminants, and the whole list of them.

DR. BEHLING: Is it going to be confined to, is there any specific time period?

MR. RICH: Nineteen fifty-five on. The entire operational period of the plant from the time that they began to get any recycled uranium in the plant.

DR. MAURO: What about that tower ash which was off the charts?

MR. RICH: That's another issue. The AEC said that -- and uranium was in short supply -- and so they simply said this tower ash has significant amounts of uranium, and we need to recover it. Now, they knew that it had high levels, you know, the concentrating mechanism at the gaseous diffusion plant is severe because of the fact when you convert to a fluoride, most of the recycled uranium is not volatile in the fluoride form. So it fell out of the tower ash or whatever.

And so that material came to the site, and you'll notice the category number 10A is 412, is a mean calculation which is over a hundred parts per billion. However, they didn't want it. They knew it was high, and it was processed as a short-term project. And it's documented that they, in this case they wore airline respirators and the whole thing. And it did not stay that way.

Category number 10B is the uranium U-03 from the tower ash, and that is again down to 20 parts per billion plutonium. So this is the only time I would suggest taking credit for respiratory use because it was a special short-term project, and documented such as they did use respiratory protection because they are mindful of it.

And now I add quickly that they did set aside some containers in a storage configuration that they discovered some years later, and that became an incident report, but that was not available in the operating system at that time.

What we're suggesting is that this default analysis covers all of the processed material and is conservative probably for 99-plus percent of the time or any uranium exposures by an order of magnitude or more conservative.

DR. MAURO: And this tower is well contained.

MR. RICH: It is so well contained and handled with so much awareness and concern that we're saying and it was such a short-term project that it went into the process and was diluted and processed down to 20 parts per billion.

DR. MAKHIJANI (by Telephone): Could I ask a question about the tower ash concentration, please? This is Arjun.

MR. RICH: Yes.

DR. MAKHIJANI (by Telephone): In our review of the Fernald site profile on page 51, we had noted that the 412 ppb value is not, does not jive with the National Lead of Ohio highest plutonium contamination in ash.

MR. RICH: It's not the highest, Arjun.

DR. MAKHIJANI (by Telephone): Sorry?

MR. RICH: That's not the highest. The range for the ash that came into the plant was over 4,000 and the low was something in the range of less than one.

DR. MAKHIJANI (by Telephone): For ash.

MR. RICH: For ash.

DR. MAKHIJANI (by Telephone): Oh, okay. I missed that. I'm sorry about that.

MR. RICH: And see, this gives just the bootstrap mean calculations. This does not, the range for the analyses for the ash that came had a wide range. And but for all of that material the bootstrap mean was at 400, but there were some at 3,000 or more.

DR. MAKHIJANI (by Telephone): That’s not how I recall the site profile, but yeah, that’s fine.

MR. RICH: But that bootstrap mean is the data taken when it does not fall into either a normal or a lognormal distribution. In other words it’s more random and it doesn’t fit any of those curves. Then there is a, well, it’s a fairly, it’s a statistical analysis where you can just simply randomly sample that database and eventually it will give you a bootstrap mean and take the place of a normal distribution or a lognormal distribution. I’m not a statistician and can’t vouch for it, but it is a legitimate analytical --

DR. BEHLING: From your information would you say, for instance, the waste residue bootstrap value of 84 parts per billion for the plutonium, is that more close to, let’s say, from the data close to a geometric mean or an arithmetic mean as a way of gauging what this bootstrap value really means?

MR. RICH: I think I can probably, I have that report here. It's in an Appendix F.1 is the complete statistical analysis. Be glad to show that to you. But functionally, it's higher than a geometric mean.

DR. BEHLING: It was less than an arithmetic mean?

MR. RICH: No, it's higher. And because these are, again, these samples don't fit a standard distribution so it's kind of hard to do a different parity.

MR. CHEW: John, I think when Mark was mentioned, we also have plutonium bioassays.

MR. ROLFES: We do have plutonium bioassay from Fernald. Two hundred and forty samples associated with the higher, the ^ projection came higher --

MR. RICH: Those were done in 1986. And those samples do not, they do not indicate that, they just indicate that people that were operating at that time, at least they were not excreting or indicate an in vivo lung count in the detectable range or just barely in the statistically detectable range.

DR. MAURO: Let's say the bootstrap mean, it’s a measure of central tendency. And what I’m hearing is that’s a reasonable thing to do because you would not expect any one person for a prolonged period of time to continually and repeatedly be exposed to raffinates that would be at the upper end. The reality is the nature of the job was that that just won’t happen. This is a recurring theme there when you work with the central tendency. It’s reasonable to do that when it’s unreasonable to assume, well, it’s always worked with the high end ^ tail. That just wouldn’t happen, and that’s what I’m hearing.

MR. RICH: There are a couple of other places, for example, the magnesium fluoride during the conversion to, from UF-4 to metal in the magnesium fluoride ^. Then the magnesium fluoride does tend to concentrate, that is a concentrating mechanism. Enriched magnesium fluoride was recycled. And so as a consequence, they broke it up and reprocessed it to recover the enriched uranium. For the lower enriched stuff they just simply disposed of it. And that runs about 96, 97 parts per billion --

DR. MAURO: It’s no longer at 100.

MR. RICH: -- uranium. It’s still below, plus the fact that, again, the people that handled the magnesium fluoride did not work that job all the time.

Yes.

MS. BALDRIDGE: With the petition there was a document on the bookkeeping practices, and there was a survey that the Department of Energy sent to Fernald to be filled out about how many records they had, bioassay. And the result was 2.6 per worker per year. Now, Mark indicated that he had extensive bioassay, so does that mean that there were a lot of people who didn’t have any?

MR. RICH: Pardon me, but do you mind if I answer? What Mark --

MS. BALDRIDGE: That you had extensive bioassay data.

MR. RICH: Starting as the contracts changed, when Westinghouse took over in 1986, they decided to take a look to see if they could detect anything in the bioassay, either in vitro or in vivo, either urine sampling or lung counting. And so they took something, or several hundred samples --

MS. BALDRIDGE: So the majority of the bioassay that you have would be post-1984?

MR. RICH: Yes. There were very little for a variety of reasons. Number one, they did not anticipate that the analytical capabilities to detect the trace levels that were there plus the fact that they had calculated that the maximum impact to the workers would be less than a ten percent increase in the exposure due to uranium. That’s the reason they did not take the --

MS. BALDRIDGE: That answers my question.

MR. RICH: And for that reason we’re defaulting to a maximum that would have been calculated based on the modern uranium that can be demonstrated they received.

DR. BEHLING: Could, question just from methodological point of view, will there be a workbook developed that will address all these default values for uranium bioassay data that will --

MR. RICH: It will be in the technical basis document, yes.

DR. BEHLING: And will there be a PER that may go back with some times to assess what was formerly not addressed?

MR. ROLFES: Yes, that's already defaulted in the site profile, the current revision.

MR. SHARFI: The only difference is currently we default from 1961 forward. This will draw back to '55 so any claims that were processed in pre-'61, will then have to be reprocessed to account for the, obviously, the raffinates that weren't included in those claims. Those are to be reprocessed. But the mixture is no different than what's currently inside the technical basis document. So for '61 on this doesn't change how we've been currently assessing recycled uranium.

MR. RICH: What this white paper has done is simply gone back with a greater description and basis for that that was for volumes basis was not in the technical basis document.

MR. CHEW: Recycled didn't really show up at Fernald until '61.

MR. SHARFI: And now we'll push it back to '55 ^.

MR. RICH: Because there was a little bit that came in starting in '55. I'm going to say it's all ^.

MR. GRIFFON: Now you mentioned the tower ash. This was the one instance where you would advocate applying the protection factor --

MR. RICH: Yes, yes.

MR. GRIFFON: -- as being --

MR. RICH: -- protection factor.

MR. GRIFFON: -- but are you applying that or --

MR. RICH: -- primarily because it was a special case, and because it was a short-term process. And as a consequence, there is no protection factor applied. We just simply will say that the uranium ratios will apply because there would have been no exposure to that particular uranium.

MR. GRIFFON: So you're saying the default still holds.

MR. RICH: The default still holds.

MR. SHARFI: It's part of the defensible default ^.

MR. GRIFFON: Because they were wearing respirators when they were dealing with this stuff that was a little too high.

In the processing at Fernald, I mean, the question we always come back to in the RU issue is does it concentrate out anywhere? Is it any kind of dry operation where it might be more than these levels you've talked about, more than these average values.

MR. RICH: We've identified all of the areas where there could be increased ratios between the contaminant and the uranium, and those are listed in the 15 or so as processed category.

MR. GRIFFON: You've showed in there -- I haven't reviewed, I mean, I'm just trying to keep up -- but the 100 you're presenting is the bounding case for all those scenarios.

DR. BEHLING: For plutonium.

MR. RICH: There are 19 process categories that are listed here, and they've done a fairly complete analysis of sampling in those process categories, listing the statistical limits on each of them. Most of them are, they're very, very low.

MR. CLAWSON: I just have a question of how this was going to be implemented. I'm trying to figure, so you're telling me that if the claimant has showed any kind of uranium that we are going to tack on all these other --

MR. RICH: Yes.

MR. CLAWSON: -- isotopes?

MR. RICH: Yes.

MR. SHARFI: And that's already currently in the process.

MR. CLAWSON: For '55 and on. So basically they're going to -- now, is this by urinalysis that they're doing this?

MR. ROLFES: The uranium is, yes.

MR. CLAWSON: I'm just trying to clarify because I know earlier there were some questions of not everybody had urinalysis, correct?

MR. ROLFES: Yes. In excess of 90 percent of the persons that were on site had at least one urine sample.

MR. CLAWSON: Per year?

MR. ROLFES: Per year? I'm sorry.

MR. CLAWSON: Per year?

MR. ROLFES: Yes, an annual urine sample was taken from all employees, well, it was greater than 90 percent of the employees onsite. And if there's an individual, for example, that didn't have a urine sample, if they were only onsite for a short amount of time, coworker uranium urinalysis results could be used to assign an intake and then the ratios would be added on top of the coworker uranium intake.

MR. CLAWSON: Now this urinalysis was for uranium. It wasn't a medical one, right?

MR. ROLFES: No, it was for uranium.

MR. CLAWSON: It was for uranium, okay.

DR. NETON: The annual sample was taken during the medical, annual physical, but it was collected separately and analyzed for uranium.

MR. CLAWSON: The reason I was wondering was because if I remember right, we had some clothing tech people or whatever like that that all of a sudden came up with a urinalysis of uranium which they weren't exposed to.

DR. BEHLING: Just to clarify, there were four individuals, and I included that in my report that, and there was a memorandum, that identified four individuals. Some had as high as 547 micrograms for a 24-hour urine sample. And in each of those cases there was a statement of where did this come from. And we were questioning who they were, and why they were even assessed since apparently they were not production workers and possibly may not have been sampled for bioassay.

But you're saying as a minimum, as a bear minimum regardless of your job classification, every person onsite who was employed at National Lead would have had at least one urinalysis done per year as part of their overall medical examination.

MR. RICH: That's true.

DR. BEHLING: Because we were talking about that yesterday, and we were saying every medical examination usually takes a urine sample, but it's not necessarily linked to anything that involves uranium. And I just want to be sure that as a bear minimum every full-time employee had at least one bioassay done on an annual basis.

MR. RICH: Anyone associated with the uranium operations themselves had many samples done.

DR. BEHLING: Yes, but because Mark was just saying over 90 percent, we were just wondering if there are any people who were perhaps excluded from even this annual medical, therefore, for whom we have no data. Would you also answer that by saying we'll go to the coworker model and apply also those values so --

MR. RICH: Yes.

DR. BEHLING: -- no one will be exempt from being assigned some intake for uranium?

MR. CLAWSON: That's the point I was trying to get to because the 90 percent -- and I understand why you were saying about that -- but I didn't want to have a group of people excluded because like these clothing techs that weren't supposed to be even a part of the process or anything else, but they were showing up with uranium bioassays. And I just wanted to make sure we were looking at that process.

DR. NETON: It was also a fairly rigorous process drummed into workers' heads that anytime there was a suspected incident, you were encouraged and required to leave urine samples at the bioassay station at the end of your shift. So oftentimes you'd get samples from people who hit their thumb with a hammer. I mean, it's an incident, and they go give a urine sample. So you will see many urine samples where people would not normally think of having potential exposure to uranium. But it was considered an incident and they followed the law.

MR. CLAWSON: Is that all? Is that finished?

MR. ROLFES: Yes, that was all that we had. If there's any other questions, we'd be happy to discuss anything.

MR. RICH: There's further details in the white paper.

DR. ZIEMER: Does this require any action?

MR. GRIFFON: Yeah, I mean, I think the only action that I can see is I think NIOSH has provided this. I'm not sure if SC&A's reviewed. I mean, we've listened.

DR. BEHLING: I've read the white paper, obviously.

MR. GRIFFON: So do you have comments at this point?

DR. BEHLING: No, as I said, it's basically an explanation for what already existed with the exception of advancing the timeframe from '61 back to '55. And if everyone is going to be the beneficiary of this assigning of RU contaminants, I think that's pretty much an all encompassing approach and inclusive the tower ash would be assumed a 50-fold protection factor in assuming 412, that would reduce your ^ load a hundred that's a default factor. So I have no comments.

DR. ZIEMER: Have you started to implement this already?

MR. ROLFES: This is already in our current site profile minus, we currently are assigning recycled uranium intakes using the default ratios that were on the second-to-last slide. What we have committed to do is go, rather than only use '61 forward, we're also going to start now, rather than in '61, we're going to start in 1955. So that would be the change that would come out of this analysis and this white paper. We'd be going back to 1955 and extending or assigning any intakes of recycled uranium contaminants based on the documented ratios to any uranium intakes that were assigned.

MR. RICH: I might add for the Board that there is more detail in the white paper and will be in the technical basis document specifically in relationship to other isotopes such as the fission products like Ruthenium-103 and -106, zirconium ^ and even though those are considered, they were analyzed as fresh product as they left the plant and because all except cesium and strontium of any significance had 30-year half-lives. The rest of them had shorter half-lives. And so again, we're defaulting on a fresh fission product basis, and so that won't contribute much at all.

DR. ZIEMER: It seems to me that just to formalize things that perhaps the work group should acknowledge that they've been briefed on this and perhaps recommend to the Board or at least indicate that some level of concurrence with this approach or if we want any further review. It sounds like, I'm not hearing objections from SC&A. I think it --

MR. CLAWSON: My question was is if you have, you feel that you've reviewed this enough and that you feel confident it's in the approach or do you need time to be able to --

DR. BEHLING: As I said, I spent a

significant amount of time reviewing the white papers. We received them several days ago, and I can certainly go through it again and raise additional questions. But right now I don't have any. To me it looks claimant favorable with the assumptions that are being applied here.

MR. CLAWSON: So I guess I'm kind of wondering which way to go on the direction of this.

MR. GRIFFON: Well, I think clearly there's no further action. I'm not -- me, as a work group member -- I'm not ready to sign off only because I'm a little, I want to look at some of the values, and I didn't look and spend as much time on the white paper. This question about, I just want to review that question about concentrating and whether, convincing myself that this is a bounding approach.

DR. ZIEMER: I think that's appropriate. I'm just --

MR. GRIFFON: But I don't think there's any further action.

DR. ZIEMER: -- I don't think we need any more assignments to the contractor. And at some point, it may be at the next meeting or whenever, I'm just saying I think we should acknowledge and formalize this has occurred at some appropriate point whether it's today or down the road.

MR. CLAWSON: And I did have one question on this. You say this is going to go into the site profile and stuff. And we're going to have to go back, and we're going to have, we're actually going to be updating the site profile, correct?

MR. ROLFES: Uh-huh.

MR. CLAWSON: And we're also going to have to be going back and reevaluating several of the claims.

MR. ROLFES: Yeah, right, Jim did mention that we would do a program evaluation report on any previously completed dose reconstructions. When we receive additional information, we do go back and reevaluate any previously denied claims, any dose reconstructions that did not meet the at least as likely as not criteria. Those would be reevaluated to determine if the dose reconstruction findings would change.

DR. BEHLING: The only thing I would ask, just again because the concept of bootstrap methodology is something of a concept that's not clear in my mind, it would be nice to look at the data that corresponds to the bootstrap of 84.8 parts per billion for plutonium and just look at the data and say how did the raw data translate into this particular value that's applied here, 84.8 and then you would default it to 100 parts per billion. It would just be, I'm sure you already know where that data exists, just for only personal insight into the bootstrap methodology, and what it really represents.

MR. GRIFFON: Maybe all of our insight, yeah, not your own personal.

DR. NETON: Were these values listed in the site profile at the time that SC&A had reviewed the Fernald site profile originally? Because I think we've already gone through this.

DR. BEHLING: Arjun may be the one that --

DR. NETON: I'm having déjà vu here, but I thought that this concept had been clear. The only difference here is going back six years or so in time to apply the same issue that I thought was already reviewed in the site profile.

DR. BEHLING: Arjun, are you on the line?

(no response)

DR. BEHLING: Because he was the person who really reviewed the --

MR. GRIFFON: It was reviewed, but it was left open as a finding. Wasn't that the basis for --

DR. NETON: Oh, was it? Maybe that's --

MR. GRIFFON: -- I'm just guessing there.

DR. NETON: I remember. That's okay.

MR. CHEW: What does it say in the matrix?

DR. NETON: I guess it wouldn't have appeared on the SEC matrix if it wasn't left open at the time.

MR. ROLFES: Mrs. Baldridge has a question.

MS. BALDRIDGE: When you referred to the site profile, is this the external exposure part?

MR. ROLFES: This would be internal exposure.

MS. BALDRIDGE: Internal exposure. I do have a question concerning the external exposure. When I was reviewing my father's dose reconstruction, I saw where ambient doses were assigned for external exposure, and that those ambient doses were based on the stack releases.

Now, at some point meetings back I was under the impression that it was mentioned that those stack releases would no longer be a consideration because of the questionable validity of the data that was presented. So my question is how are you going to address the issue of external exposure based on ambient data when you get to that part of the --

MR. ROLFES: I understand what you're saying. Some of the dose reconstructions that we have completed early on we were assigning, in addition to any dose that was received by the individual's dosimeter, we thought it was possible that background radiation exposure to that badge might have been subtracted from the individual's whole body dosimeter.

So we were adding that back in to dose reconstructions. However, there were, I believe we have changed that now. I don't believe we are adding ambient external doses any more into our dose reconstructions because we did not have --

Is that correct?

MR. RICH: I think so.

MR. ROLFES: Okay, I think we've implemented that change already.

MR. RICH: Prior to '85.

MR. SHARFI: After '85 we still add it back in.

MR. ROLFES: Okay, so after '85 we are adding ambient external doses back in.

MR. CHEW: Brad, just to make sure, Arjun wasn't here, but I think his Finding 4.1-5 in the matrix, and I'll read it. And there are several radionuclides, contaminants and RU that were not adequately considered for internal dose estimates. And most relevant to this concern are the impacts of these contaminants in the RU raffinate waste stream. I think that's what the paper is targeting. I think that's what Arjun's issue is.

MR. GRIFFON: The paper's out there, but I don't know if we ever considered the underlying, how the numbers were averaged and all that, that the bootstrap analysis. I don't know.

MR. CLAWSON: I guess kind of what I would ask -- and correct me if I'm wrong -- but I guess what I would suggest is that SC&A evaluate this, look into the bootstrap method, but also I guess I'm just kind of, I'd like to kind of look at these urine samples to make sure how we're going to implement that, make sure we're doing that right. But I guess I'd like to task SC&A to be able to look at this and make sure that we're all on the same page of how we're going into this.

This shouldn't be too much, Hans?

DR. BEHLING: No, I'm going to have to rely on them to identify the documents which contain the original data on which the bootstrap methodology was based.

MR. GRIFFON: Or was that compiled --

DR. BEHLING: I said I'd like to look at the data that gave rise to the 82.4 parts per billion that ultimately would move it up to a hundred parts per billion and as a default value. But just look at the background data to say what do those data look like that represents this particular bootstrap value that is now a default value to be added to the urinalysis as a contaminant for uranium. It may be a very simple thing to have to document, but --

MR. GRIFFON: Well, I wonder if, do you have it compiled in a analytical, like a spreadsheet or something or is it, I mean, is it something easy to --

MR. RICH: This analysis was done by the work group that did the mass balance report, and it's reported in that document.

MR. CLAWSON: In this white paper?

MR. RICH: Pardon me? No, it's in the mass balance report, but it was done by the DOE. And that was reviewed. It's in Appendix F, and in fact, I have a copy on my hard drive if you'd like to see it. It's lengthy.

DR. MAURO: Just as a sense of the range, the 100 number for parts per billion of plutonium, that is a measure of central tendency toward the high end, and that's what --

DR. BEHLING: I mean, we looked at the tower ash because it's in the white paper, and it's

0.6 parts per billion up to 3,500. And the bootstrap value, 412, is something that almost looks like a geometric value, mean. No, actually not. It would possibly be, it’s certainly well below the center value between those two extremes, between 0.6 and 3,500.

DR. NETON: Well, you don’t know unless you look at the data.

DR. BEHLING: No, those are just the two values that --

DR. NETON: I know, there are two values. You have no idea --

DR. MAURO: Let me finish my statements.

DR. BEHLING: No, I didn’t --

DR. MAURO: Tower ash is some place else. In other words tower ash is something you’re dealing with differently because it’s well contained. So your default value that you’re using for all of these dose calculations for plutonium I understand is 100 parts per billion. That’s what, so whenever you see anything in uranium in urine, you can figure out what the intake was for plutonium. Now my question is in that number, that 100, represents some number within some distributional values. How wide is that distribution? Is it some numbers that are up to 10,000 or are we talking about a relatively tight distribution around that 100?

MR. RICH: It's not a tight distribution.

DR. MAURO: It's not a tight distribution.

DR. NETON: They can go pretty high.

DR. MAURO: But it can go pretty high. Then again, the extent to which, one of the things I would like to do, and I think is worth doing, is that are there scenarios -- I said this before, but I think it's important to say again in light of the answer to your questions -- are there scenarios where it seems plausible that a person could have been exposed for a protracted period of time because of where he worked and when he worked. Or he might have been exposed to something well above the 100 parts per billion or is that something that you really could rule out. It just doesn't seem to be something that could have happened. And the extent to which we could look into that I think it would benefit everyone.

DR. NETON: I think remember though that you’re applying this value to every urine sample in ^ intakes for the entire work history.

DR. MAURO: Oh, that. Do you remember though, see, I keep going back. The recurring theme in my mind is that every worker needs to be treated and given the benefit of the doubt. And when you’re in a situation where you don’t know, there might be a worker, we’re dealing with a real person now.

DR. NETON: I understand what you’re saying.

DR. MAURO: And so do we know that he did not have this job where he was exposed for two years continuously to a thousand parts per billion of plutonium. Now, you could say, no, that can’t happen for the following reasons.

DR. NETON: I think you not only need to look at the range of the values but the distribution of the masses associated with those values.

DR. MAURO: Yeah, that’s true.

DR. NETON: It’s very important.

DR. MAURO: If it’s only a very small fraction, then the averaging works. It’s all commonsense, you know?

DR. NETON: We'll take a look at it.

MR. CLAWSON: There's a, people were sampled usually on their birthday, wasn't it? Wasn't that when they did their medical or their bioassay or, I'm trying to think. The reason I say that is because --

DR. NETON: It might be more associated with your start date at the plant.

MR. CLAWSON: Okay, something like that. They had a process that every year you --

DR. NETON: An annual physical once a year.

MR. CLAWSON: Once a year, and you come forth. Out to our place it's on our birthday, and that's why I'm bringing that up. If somebody came up with a uranium uptake, that would stay in their systems for a year, wouldn't it? Or would it --

DR. NETON: It may be below the detection limit by that point. But remember, our program assigns a missed dose, a missed intake based on what the urine could have been and not been detected. In other words we'll give you credit for the fact that you may have had a chronic intake, but your urine cleared just below a detectable level which in itself is a fairly claimant-favorable approach.

MS. BALDRIDGE: I have a comment on that. I got my father's urinalysis and bioassay information, and it seems to me that the frequency of the testing leaves a lot of questions about what exposures were received when, especially in regard to the discovery of the renal damage, the chronic glomular (sic) nephritis or whatever that was diagnosed in December that had gone, I mean, his exposure to that level hadn't even been discovered until they did the urinalysis.

And what was brought up before is what effect does that, the development of a renal condition have on the possible excretion rate of the urine. Now, there's some reports that say there's no such thing, but it doesn't identify the conditions that they were examining either. And that some conditions are reversible. Well, if the condition only involved inflammation of the certain aspects in the kidneys, then that could clear.

But there were other conditions, the chronic glomular (sic) nephritis which involves scarring of certain portions of the glomular (sic) whatever in the kidney that would affect the ability to excrete and the fact that salts, which are your soluble forms, are retained in the kidney. So --

DR. NETON: I'd like to answer your question, but I think that's subject of a whole additional discussion in this working group that it might be best taken up at that time if that's okay with you because this could go on for another --

MS. BALDRIDGE: Well, it kind of came up before but --

MR. GRIFFON: Well, we still have it on, yeah.

DR. NETON: It's going to be discussed.

MS. BALDRIDGE: Well, see, I don't have any paperwork so I don't know what's on there.

MR. RICH: I just looked at some of this data again. The bootstrap mean comes up fairly close to the average --

DR. BEHLING: Arithmetic average?

DR. MAURO: The geometric mean, or the geometric mean?

MR. RICH: Geometric, let me give you the simply looking at the --

MR. GRIFFON: Can you sort of --

MR. RICH: -- this is the category for the --

DR. ZIEMER: Why don't we just have --

MR. GRIFFON: Yeah, an action to follow up.

DR. ZIEMER: -- NIOSH to supply that to SC&A and let them look at it. We can't resolve that.

DR. WADE: We need to get back to business. There's a proposal for how to proceed.

MR. CLAWSON: Well, let's make sure we've got the action --

MR. GRIFFON: Yeah, I just have an action on that just so we can all see that maybe, Bryce, maybe we --

MR. RICH: I think so. This is just a, this is an appendix. We can take a look at it afterwards.

MR. GRIFFON: I have, and maybe this is a bad idea, but NIOSH to provide data --

DR. WADE: Okay, we need to stay with the -- hey, guys.

MR. GRIFFON: I have an action for NIOSH to provide data used to devise the average values presented in the white paper -parentheses- DOE

Mass Balance Report with appropriate appendices. And then SC&A will review this data. And I think that's some of what we're doing on the sideline here, but I think we need to do it that way.

MR. CLAWSON: Do you understand what you're being tasked with, both sides?

MR. GRIFFON: Is that okay, Mark?

MR. ROLFES: Yes, the DOE reports that were used in our white paper and the appendices that will allow you to review the bootstrapping and arithmetic mean, et cetera.

MR. CLAWSON: Okay, sounds great.

MR. RICH: I think it's on the O drive. We can give them reference to --

MR. CHEW: I think you ought to mention where I find it. There was an error actually in the 2000 report that we actually discovered because it was not peer reviewed before it was published. Remember Bryce, when we did the background on that, and remember it was a factor of a thousand off ^.

MR. GRIFFON: Yeah, I've seen that actually.

MR. CHEW: I just wanted to make sure don't get ^.

DR. MAURO: One of the things we talked about that's related to that, and I would suggest, is that this business we talked about why measure a central tendency for it's reasonable given the nature of the work at the site. In other words you folks have probably a pretty good idea of who handled these materials and under what conditions and what times and why you believe over the time period any given worker might have been involved.

The overwhelming argument can be made that he's going to experience something close to the geometric mean or central tendency as opposed to being chronically exposed to a high-end number. I mean, I don't know the degree to which that is a tractable question that could be answered, but in my mind it was an important question.

MR. GRIFFON: First silence we've heard in the room.

DR. ZIEMER: These deep questions bring us to a halt, John.

MR. CLAWSON: We've discussed the raffinates. To tell you the truth I really don't understand where we're at in the --

DR. WADE: Do you have a third?

"Comparison of FMPC Hardcopy Bioassay Records to the HIS-20 Database"

MR. ROLFES: The HIS-20 comparison, that's five slides, so you can just go through that.

MR. GRIFFON: It gets to the question of the data integrity question we raised, right?

DR. WADE: Just one little page.

MR. ROLFES: Yeah, one single sheet for everyone. I believe I had five slides. This was just a summarization of the comparison of the Fernald hard copy bioassay records to the HIS-20 Database. The purpose and background was to compare the available hard copy bioassay records to the HIS-20 database. This was discussed at the October 24th, 2007, working group meeting. The paper contained details about HIS-20 and its predecessor databases. Actual comparison was to data extracted by DOE and imported into MicroSoft ACCESS. Comparison assumed that all results in hard copy were intended to be in HIS-20.

I don't know if we have Gene Potter on the phone, no, we don't have him on the phone. Gene Potter was the individual who had done quite a bit of the cross-comparison work for us.

The method of comparison, we used 33 PDF files which were acquired for comparison. There were a few already in the site research database that allowed us to get a head start on this. We used the method a military standard 105A. It was sampling by attributes. And in this method the user specifies the acceptable quality level, the batch size, the type of inspection, whether it's a normal or reduced or a tightened analysis.

The standard gives the sample size, the number of unacceptable results permitted to meet an acceptable quality level of one percent. Attachment A of the white paper has the procedure in it, and this is also documented in the Fernald HIS-20 Comparisons-dot-X-L-S, a spreadsheet. It's an Excel spreadsheet that's been put out on the O drive in the AB-doc-^ view folder.

The results of the comparison are listed here in this next slide for the decade. We were asked to review a sampling of results from the '50s, the '60s, the '70s and the

'80s. In all, we reviewed a total of 33 PDF documents.

MR. GRIFFON: What does that mean, Mark? What are PDF documents? What's in them?

MR. ROLFES: That would have been a series of scanned hard copy urinalysis results. We would have captured those in data. For example, like the handwritten data cards that contained the raw data, the uranium bioassay data.

Let's see, and this gives our results here. Let's see, the number of files less the subcontractors and alpha/beta results. I would have to default hopefully to Mel maybe to explain this. And also we've got the number of files that met an acceptable quality level of one percent. Out of the 33 PDF files minus the ones that, let's see, we had 25 files after removing subcontractors and alpha/beta results. Out of those 25, 20 files met an acceptable quality level of one percent.

So the conclusions, eight files were primarily subcontractor urinalysis data for alpha/beta urinalysis results that were not in

HIS-20. Twenty of the 25 remaining met an acceptable quality level of one percent. The five files that did not meet the acceptable quality level were unlikely to result in any significant change to the coworker study.

Overall, 90 percent of the results were matched, and this was 1,627 results out of 1,800 total. And I said I'd like to reiterate that the white paper and the files are on the O drive for any more detailed review.

MR. GRIFFON: You said the white paper and the PDF files are on the --

MR. ROLFES: The PDF files and the Excel spreadsheet as well.

MR. GRIFFON: Can you tell us anything about the last item, and I guess 90 percent of the results were matched, and 80 percent of the files were an acceptable quality level, right? Is that what you're kind of saying?

MR. ROLFES: Correct, 90 percent of the results were matched and 20 out of 25 met an acceptable quality level of one percent.

MR. GRIFFON: I mean, did you -- I didn't look at this detailed white paper, so I don't know if you, anything on the ten percent, I mean, was there any kind of bias in the ones that weren't published? Were they high or low or there's no trend at all. I don't know if you looked at that kind of detail.

MR. ROLFES: I apologize. I have not looked at this.

MR. GRIFFON: And I don't know if it's in the paper. I'm catching up, too.

MR. ROLFES: I do have some notes here on the description of the five files that did not meet the acceptable quality level. And I can go ahead and read those.

For Reference ID 31-69, this file consisted of 1952 to 1953 fluorometric analyses for uranium which were conducted by the New York Operations Office Health and Safety Division. After failing to meet the acceptable quality level, the file was given a 100 percent inspection. The results showed that 84.2 percent of the results in the file were in HIS-20. The 50^{th} and 95^{th} percentile results for these data were identical with and without the missing data.

MR. GRIFFON: So that speaks to the --

MR. ROLFES: So we went to a more detailed focus. We went to a more detailed inspection when they didn't meet the acceptable quality level for the 100 percent.

Then I have additional details as well for the Reference ID 40-322. This was a file from 1961 through 1963 bioassay analytical datasheets. Since it was obvious, based on a spot check, that the acceptable quality level would not be met, the file was given a 100 percent inspection. Only 69 percent of the results were in HIS-20. Since it was a relatively small file, this amounts to only 70 missing results.

Some of the results in this file seem to be samples collected to monitor the effectiveness of workplace controls rather than as the bioassay of record for the employees. Most site employees in this file have other 1961 through 1963 results in HIS-20. The 50^{th} and 95^{th} percentile results for these data were very close with and without the missing data. And it refers back to the table within the paper in the main paper.

I can go through the additional next

two reference ID numbers that were inspected. Excuse me just a second.

Reference ID 40-389 and Reference ID 40-390, these files were for the first and second quarter of 1957. Neither file met an acceptable quality level of one percent but would have met an acceptable quality level of four percent. Since the files contained nearly 900 pages of results, 100 percent inspection was ruled out. Instead queries of the HIS-20 database for the same time periods were performed. From these queries the 50th, 84th and 95th percentiles were calculated. The eight missing or incorrect results in the two files were distributed around the respective 50th percentiles although one result was above the 84th percentile. The problem with missing data seems to be confined to the first two quarters of 1957.

The third, Reference ID 40-391, and fourth, Reference ID 40-392, quarters of 1957 met the acceptable quality level. And the fifth Reference ID, 40-399, this file was only six pages long and consisted of August through September of 1958 in-house uranium urine samples. This file contained multiple samples on only two individuals. HIS sampling is typical of that following an incident.

The first individual had 36 samples collected over a three-day period which are not included in HIS-20. To determine a possible effect on a coworker study a query of all uranium fluorometric results in HIS-20 for the same time period was performed. Of the 36 missing results, 11 were above the 50^{th} percentile of the data in HIS-20. Four were equal to the 50^{th} percentile, and 21 were below the 50^{th} percentile. One of the results was equal to the 84^{th} percentile.

The second individual had five samples collected over a two-day period which were not included in HIS-20. However, there is an entry in HIS-20 for the first of the two days that is very close to the weighted average of the five results.

DR. BEHLING: May I ask you some questions about, I guess I'm looking at the white paper and I looked at it very carefully. Somewhat at a loss to understand what an acceptable quality level is. When you talk about a one percent, you define here as AQL of one percent consisting of ^ results and a hard copy to the results of HIS-20. An AQL of one was selected.

And I guess what constitutes something that exceeds that limit? Is it the absence of that particular file being incorporated into the HIS-20 database? Is it an error in the transcription when it is actually there? What constitutes something that is a deficiency because I can see the whole file not being there.

And you already mentioned in a couple instances there were files missing. In other instances there is a slip in a decimal point or the transcription. What constitutes this value of one percent?

MR. ROLFES: Well, let’s see. I don’t know if I’ll be able to answer that. We do have the procedure documented, and I might not be able to provide a response to you today. So in that case I can simply get back to you via e-mail or a phone call.

DR. BEHLING: I mean, you can certainly understand if a file is missing in its entirety. That's a lot worse than having a mistake of 0.01 microgram per liter having some smaller value on either side of that. They might both be construed as an error, but one is considerably more significant than the other.

MR. ROLFES: Sure, I certainly understand. Let me see if I can find, I do have a procedure somewhere here.

DR. BEHLING: Yeah, it's in the appendix, Attachment A gives you the procedure.

UNIDENTIFIED SPEAKER: ^

MR. ROLFES: Yeah, maybe that'd be the best way to resolve this is to have a discussion on this specifically.

DR. BEHLING: In fact, here they seem to suggest that even a misrepresentation of a name on a file could constitute, but that really would have no impact in your coworker model which attempts to assess the 50^{th} percentile, et cetera, so while some errors may have no impact, others may have significant impact.

MR. CHEW: I think we're suggesting a call with Gene --

MR. GRIFFON: Why don't we have a technical call? It won't be a work group call, but we've done this in the past meetings. I think it works well to just have a technical call with maybe a Board representative on it. We can work that out, but set up a technical call.

DR. ZIEMER: It was my impression that they're not assessing the impact. It's whether or not the data match.

DR. BEHLING: Yes.

DR. ZIEMER: Within certain rules because one dataset was rounded or truncated I think in so many places and the other was carried out but they didn't match because of that, that was not an error. It wasn't my impression that they were assessing the impact of -- what you're saying is exactly true.

DR. BEHLING: But it really does. It does, for instance, in Table 3 in the white paper under Reference ID 43-22. You get comparisons for all the results minus the ones that are in the HIS database, and you see the differences between the 50^{th} percentile and the 95^{th} percentile. They're very close, and obviously if they were to match even though there are files missing it wouldn’t matter because, in essence, the numbers are identical.

DR. ZIEMER: But that’s done after the fact, right? I mean the one percent is just a match versus a mismatch, I believe. A mismatch could be a wrong number or a missing number.

DR. BEHLING: Or a name is misspelled in which case it has no impact.

MR. CLAWSON: So I guess as an action item do we want to set up between SC&A and NIOSH a technical call then?

DR. BEHLING: Well, you know, I have to admit. I looked at this very carefully. I took notes, but I did not really go to Attachment A which provides you with the procedure. And before we invest a lot of time, let me at least look through this and see if I can answer my own question.

MR. GRIFFON: Well, not only that go through, but maybe SC&A can provide a written review with any outstanding questions. And then if we need a technical call beyond that, then we do it.

MR. CLAWSON: We can do that. Would that be fine by everybody?

(Whereupon, there was general agreement.)

MR. GRIFFON: Where was that? Oh, I'll find the matrix.

MR. CLAWSON: Mark, I've got a question. I'm looking at your white paper, and I'm trying to understand something under the exposure study. I've just got Plant 2 and 3, 1967, but part of my thing is I've got information down, and it says that it's an average for, and I've got a lot of blanks in the process. And something that I find interesting is the denitration (ph) operator, all of a sudden I've got the 1962 is blank. Nineteen sixty-five is 0.3. 'Sixty-six is 0.2. 'Sixty-seven's 0.5.

DR. ZIEMER: What table are we looking at?

MR. CLAWSON: We're looking at --

MR. ROLFES: -- white paper.

MR. CLAWSON: Yeah, we're looking at that white paper. It's on page 23. I just picked one of those. I was just wondering why there'd be blanks. Because if this was an average of all the operators, I didn't know how they'd end up with zeros I guess. It's

Exposure Study for Plant 2 and 3, 1967.

MR. ROLFES: Okay, this is back to the recycled uranium. We were discussing the HIS-20 --

MR. CLAWSON: Right, I apologize. Let me -- and I apologize. I shouldn't have jumped back like that. I was just wondering about the zeros in there. They're not zeros. They're just dashes. There's nothing there. And if this was an average over everybody, everybody got zero or?

MR. SHARFI: What page?

MR. CLAWSON: Page 23. I just, it's throughout all these, and I was just wondering how this implements into the -- because when it comes down to the bottom, it has an average for each one of these years. I've got a lot of blank spots in numerous ones of these.

MR. CHEW: You're on page?

MR. CLAWSON: Twenty-three.

MR. ROLFES: Exposure Study for Plant 2 and 3.

MR. CLAWSON: Right, I'm just wondering if --

MR. ROLFES: This might be because was that the time period when that operation might not have been operating? Is that it?

MR. RICH: No, I think, they don't have a measurement in 1962. For example, for the ^ operators, and your question is how did they get an average?

MR. CLAWSON: Well, yeah, they're getting average, and they've got one for '62 but not for '65.

MR. ROLFES: Brad, the footnote down at the bottom it says denotes classification did not exist or was included in another job classification, so that's --

MR. CLAWSON: Oh, so they --

MR. ROLFES: Job title.

MR. RICH: So it's a job title change.

MR. ROLFES: The job title didn't exist. A combined raffinate operator was not the job title at the time. They might have been included in the digestion operator category. That's simply what it is.

MR. CLAWSON: I kind of looked at that, but I thought you'd always have an area foreman. I've got one for '62 and one for '67, but '65 and '66 it's not there. That's why that kind of threw me off a little bit. Of I guess, a foreman went to a --

MR. ROLFES: I'm not seeing where you're referring to. I see above the foremen there's a denitration operator, and there's some dashes in '60, '61 and '62.

MR. CLAWSON: Okay, so what I've got is area foreman, one man --

MR. ROLFES: Are we on page --

MR. CLAWSON: Twenty-three.

MR. ROLFES: Twenty-three, okay.

MR. CLAWSON: I was just, it didn't quite make sense to me. It's, so it could have been combined back into another.

MR. RICH: Yes.

MR. ROLFES: Yeah, let's see. I see. Area foreman, there's a couple of dashes, but it could have been the digestion foremen or the denitration foremen.

MR. CLAWSON: They could have been put into that category. Okay, I was trying to --

MR. ROLFES: Just a change, a change in job classification. It says it denotes classification did not exist or was included in another job classification.

MR. CLAWSON: Okay, I just, I know there's always got to be foremen around. I was wondering what it got into.

Do we have any other presentations, Mark, that --

MR. ROLFES: I don't think we have any presentations so I don't know if you'd like to go back to the matrix to see if there's, I mean, whatever you would like to do.

MR. CLAWSON: Well, I'd like to go back to the matrix to make sure that we've captured everything.

MR. ROLFES: Would we like to take a comfort break before we do that?

MR. GRIFFON: Yeah, I think that's a good idea.

MR. CLAWSON: Sounds like a marvelous idea.

DR. WADE: We're going to take a break. Would you think maybe ten, 15 minutes?

MR. GRIFFON: Yeah.

DR. WADE: We'll just mute the phone. We'll be back with you.

(Whereupon, the working group took a break from 2:40 p.m. until 2:55 p.m.)

DR. WADE: We're back in session.

Brad?

MATRIX DISCUSSION

MR. CLAWSON: We're going to start from the matrix. I want to make sure that we haven't missed anything in Finding 4.1.1, we've gone over the RU white paper in quite detail. Next thing that we need to go over is this chemical toxicity of the uranium. And I believe Sandra brought this up a little bit sooner.

So which one of you would like start on that one?

MR. ROLFES: I guess I can give a brief update. I posted a couple of additional documents that Jim Neton had come across. One was a reevaluation of a case study that was done in 1990 by Zau* and Zau*.

DR. NETON: This is a reference for Hans --

MR. ROLFES: Yes, correct. Hans had assembled a white paper to evaluate the potential for kidney toxicity from large uranium exposures, and he had cited a 1990 Zau and Zau Health Physics Journal article. That case study was actually just recently reevaluated and was documented in the Health Physics Journal from 2008, February of 2008.

That document and another supporting reference were provided to the Advisory Board. We haven't done any additional work on this, but we're prepared to have any discussions that you'd like to have on it.

DR. NETON: I'd just like to have a few comments. I missed the last meeting where this was discussed. And it's a very important issue, and I think it's a significant issue. The uranium toxicity rating which, of course, has been well established for decades. Toxicity effects known of uranium.

But the two papers that Hans did cite I looked at in some detail and neither of them, at least in the eyes of the reviewers that I read, consider those to be evidence of acute chemical toxicity for uranium of the kidney. The Zau and Zau exposure was considered, at least by Ron Katherine to be more related to an overwhelming of the lungs with about a gram or more of exposure which is what they feel the intake would have been.

And you see that in the beginning there was a low exposure, and the excretion started to increase over time. And I think that was the lung just sort recouping from this tremendous insult of a massive amount of uranium and then reaching into the stream and the kidney taking over.

The other paper where the person had extremely low urinary outputs was considered to be mostly the result of dehydration. They had complete burns over a large portion of the body, and the person just desiccated from oozing out of the pores. It's kind of a gory situation, but that was not necessarily the result of kidney toxicity.

DR. BEHLING: No, and it wasn't intended to even imply that. When I identified the Zau and Zau paper, it was really the first case that I wanted to draw attention to. And I think if I can elaborate a little bit, what struck me was that if you apply the ICRP model, excretion model, you would expect that the maximum excretion rates for any intake -- and they usually obviously model it on the basis of a very modest intake, respiratory intake.

And if you ^ the ICRP data, you would expect the maximum excretion rate in the first day or two and then exponentially with a count that exponential gradually coming down. In the case of the Zau and Zau this was a massive intake. It did really result in some changes in urinary excretion patterns or urine constituency that would suggest some renal damage. And what you saw from day one through day 65 there was an almost a 30-fold increase from something like 100 and some, whatever units were, to over 3,000. Thereafter, it peaked and then came back down again. And that totally conflicts with the ICRP model which is based on a non-damaging intake, respiratory intake.

DR. NETON: But again, at least Ron Katherine's take on this, I believe this is borne out by the other paper, which I believe was the Royal Academy or Royal Society in Britain. I think they had similar conclusions that this was a large intake that affected the ability of the lungs to clear material. This is more reflective of that than kidney damage that occurred. I mean, at least the one in the peer review journal article, and I tend to agree with it that it really is not a nephrotoxicity issue.

DR. MAURO: So there were no measures that indicated that it was some type of kidney dysfunction?

DR. NETON: There was, but that was later on. That was way, way down the line. But that did not necessarily affect the kidney. That’s what I want to get to. That did not necessarily affect the ability of uranium to be excreted and follow the normal clearance path. Kidney toxicity in and of itself does not necessarily invalidate the metabolic model for uranium being excreted.

There are, I think as Mrs. Baldridge pointed out, irritation, glomerulus nephritis, those kind of things, plugging of the ^ tubule, those kind of things that we all know. But they don’t necessarily in themselves invalidate the excretion as long as the urine’s coming out, being filtered at a regular rate.

That being said though, there are several things to discuss. One is how would NIOSH handle a situation in which a person had abnormal kidney function irrespective of their exposure to uranium. They just had an abnormal process or something. And that, of course, would have to be handled, you'd have to treat that person essentially as an unmonitored worker at that point and rely on coworker data or something of that effect to reconstruct a dose.

If you have a situation though where a person is exposed massively, I'd say a fairly large exposure in the workplace, then one would need to evaluate what possible effect it could have had on the kidneys and treat it that way at that point. Of course, you also treat that as unmonitored. You'd have to go to other means to assess exposure which would either be some air sampling data that might be available, source term, that sort of thing, to flesh out the rest of the story.

I guess the crux of the question then is at what point is it decided that kidney damage is possible. It's mostly considered to be possible only with soluble forms of uranium, UF-6s and that sort of thing. And that would have to be taken, you know, that would be one of the triage cut points. But it’s pretty well documented in like the health physics manual, good practice at the uranium facilities what these no effect levels might be.

Correct me -- I know, Bryce, you were the author of that document. Is it one microgram per gram was considered at one point to be the no effect threshold level which would be any time you had above -- a kidney weighs about 300 grams, somewhere on the order of three-tenths of a milligram of one kidney, one might want to be looking for those effects.

I’ve modeled this before in the past and for moderately soluble, insoluble form, you have to have some pretty massive intakes to get to that level in the kidney even under acute exposure scenario. So I’m not aware of any situation documented in the literature where under a routine occupational exposure scenario, kidney damage has occurred to the extent that it is invalidated or made not useful the standard metabolic model.

And we see a lot of this in reconstructions going on in the past, and I’m not aware of any incidents under normal conditions. We wouldn't have to account under these acute, you know, massive, acute exposure incidents. We'd have to look at this on a case-by-case basis.

DR. BEHLING: And admittedly I looked through the literature extensively, and this was the only instance I found. But also, I should mention the fact that you don't have a lot of data, human data, where a single acute exposure's followed up by daily excretion rates either. So there isn't a wealth of information that would suggest that this is an artifact, and this is abnormal.

DR. NETON: I think Darryl Fisher* followed up a lot of people that worked at the Kerr-McGee facility that had a massive release at one point. And I thought --

MR. ROLFES: First Fernald in 1966 with the big UF-6 release from the pilot plant. That was, I think we discussed that a little bit, and I believe we provided that to the Advisory Board as well on the O drive. I don't recall the numbers off the top of my head, but there were several hundred bioassays following that incident on February 14^{th}, 1966. I think we did discuss some of the individuals had in excess of ten or 15 bioassays following that exposure. But that was pretty well documented and tracked.

DR. BEHLING: And that study is where?

MR. ROLFES: It’s on the O drive. It’s the 1966 release of UF-6 from the pilot plant. And if I can get into my documents here, I will give you the exact title here.

MR. RICH: There’ve been a number of studies associated with change in solubility from the lungs giving you markedly different elimination patterns ^.

DR. NETON: We just published a ^ on uranium aluminide which looks very much like the excretion pattern that you observed for the Zau and Zau case, not quite maybe as pronounced, but the urine excretion continued to climb over time.

MR. SHARFI: This was at Rocketdyne.

DR. NETON: Uranium aluminide is kind of a strange composite material, but it behaves similar that way, and that’s really a function of the lung, the way the lung clears its materials.

MR. RICH: It’s a solubility issue.

MR. BEATTY: I think Sandy’s got some very important news you might want to hear on this.

MS. BALDRIDGE: When I got a copy of the article, “Acute Chemical Toxicity of Uranium,” there was something in it that I didn’t particularly like. Near one of the back pages it said, “There are also no known long-term chemical injuries from uranium intake that are sub-lethal...,” end of quote.

And then it goes on to say, “which would seem to imply that intakes of uranium no matter how large that did not cause death would not result in permanent kidney damage and further notes that permanent renal damage has never been observed in humans according to Athey*, 2007.”

So I went online, and I called Mr. Athey, and I talked to him about it. And he felt that the person who wrote the paper had misrepresented the intent of the quote. And he further directed me to Mr. McGuire who also co-authored that paper, and he gave me the resource material. And it seems that the determinations were based on two individual cases in China and that all the research that had been done was based on acute exposure and not chronic exposure.

So I’m sure that there are some aspects of this that have not ever been discovered. And when I went on to tell him about the 17 men in pilot plant in 1952, he was very interested because he didn’t know that there had ever been an incident where more than one or two individuals had been exposed at a single time. And I said, well, you said that it never caused death.

I realize uranium poisoning hasn’t caused death, I said, but do you, you know, what would make it permanent, a permanent condition? My father was still being tested 12 years later. His urinalysis was still showing casts, levels of protein, so forth, to the point that right before he retired, he was being checked every week, every two weeks to monitor the renal condition. You know, maybe 21 uranium urinalysis out of 60 urinalysis results over a timeframe. They were looking, they were watching something. So the fact that when he died he still had it made it permanent as far as I was concerned.

DR. NETON: I guess I don't want to get into too many specifics here, but was there an incident, a large exposure incident associated with your father's condition?

MS. BALDRIDGE: Well, there were 17 men who were exposed in the pilot plant in 1972, 100 percent of whom were determined to have renal damage. The document is in the petition. My father was not one of those 17.

DR. NETON: He was not one of the exposed.

MS. BALDRIDGE: He was not one that was recognized to be exposed.

DR. NETON: So I guess the question is then was there any evidence of, in the urine -- your father was presumably monitored for uranium in urine over time.

MS. BALDRIDGE: Right.

DR. NETON: Was there any evidence in his urine samples of increased excretion of uranium in urine?

MS. BALDRIDGE: Not necessarily uranium.

DR. NETON: I guess the question is then how does one know whether the kidney damage was caused by uranium exposure or some natural --

MS. BALDRIDGE: Because he didn't have it and he had it within the first year of his employment.

DR. NETON: But again, I guess it's an open question.

MS. BALDRIDGE: And it was diagnosed by the plant --

DR. NETON: I'm not questioning if the uranium and kidney damage was there, but if it was --

MS. BALDRIDGE: -- and they attributed it to exposure.

DR. NETON: That's been documented in the file?

MS. BALDRIDGE: Yes.

DR. NETON: I'd like to see that.

MR. ROLFES: Did you bring those medical --

MS. BALDRIDGE: Yes, I did.

MR. ROLFES: To address what you had asked about the exposure studies for individuals who were chronically exposed, at the last working group meeting we did discuss a little bit of some of the autopsy data and some of the studies that were done for individuals.

They had not found any indication that individuals who were exposed to large quantities of uranium had any observable effects on kidney function or the physiology of the kidney. The case study that was quoted by SC&A in their review was, in fact, an acute exposure scenario, and it’s been reevaluated in this current journal.

MS. BALDRIDGE: There’s also a document that talks about the effect that the uranium has on the proteins and the glucose and how the cell damage causes, when the cell ruptures, it releases the proteins and so forth from the cytoplasm which all are evidenced in the urine.

DR. NETON: That’s fairly well established. I understand that. But as I mentioned before, there are at least reference studies that demonstrate or at least indicate that it takes a certain amount of uranium exposure to initiate any observable damage, and those levels have been fairly well documented. And they would be fairly large exposures that would result in urinary excretion of uranium. I don’t know where to go other than one can calculate the level of exposure necessary to start to have these changes in the kidney. And I think it would have to have some fairly high level of exposure to result in those --

MS. BALDRIDGE: And if that's the case, he was not, you know that wasn't documented for him, the exposure rate --

DR. NETON: Well, if there was uranium in the urine samples, but --

MS. BALDRIDGE: --especially since the exposure, the incident that involved the 17 men was estimated to be in August. His urinalysis was done the end of December.

MR. ROLFES: The 17 individuals, I did look back in the HIS-20 database and took a look through some of the urinalyses that were documented in there for the 17 individuals that were involved in the pilot plant work. I don't believe it was one small release that occurred in the pilot plant in 1952. It was a series of chronic exposures that occurred in August and September of 1952. The individuals that were working in the pilot plant, there are some high exposures that certainly are, there are a couple of exposures that were in excess of one milligram per liter, but there are data there.

Getting back to what we were referring to before, I had mentioned the urinalysis results for the individuals who were involved in the 1966 release of UF-6. We have a National Lead of Ohio document indicating urinalysis results for the AEC employees who were involved. And there are individuals who had, let's see, for one of the AEC employees following the 1966 release on February 14th, he'd provided four separate urine samples on that, on the 14th, three urine samples on the 15th, a urine sample on the 16th, another on the 17th, another on the 18th, and his final one that's documented in this report was on the 21st, so one week after. But I haven't gone into HIS-20 to see if they were monitored beyond this time period. But there were some pretty close, if there was an incident that occurred, they did track these urine samples to make sure that --

DR. ZIEMER: What about the excretion patterns on this group of 17? Do they look like the normal models or do they --

MR. ROLFES: Yes, they, all of them start off from UF-6 which is fairly soluble, gets into the bloodstream pretty quickly. It's excreted pretty rapidly. And all these individuals, I think all of them listed on this page, their highest results appear to be on the first day, on the 14^{th}, so on the day of the release.

DR. NETON: One of the issues with exposure to UF-6 is it's also usually accompanied by exposure to hydrochloric acid because UF-6 oxidizes in air immediately and forms UO2F2 and hydrochloric acid. And that definitely can influence your lung clearance and make patterns look somewhat different, but it's not related to chemical issues with the kidney; it's lung clearance issues.

MS. BALDRIDGE: Since you bring up lung clearance, another, you know, looking through my father's case, another thing he was exposed to is nitric oxide. And they didn't discover until 1986 that it causes vasodilation in the lung and increases the capacity of the lung. Now it seems to me that it's a possibility that if the lung tissue is dilated, it allows a greater absorption. But when the exposure to NO is diminished, it would present a situation where there could be folds in which particulates could have been captured because those portions of the lung aren't normally expanded.

MR. ROLFES: That's an interesting, there are some agents that are given, it almost sounds as if you're saying that this could be like a kelating agent. If you have uranium that's deposited in your lung tissues, if vasodilation occurred, that would seem that it would expedite the clearance of uranium from the lung tissue and speed up the amount of -- excuse me, speed up the amount excreted. So by doing that it would impart less dose to the organs because the uranium wasn't residing in the tissues quite as long.

DR. BEHLING: Well, it would be the opposite. You would transfer much more rapidly the uranium from the ^ to the blood meaning that it's more likely to ^ in the kidney, and therefore, do the damage in the kidneys.

DR. NETON: But you'd also get a much higher uranium output which would overestimate your intake.

DR. BEHLING: Well, but the kidney damage only occurs when you have blood-borne uranium that is now either ^ the kidney or goes to --

DR. NETON: I understand, but you do need to have a certain level of uranium where you start to see kidney damage. And we can do those calculations if you want to go through this in a working group. But it takes a considerable amount of intake to get the kidney damage.

DR. BEHLING: But for a given, let's say a large intake, you have an intake, the addition of bronchodilation and increase of blood flow would obviously imply one thing. There is a much more rapid clearance by transfer --

DR. NETON: That's all speculation, Hans, and I don't know. I mean, we're speculating in biology and none of us can prove theory.

MS. BALDRIDGE: But what it does present is an unknown factor.

DR. NETON: True, but this is one of the reasons we have a GSD, a geometric standard deviation, associated with our defined dose estimates because we don't know all these factors. It's also another reason why the 99th percentile is used for a compensation decision in this program. So there's a number of safety nets built into the program to account for some of this variability in the biology.

(no response)

DR. NETON: Boy, I must have answered everything.

MR. GRIFFON: I don't know where to take it. I've actually brought up the HF issue from way back in Mallinckrodt, and ICRP-66 does a lot of U-2 to use modifying factors, and I don't know if anybody has a sense of what, in looking at that we could do a couple things. I mean, I wasn't clear exactly what it would do on lung doses or other doses so this could be another one of those things that fits in that category. Maybe it's something should be deferred to our science issues, that's your category, right?

DR. NETON: It's something that --

MR. GRIFFON: Have to give you something to do here.

DR. NETON: --I don't know if we're going to address it with the known information as it stands.

DR. ZIEMER: I'll just add a comment which won't really enlighten us that much more, but Sandra makes a good point about the fact that there are many chemicals, in fact, that we know can alter the metabolism. And the only way we can currently account for these is the way Jim described, and that is by assuming a big enough distribution and going up at the end of the distribution to in a way take care of those. But in principle, if we knew the concentration of the other chemicals and, in fact, had biological data that we could go to, which in most cases we don't with the chemicals, we might be able to say how much a model was altered.

MR. GRIFFON: See, that's, ICRP-66 does have some --

DR. ZIEMER: Allows you to do that. But I'm saying you still need to know what the exposure to the other chemical was, number one, and, two, what the effects of that were. By and large for most chemicals we all know that.

I know that the industrial hygienists sort of had that information most of which is based on animal data, like the uranium is mostly based on animal data, and extrapolated with usually a factor of ten thrown in to be on the safe side. So I mean, in principal we want to be able to do that, but in practice it is going to become very, very difficult even in individual cases unless you knew precisely what the other exposure was.

MR. GRIFFON: And I mean, it's also -- I would agree generally, Paul, but I think that there's some, the reason I brought up HF was as Jim said, usually if you get exposure to UF-6, you, you know, once it's in there you get UO2F2, and you've got HF. They're always together. So that was a unique situation where you always have the chemical exposure with the radionuclide exposure.

DR. ZIEMER: But what do you do with that, see.

MR. GRIFFON: Well, and ICRP does have some guidance.

DR. ZIEMER: Yeah, and in fact, you could take that group of people, and if you could show that their excretion rate was different from the ICRP model, you could say, okay, here's what you should do if you've had that kind of exposure.

DR. NETON: I suspect in the long-run though, you're talking about second, third order corrections here on something that we don't really know that --

MR. GRIFFON: You may be right --

DR. NETON: I just made a list here --

MR. GRIFFON: -- you might do the analysis and see that your --

DR. NETON: We don't know the ventilation rate for sure. We're assuming 20 liters per minute. We don't know the lung size. We're assuming a thousand gram lung. Oronasal breathing has been brought up before as an issue. Mucociliar clearance rates that are affected by cigarette smoking are not considered.

So there's a number of factors such as this that are in there, and I'll go back to my initial point what Dr. Ziemer mentioned is, that's why we have uncertainties built into these models because in a program such as this, you just cannot possibly account for all these factors on an individual basis, I don’t think. I don’t disagree that it’s not something that NIOSH shouldn’t be aware of and consider to the extent we can, but I’m not real optimistic that we’re going to be able to do anything in this area although we certainly want to keep our eyes open for areas where we --

MR. GRIFFON: I think at least where there is -- I mean, we always say current ICRP guidelines, where there is guidance out there on certain modifying factors, we should consider that.

DR. NETON: Yes, and where we have HF exposure, maybe we ought to take a look at that. I’m not saying we wouldn’t. At Fernald in my recollection there were very few HF exposures. I mean, we pulled out a couple here, but at least to most of my knowledge and the operating history of the plant, HF was not a big player, I mean UF-6 was not a big player. There’s limited, but unfortunately what they did do, they had a few unfortunate encounters with screwing valves on tanks and stuff.

DR. ZIEMER: Could I ask one other question? And maybe Bryce or maybe Mark can answer this or Jim, but do any of you recall in the Uranium Transuranic Registry I know they have autopsies for some of these where they can relate to body burdens. What's in the registry on those with heavy uranium burdens as far as the damage to the organ is concerned?

MR. ROLFES: Yeah, we did have some, let's see, I've got a paper here in front of me that's titled "The Histological Kidney Study of Uranium and Non-uranium Workers". And --

DR. ZIEMER: Is this from the registry?

MR. ROLFES: Yeah, there's comparison of case studies from the United States Transuranium and Uranium registries, and there's specific cases in here that are compared. Their findings essentially said that there was no observable effects in the kidneys that were inspected from the exposed population versus the non-exposed population.

DR. ZIEMER: Even in the heavy uranium cases?

MR. ROLFES: Correct. They had considered -- I will get back to, there's some specific USTUR Case Number 10-40. He was a chemical operator and fuel operator who was employed for 31 years. He passed away in 1982 and was 71 at the time of death. His estimated occupational exposure was tens of milligrams of uranium.

DR. NETON: Just so Emily understands, this is peer-reviewed literature we're working from.

MR. ROLFES: Yeah, yeah.

DR. ZIEMER: Open literature.

MR. ROLFES: There was a second chemical operator who had worked for approximately 26 years, passed away in 1978 and was 49 at the age of death. He was exposed to hundreds of milligrams of uranium. A millwright who was exposed to tens of milligrams, and then on down to -- and then about seven specific USTUR cases, and then six individuals who had no occupational exposure to uranium.

DR. NETON: They were in the USTUR?

MR. ROLFES: Yeah, these were --

DR. NETON: They were controls.

MR. ROLFES: These were controls and there are discussions of the microscopic kidney diagnostic scores that were conducted for the various cases. There were, let's see, four abnormal findings in the unexposed population and three abnormal findings out of the seven in the exposed population. I believe this has been provided to -- let me verify that.

I apologize. I've got many documents on my disk here. The title of this, it is a Health Physics Journal article, and it's titled "Histological Kidney Study of Uranium and Non-Uranium Workers". And it's from Health Physics 70-bracket-4, pages 466 through 472. Let me see if I've got it in an electronic form here.

There were some other studies as well also that were conducted at Fernald early on. One of the individuals that was involved in industrial hygiene and health and safety had prepared some tissue samples for the Hamilton County coroner, I believe, for the coroner in the area to examine also.

And this was certainly one of the things that they were concerned about is early exposures. They didn't have human information to confirm their bioassay results. And so there were certainly concerns early on and studies done early on. And I do have documentation of that. I apologize. I've got a box of records here in front of me, and I could dig through there and look to see what we have in there. I don't have the titles of those documents. But those are documented on the site research database as well in addition to this Health Physics Journal article. I can certainly --

DR. NETON: I think this pretty much bears out what we've been saying is that as far as the routine occupational exposures, we're not aware of any permanent damage to the kidneys that I'm aware of in the open literature.

MR. GRIFFON: I mean, is there any instance from their annual physical data that you would say, clearly we've got, this person had a problem identified in their annual physical?

DR. NETON: I think there's a difference between a test that has an end point that determines there's something awry with the kidney versus damage that would affect the kidney's ability to clear uranium. Those are, because as the tests get more and more sensitive, some of these enzyme tests and stuff, you can measure changes of people drinking uranium in well water.

I mean, you can start to measure changes in the kidney. What does that mean on a practical basis? I don't know. Just because you can measure an effect doesn't mean that it does any, has an impairment to the person's function. I'm sure in the medical files of people there are tests that have demonstrated protein albumin urea increases and such based on exposures to uranium. But I'm not certain that they've done anything to impair the ability of a person to excrete uranium normally. I guess that's sort of the bottom line.

MR. BEATTY: Jim, a question for you there as far as this is much more problematic or even legislative in nature, but you're saying some cancers are more radiogenic than others. But why would the certain types of cancers when you try to do dose reconstruction on them are so complex but yet they're on the 22 covered cancers under an SEC? This doesn't make sense to me. Pancreatic's another one that I have trouble with.

DR. NETON: I can only say that NIOSH was not responsible for establishing that list and so I couldn't comment on the rationale behind those 22 cancers.

MR. BEATTY: Okay, thank you anyway.

MR. GRIFFON: Well, I'm just not sure where to go with this action item. We've got a response. I don't know if there's any follow up needed.

Hans, have you had your questions answered?

DR. BEHLING: I mean it's just an aberration of sorts that defines in Zau and Zau. It may very well be to more a damage to the lungs in transferring the material into the bloodstream as opposed to kidney damage. We don't know. I mean, it's an open-ended question that can't be answered by us.

MR. GRIFFON: Do you want a chance to at least look at the Katherine paper?

DR. BEHLING: Well, I looked at --

MR. GRIFFON: I don't think there's any further action --

DR. BEHLING: I looked at the other papers. I mean, Katherine offers very little other than this speculation that it might be due to lung damage in the transfer rate from the lungs to the bloodstream that is the key factor for this aberrant excretion.

DR. NETON: We recognize the fact that this was over a gram of exposure if you believe Ron Katherine’s dose reconstruction --

DR. BEHLING: Well, it is a Katherine that the 82-point-some milligrams excreted total is only a fraction of the total intake.

DR. NETON: I think that we would agree that any time we had a situation where a person’s exposed to a gram of uranium or something, we would take special precautions to make sure that our dose reconstruction, that the person’s excretion patterns follow the normal metabolic parameter.

So maybe that’s the outcome of this is we need to document that we would do that. I think that we would normally do that, but if we need to put that in writing that we need to exercise caution for extreme exposure incidents or something.

MR. GRIFFON: Now how do you know? Oh, just from an incident database or from the personal records that it's in there or how do you --

DR. NETON: See, my feeling is that these type of incidents would be virtually and possibly undetected. I mean, they would be these massive, a person just enveloped in a cloud and they go to Medical or something like that.

DR. MAURO: This almost goes to the question that I have, and maybe it's more academic, is that the models we have are the standard man, reference man, given the uncertainties both individuals realize no one is a reference man. Everyone is an individual, variabilities large. But at some point the variability for a given person may be due to some pathological condition, perhaps some kind of kidney dysfunction unrelated to work.

It brings you to a point where perhaps these models don't work for that person. And I guess the question becomes is there any provision to deal with that, for example, in the CATI. When you interview or you find out from a person's medical records that this person had a certain type of dysfunction, a medical condition, which would invalidate our models and maybe we should deal with them a little differently or that would be something that we would look into.

DR. NETON: Well, we've done that, and there's cases where people had their thyroid removed and they were exposed to iodine, and we're certainly not going to use a standard metabolic model for iodine.

DR. MAURO: I'm sure.

DR. NETON: But I don't know how we would do that. We're not medical people to begin with, and so we do get the medical files on these folks, but unless it was pointed out to us, I'm not sure what we would do about that.

DR. ZIEMER: But if you had an incident where you followed the excretion -- I mean, I've had this -- and the individual's excretion rate is a little different than the ICRP model, maybe not a great amount, and you can calculate using the actual data, the actual dose to the person. And it will be a little different than the model. The model, if you just have a couple points, the model helps you, but if you've got a bunch of points, you can do it.

DR. NETON: I'm certain that we've done some of that, and Super-S is a good example of how we've taken real data and come up with our own interpretation of uranium aluminide that just came out of another good example. So to the extent that we do find these things and can quantify them, we do. Some of these more subtle changes that we discuss here though I think are subtle, subtle. By definition they'd be difficult for us to deal with except to say that they're covered by the uncertainty in the distribution.

MR. GRIFFON: Well, I guess that's the question on the table. Is that the final answer? Is it covered by uncertainty or are you going to propose that you'll -- and I'm not sure when you say find, that's the question I have. How do you find them?

DR. NETON: I hate to offer this up because we're swamped, but I do think that this is not necessarily a Fernald issue, just a Fernald issue. It is a more overarching issue, and if we want to keep it on the table, we can move it to the overarching science issues.

MR. GRIFFON: Yeah, but we've got an SEC at hand here.

DR. NETON: But I don't know that this issue is necessarily, would affect the SEC.

MR. GRIFFON: ^ from bounding an --

DR. NETON: Yeah, from bounding and --

DR. MAURO: You basically made your case, when I say made your case, you've presented your case that says that we don't believe our ability to reconstruct doses with sufficient accuracy could be affected by the fact that some workers may have had quite high intakes. And as a result of that we, our models don't really work very well for a large portion of the population to such an extent that it affects your ability to reconstruct doses. And that's what I'm hearing. That's your position. And I heard, and you cited the various papers, and that's your position. So your argument is, no, it does not affect our ability.

DR. NETON: But we do acknowledge that people with abnormal kidney function or people involved in extremely high-level exposures from incidents need to be treated special on a case-by-case basis.

MR. GRIFFON: Well, I guess that's the question is how do you find abnormal kidney, you know, and that's why I was asking a medical question. Do you look back at the annual physicals --

DR. NETON: I don't know. There was just no way that would be --

MR. GRIFFON: I'm not trying to put you on the spot.

DR. NETON: No, I understand, but --

MR. CLAWSON: I'm just wondering how the dose reconstructor develops, be able to go through this.

DR. NETON: Right, like I said, we're not medical people. I mean, we're health physicists. We do have access to medical personnel, but --

UNIDENTIFIED SPEAKER: ^

DR. NETON: Well, it can lead to a massive intake. I mean, we can certainly deal with that.

MR. GRIFFON: So one criteria you have is if you can red flag --

DR. NETON: Yeah, there's --

MR. GRIFFON: -- maybe you can just define that for us. Give us over whatever, whatever it is.

DR. NETON: An intake that would result in something over 200, 2000 millirem, something like that. That would be, we could document that. But the case where you have abnormal kidney function, which at least to my knowledge is not uncommon. High blood pressure can cause kidney dysfunction, a number of things can do it other than uranium.

DR. ZIEMER: Coffee does pretty well.

DR. NETON: I don't know how we would be able to flag that other than it would have to come ^. But that's not just uranium in the kidney. It has to do with liver function and cirrhosis of the liver and all the metabolic parameters. ^ the thyroid.

MR. GRIFFON: I don't know that there's any more actions on that, but let's go ahead with the next one.

MR. CLAWSON: The next one we need to come up to, we kind of covered because we were talking about the thorium model and so forth of how you guys were going to cover it, but part of the process is after 1969, how are we going to, yeah, 1968, how are we going to be able to deal with the thorium issue. This is one that portable in vivo came on line.

DR. BEHLING: And let me, I can answer specific questions because it's a more focused response. I guess this morning's discussion regarding the coworker model in context with all the workers who may have been exposed to thorium prior to 1968. And the use of that coworker modeling involves identifying the worker by either being an H, M or L worker, the years of exposure, the location of the exposure, and you apply the specific coworker model I take it.

Now we're into 1968 where there's the beginning of chest counting, in vivo chest counting using the mobile in vivo radiation monitoring laboratory that, at least for the most exposed individuals would perhaps assess them once a year, sometimes twice a year, et cetera. And I guess one of the concerns I had up front is that between '68 and '78, the data was recorded as thorium in milligrams. And I'm not sure we have a firm handle on how the thorium milligram quantity was obtained.

Obviously, the system relied on Actinium-228 and Lead-212, and we all know what the problems are regarding the disequilibrium between Thorium-232 and 228 and the surrogate radionuclides used. Obviously, it's times zero if you were to assess a person with a high thorium intake, but you're looking at that intake by way of Actinium-228, you'd end up with zero dose because you wouldn't see any Actinium-228 at times zero because you remove the Radium-228, and therefore, there wouldn't be any Actinium-228 to look at.

You would obviously have to rely on an in-growth of the shorter-lived daughters for Thorium-228 which turns out to be Lead-212. But again, as a function of time, Thorium-228 has a 1.9 year half-life and it's a function of time after that chemical separation which you find. And we've all seen the curve which says that the dose ratio between Thorium-232 and Thorium-228 is about 0.42 or 42 percent. So the question I have is not knowing what the chemical ratio is or the ratio between Thorium-232 and -228, and the indicator radionuclides for each of those two radionuclides, and how do you validate the milligram thorium quantity? What was the basis of it?

Because if you relied on Lead-212, you could be off by approximately a factor of two and a half if the maximum disequilibrium between the two radionuclides occurred. In other words for every microcurie of Thorium-228, you would expect to have approximately (telephonic interruption) Thorium-232. Conversely, if you relied on Actinium-228 because that's the surrogate for Thorium-232, you might end up with a very low value based on the fact that Radium-228 has a 6.7 year half-life and will take 30 years for in-growth.

So that could be full equilibrium again. So that you would have to wait 30 years in order to look at Actinium-228 to give you a true indication of Thorium-232. So those are the problems. I know I've used an awful lot of numbers, but you can look at that table and understand the difficulty by which the milligram of thorium quantities for the years ’68 through ’78 is translated into real numbers involving Thorium-232 and Thorium-228. And I think that’s my principal concern and question.

MR. ROLFES: I don’t know if Bob Morris is still on the line. Bob?

MR. MORRIS: I missed the last part because I was trying to unmute, and I turned myself off instead. But what I would say based on what I heard up until 45 seconds ago was we explained our assumptions pretty clearly in the coworker paper. Have you seen that paper yet?

DR. BEHLING: Yes, I have, and I do have some problems on that.

MR. MORRIS: Well, I think that that’s fair then. You should provide them in writing, and we’ll address them.

DR. BEHLING: Well, then I think we can address them here because somewhere is the assumptions. It says on your white paper --

DR. ZIEMER: Which paper are we looking at now?

MR. ROLFES: This is the Fernald Thorium In Vivo Coworker Study final draft.

MR. GRIFFON: And, Mark, I don't know if you're following this on the matrix. What finding is this?

DR. NETON: Are you suggesting that radium precedes actinium in the decay chain of thorium? I don't think so.

DR. BEHLING: Yeah, Radium-220, it precedes Actinium-220.

DR. NETON: Refresh my memory again, the half-life's, the half-life of radium is around six years?

DR. BEHLING: Six years, yes.

DR. NETON: The thorium is, actinium is --

DR. BEHLING: A few hours --

DR. NETON: I haven't looked at -- I used to have this committed to memory.

DR. BEHLING: In that paper, it's on page seven of 19, there are --

DR. ZIEMER: This is the white paper on --

DR. BEHLING: Yeah, the white paper and that's -- and here's some of the assumptions. It obviously makes reference to this potential problem that says, "for the thorium data reported in milligrams, the master activity conversion assumed that all of the mass of natural thorium is associated with Thorium-232." And that's, of course, correct because of the long half-life of Thorium-232. The mass is driven by the long half-life of Thorium-232 as opposed to the shorter one of Thorium-228 which is only 1.9 year half-life.

And then goes on further, "The specific activity factor used for this conversion was 0.11 nanocuries of Thorium-232 per milligram of natural thorium." And so I assume what you're doing is trying to convert some value that you observed either from actinium and took a Lead-212 or both into this conversion of milligrams.

And then I'm not sure I know what measurements were taken at the time because it's clear that they probably -- and I've looked at a host of values that are shown in one of the documents that are empirical values, and you realize that the ratio is hardly ever one where the Lead-212 and the Actinium-228 are there in concentrations of activity values that would suggest a second ^

between the two thoriums. And so the question I have is how was this milligram quantity reported for the full duration of ten years?

And I might also add that the time period of ’68 to ’78 is the time period during which thorium was really processed. It was only thereafter that we see reporting of thorium in units of Lead-212 and Actinium-228 but that in 1978 post-dates the processing of thorium. So I think it’s a critical issue here to understand how milligrams of thorium reported in those days are converted into real values of what do they really represent.

DR. NETON: I think you raise a good point. I mean, I don’t know off the top of my head how Fernald --

MR. RICH: Number one, there’s an assumption made about the time since separation.

DR. BEHLING: Yes, that’s a critical part.

MR. RICH: And once you know that then, of course, you can, the Thorium-228 is fairly easy because that’s a short-lived daughter build-up which then can give you a fairly good handle on the Thorium-228. And then with the knowledge of the time since separation of the daughters either through metallurgical or chemical separation, so there is a respondent for some knowledge of the time separation of the, or the purification of the thorium.

DR. NETON: I think that's what Hans is asking. What we've used in this calculation. And I don't really know what Fernald did at that point in time.

DR. ZIEMER: Is what's on page 17 applicable here? It gives conversion factors there.

DR. NETON: Yeah, the conversion factors, I have to go through them and calculate and probably estimate based on the conversion factor what they used. I don't know.

MR. RICH: Different ^ materials that ^ to Fernald's in the one or so year post initial separation. And ^ it probably would be in ^.

DR. ZIEMER: They also give the assumed ratio as the midpoint between the lowest and the highest value. It's a 0.711 ratio.

MR. RICH: And that gives you about a 0.7 ratio.

DR. NETON: I mean, the numbers are there. Clearly, they understood what they were doing.

DR. BEHLING: They understood.

DR. NETON: How they actually did that to come up with those values I really can't tell.

MR. RICH: Like I say, you start with an assumption or a knowledge of the time since separation which gives you a ratio of the Thorium-228 --

DR. BEHLING: But that, was that a constant value? I mean, the thorium was processed over many, many years, and I don't think the -- at times zero, one can reasonably start out in assuming that the two thoriums are in equilibrium. That's not unreasonable because it's a natural product, and they ^ . And at that point you'd say one-on-one, but as a function of time you will see disequilibrium which is maximum at about four years, five years after separation where you have --

MR. RICH: Hans, Hans, immediately after purification, you have a ratio of one-to-one.

DR. BEHLING: Yes, uh-huh.

MR. RICH: And then after 30 years, you have --

DR. BEHLING: You go back to one-to-one.

MR. RICH: Right. And in the interim between immediate and zero, you wind up with something in the range of --

DR. BEHLING: Up to two and a half whole difference.

MR. RICH: Seventy percent equilibrium.

DR. BEHLING: Well, I think in ^ 40 percent. The ^ is about 40 percent.

MR. RICH: Nonetheless, I think that's right. But typically the material was in the range where you would get between 60 and 70 percent. And I think that from a knowledge of the operational history of the material in the plant, they made an assumption like that to arrive at a ratio to apply that would allow you to go the actinium and Lead-212. Those are the major ones that they made in the in vivo counter to --

DR. NETON: Was it either or though? I mean, did they --

MR. RICH: They measured both, Actinium-228 and Lead-212, and that gave you an arrangement that allowed you to fundamentally determine the mass of Thorium-232. And then you add to that the equilibrium ratio of the 228.

DR. ZIEMER: Is the concern here the magnitude of the potential error? I missed that.

DR. BEHLING: Yeah, I mean, it's a question of how this conversion was done when you have milligrams reported. What were they measuring to arrive at that conclusion? And again, and I also want to throw in there's the issue of the detector itself. I mean, it is not the most efficient way of doing this analysis when you're dealing with fairly low energy photons. And we've commented on this before, and I even brought in one of the documents that was a DOE document that criticized the use of the three-by-three crystal for doing this kind of analysis.

DR. NETON: What three-by-three crystal? The whole body count was not a three-by-three inch crystal.

DR. BEHLING: Yes, it was a large crystal.

DR. NETON: It was a three-by-14 or something like that. It was a very large --

DR. BEHLING: Well, a very thick, large crystal.

DR. NETON: It was bigger than three-by-three. It covered the whole lung area. As a matter of fact, it was a sandwich between those two detectors, one on the top and one on the back. And you laid a sort of a mesh, a webbed top to --

DR. BEHLING: It's a nine inch by four inch crystal, ^ crystal.

DR. NETON: Yeah, and there are two of them.

DR. ZIEMER: Well, we've had this discussion before. The background is a little higher because it's thick, and you do better --

DR. BEHLING: And it's ^ sensitive.

DR. ZIEMER: -- well, let's see. I'll make the argument I made before. Usually the figure of merit is sample squared to background. So you can atolerate (ph) a high background if you can run your sample count up higher. So thin crystals often give you better sort of resolution because they get rid of background noise. But --

MR. RICH: In the area that would give you ^.

DR. ZIEMER: But generally, you compensate for that. You end up counting longer or something, but I mean, I think people can calibrate for this. You're right. It probably wasn't the optimum. If you had the money and started over, you'd get a different setup, but that doesn't mean you can't do the counting.

MR. RICH: They didn't get thin crystal technology until --

DR. ZIEMER: At that point, yeah.

But I think Hans is right that that's probably not the best way to use for this type --

MR. RICH: That's not how they're doing it now. You would use a jelly detector, an array of jelly detectors. But at that time we were using sodium iodide and there was stripping techniques that allowed you to do the analysis in the range of permissible body burden range.

DR. ZIEMER: The conversion from mass to activity may be more critical, Hans, in terms of potential errors I would think. Wouldn't you?

MR. RICH: The conversion to mass was only for Thorium-232 because Thorium-228 contributed to ^ mass.

DR. MAURO: Am I hearing that the concern is that you could be off by a factor of two if you don't --

DR. BEHLING: Up to two and a half depending upon if they didn't make some very, very precise corrections that suggest the ratio disequilibrium as opposed to final separation. I mean, if you wanted to be extremely conservative, you would take the Lead-212 data, derive your Thorium-228 value and then multiply that times two and a half to get your Thorium-232. It couldn't get any worse than that.

DR. NETON: I'm not really convinced that they can't do that knowing Actinium-228 and Lead-212 separately.

DR. BEHLING: Well, of course, yes.

DR. NETON: It's like where are you going equilibrium --

DR. BEHLING: You don't know where that is, if they used that data or not.

MR. RICH: See, the only issue -- yes, they did.

DR. NETON: See, that's what I'm thinking, they did.

MR. RICH: And after about '70 or so they no longer recorded in the formal dosimeter files the amount of, they didn't make the milligrams version. They just simply gave the Actinium-228 and the Lead-212, and then the conversion was made at the specific ^.

DR. ZIEMER: And so they actually did determine the ratio. Is that what you're saying? Can we confirm that?

MR. RICH: The only issue is that 212 is a little bit better gamma to make a determination by --

DR. NETON: Yeah.

MR. RICH: -- your sensitivity for 228 is not as good, but that was a check to validate your assumptions ^ the ratio.

DR. NETON: I'm sure the MDA was fairly large. It wasn't small.

DR. ZIEMER: What item are we at?

(Whereupon, multiple speakers spoke simultaneously.)

DR. WADE: Well, you should but we're degenerating.

MR. RICH: And six milligram, and that is ^.

DR. BEHLING: Well, I guess the question I have when we have, let's say, we all start out with the assumption that when a milligram quantity is reported, it's basically a hundred percent, 99.999 percent Thorium-232. And now what do we do when we convert that into the radionuclides? Do we assume that they are in ^ equilibrium? In other words, if from the specific activity of Thorium-232 convert the milligrams that we have available to us as the only documented data, convert that into what is the proven activity for Thorium-232, and now what do we do with regard to Thorium-228? That's the question.

MR. RICH: ^.

DR. NETON: Two-twenty's measured directly almost via Lead-212.

DR. BEHLING: Yeah, but you don't have that data. I'm giving you the data for 1969 for ^.

MR. SHARFI: The earlier ^ report of the total mass.

DR. BEHLING: The total mass. And let me give you the milligram data. What are you going to do with it and --

DR. NETON: We need to look at that conversion factor.

MR. GRIFFON: We can talk about this and speculate for another hour, but --

MR. RICH: Let me just make one statement.

The technology is there, and it’s an accepted technology. And it does require some assumptions which is not unusual for any technology. And it’s just a matter of, it’s not a matter whether we can or we can’t do it. We can do it. It’s a matter of deciding do we need to add some additional, a factor to, for that purpose.

DR. BEHLING: The problem is not so much how did they do it. How are we going to translate milligrams into --

DR. NETON: And it sounds like we’re in agreement that we can do something that would be bounding, correct?

DR. BEHLING: Yeah, I mean the bounding value would be to --

DR. NETON: Maybe this issue is that we should stop here.

DR. BEHLING: The bounding value would assume that the milligram -- here’s a bounding, my approach to a bounding value. Convert the milligram into, from the activity of 232 into activity and assume that two are from ^ equilibrium which means the activity’s twice that.

MR. RICH: We can do it. It's a matter of --

DR. NETON: Is that reasonable given that most of the uranium and thorium at Fernald was more than one year old?

DR. MAURO: This is not an SEC issue.

DR. NETON: No.

DR. BEHLING: But it is an issue that needs to be resolved because you could have ten years of data where the only thing you have is milligrams, and you have to make a decision as to how you apportion that value into Thorium-228.

DR. NETON: That's a site profile issue in my mind, not an SEC issue.

DR. BEHLING: Well, I'm looking at the white paper here, and I'm not sure I'm in agreement with you.

DR. NETON: But you don't think it's --

DR. BEHLING: Well, they use a value of 0.77 as a central value between 0.42 and 1.0.

DR. NETON: Well, whether you agree with that or not is irrelevant. It's an SEC issue or a site profile issue. There you go. Let's move on.

I do think we need to investigate it. I do have some academic interest in this area obviously. I'd like to figure out --

MR. RICH: There are some published reports. It is an Oak Ridge technology that was used at Fernald up until '80-something.

DR. NETON: I'm conflicted here, of course, but I was involved in the reprogramming of that Y-12 counter when I worked at Nuclear Data, and we wrote the algorithm that did the calculation. I just don't remember what was done. And so I would take it upon myself to --

MR. GRIFFON: The only other thing before we dismiss this, I mean, it gets late in the day and we tend to go through items quicker, but -- not that we're going through this one quick, that's for sure. But the question of that particular part of the finding, I think you're right, is a site profile type issue. I think the other part of this whole question of the coworker model for that time period was the representativeness, did we, are we going to still bound, were the right people monitored, that sort of question I think was still on the table. I'm trying to --

DR. NETON: I wasn't trying to --

MR. GRIFFON: Yeah, so that piece of it I agree. But before we dismiss the whole finding number I just want to make sure it's --

DR. MAURO: I have one question, and it was really related to this thick protector issue and the sensitivity issues. Now, could a circumstance arise where you're doing a ^ person and you don't see anything because there's not enough, whether it's Lead-210 or actinium there to give you a signal that's detectable above background. And that's a very weak photon that ^ a lot of activity. What I'm concerned about is that it may be important. If you're in a situation where you can't really see unless you have lots of Lead-210 or actinium, is that taken into consideration when you report what you believe to be the Thorium-232? The fact that, I mean, I'm not --

DR. NETON: There's an MDA calculation.

DR. MAURO: I mean, it goes toward the very --

MR. RICH: During this period of time that we're talking about in the early days, the MDA was quoted as six milligrams, and they reported down to one. So there are values, nothing below one milligram for Thorium-232. But the MDA is recorded as a six.

DR. MAURO: So they took that into consideration.

DR. ZIEMER: Well, there is another factor, and that is that there's attenuation in the body, and you get different ratios of the two energies out depending on the size of the person. But if you calibrate properly, I think they're doing a lung scan, and you can calibrate for that. And if I've got a 250-pound guy, and I look at those ratios and this represents disequilibrium; I got 130-pound guy/gal, then that same ratio represents something very different equilibrium-wise, and you can calibrate for that.

MR. RICH: That was taken into account.

MR. MORRIS: With regard to our question about did we monitor the right people, were the right people monitored. That is clearly addressed in the white paper. There was a memo to all employees at the time when the lung counter was first introduced in 1968, and it explained who was going to be monitored, why they were going to be monitored, and how often they were going to be monitored.

And we also were able to track back through the dataset and find that there was a set of people who were identified as thorium workers, and they were given priority first monitoring. So I think that we can answer that question pretty clearly that the right people were monitored.

MR. GRIFFON: Okay, I haven't looked at that but I just wanted to keep it on the table at least for us to consider. We'll look at that white paper. I would point out in 4.3-4 there's a -- I know nobody's looking at the matrix -- but there's a sentence here that caught my eye. It says, "DOE files of claimants who are known to be thorium workers," I think that's what you're talking about.

MR. MORRIS: Right.

MR. GRIFFON: "Based on their in vivo counting notations will be examined to see if they were given or special bioassays were taken." Did you include the details of that in that white paper? Like you examined some of the --

MR. MORRIS: Well, we were able to find that there was a correlation.

Mark, maybe you can remember that better than I do right now.

MR. GRIFFON: Have you looked at claimants files? I mean, do you have that documented --

MR. ROLFES: I've assembled a compilation from the mobile in vivo data of the individuals who were flagged as thorium workers, former thorium workers or current thorium workers. Interestingly enough, some of those same individuals were listed by name in some of the chronic or daily weighted exposure reports that I passed around. And they were also some of the individuals that were sent offsite prior to the mobile in vivo coming onsite, individuals that had either participated in an offsite lung count at Y-12 or provided thoron breath samples at the University of Rochester or had provided urine samples that were analyzed using neutron activation analysis for thorium determinations.

MR. GRIFFON: Did you tabulate that anywhere in, is it in part of that white paper? Because I've got to admit I'm not, you know. Is it tabulated in any way? I mean this suggests that you would review claimants' files.

MR. ROLFES: Yes, and --

MR. GRIFFON: On a number of or, you know.

MR. ROLFES: It may not be in a consolidated place, but all the supporting references and documents have been provided to the Advisory Board on the O drive I believe.

MR. GRIFFON: The supporting documents, but I mean the conclusion. Is the conclusion anywhere? We reviewed X number of claimants' files and --

MR. ROLFES: There's no white paper separate for that.

MR. GRIFFON: Well, I didn't, okay, but I mean, it was an action on here. I'm just going back to some old things I didn't want to overlook.

DR. MAURO: Is the time-weighted average going back continuing to ’68, ’69, ’70? In other words, remember we talked about doing it pre-’68, we’re going to be basing all the thorium exposures --

MR. RICH: I think it ended about the ‘70s.

DR. MAURO: That’s very interesting in relating, I would predict in using time-weighted average, and I wasn’t going to use the chest count. And then, see, this was a way of validating it.

MR. RICH: We talked about that.

DR. MAURO: We did talk about that, yeah.

MR. RICH: And by the way, a lot of counting was not done near as frequently as urine, but for thorium it’s okay because it stays in the lung a long time. That’s the reason that bioassay urine sampling was so difficult. It simply wasn’t eliminated there.

DR. BEHLING: Yeah, I’m looking at a few datasheets that I have for select individuals and it tracks them. And this particular individual I’m looking at here, he was given a chest count only every other year, ’71, ’72, four, six, eight and ’80 and ’82. So he was given every other year, chest counting.

MR. GRIFFON: I think that's still -- just to get back to the matrix, if you can follow up on that action. It's just an outstanding action. I'm not saying it's a -- it's under 4.3-4. The middle comment appears in red still on your version, Mark, on the bottom paragraph there. And I don't think this was just a way to cross-check whether these people on the list --

MR. ROLFES: You said 4.3.4?

MR. GRIFFON: 4.3-4. Whatever, yeah.

DR. BEHLING: What happens to people who might have been exposed but for whom there's no, some how or other they worked there for a period of time but the mobile lab just left? They start to work. They quit their job before the next go around --

MR. GRIFFON: That's where the coworker model comes into play. As long as we can determine the highest exposed were monitored, it's a site profile issue.

MR. ROLFES: And there were employees that were brought back to the site for follow-up counting as well.

MR. GRIFFON: So that's the only action item

I have remaining if we can just follow up on that.

MR. CLAWSON: There's a few other action items. We started to lose --

MR. GRIFFON: I mean on that issue.

MR. CLAWSON: On that issue. We've lost several members, but I'd like to review, Mark sent out a paper for us, but I'd like to tell NIOSH how much I appreciate, we've got an awful lot of information on the O drive, and I have been trying to go through a lot of it and so forth like that, but there's a lot there. But I just want to make sure that we have covered a lot of these.

In 4.3.1, NIOSH will provide a white paper detailing approach for thorium, which I believe that we have covered pretty good. I want to make sure that's covered.

SC&A will develop an outline of a sample plan to SS personnel dosimetry data composition and regard to internal dosimetry, and this is a post-1968.

MR. GRIFFON: This is the data integrity and completeness question. And we asked SC&A -- if you remember from the last meeting -- to come back with us with a sampling approach. You know, there was, as there always is, a question of, you know, how much is enough. So before we just task them with doing that, we said give us a sampling plan first on how you're going to do that. That kind of got lost in the fray, I think it's fair to say. I didn't update the matrix until like last week, so --

DR. MAURO: Well, it might have been this conversation where now we have a much better understanding of the data you're using and how you're using it such as the chest count and the time-weighted average air sampling because this is all related now to thorium. Now, given that, and we've covered a lot of territory here, is there anything about that sampling plan that changes or --

MR. GRIFFON: I think it's still, I mean, think we might want to discuss some of the defining parameters like we did in the --

And you may have talked to others already, Mark, but I, maybe refresh my memory. How often do we use the coworker models? I mean, I think it's fair to say external dose, there’s no coworker model being considered, right? They all have their own dosimetry data that will be relied upon. But then on the internal dose side you have basically two different thorium models, right? Post-’68 and Pre-’68. And then you have the potential of using a uranium coworker model.

But my sense is that most people have enough of their own uranium data. So then, I mean, the path we went down, this is part of the Board’s procedures. The path we went down is just to make, to assure that we say that people have a lot of uranium data. Well, if, you know, where we ended up at Rocky Flats is if you had data, especially toward the end of your tenure there, then certainly you can use personal data in your file.

If it turns out that we review on data completeness and find out that actually it’s pretty -- I don’t have any reason to believe this -- but if it’s spotty, in other words some people had some urine samples, but then they went ten years, and then they left. If it happens a lot and we see that, then we may say we better, we have to pay more attention on this coworker model because it’s going to be applied more often. So I guess that’s in the context that I bring this in. From the external standpoint we haven’t cross-checked any data from the external side I don’t believe, and I don’t know if we can quite frankly. I don’t if we have any TLD like raw data to examine versus HIS-20.

MR. ROLFES: We didn’t go and pursue that. We hadn’t been asked to.

MR. GRIFFON: Well, that’s kind of the context this is brought up in.

DR. MAURO: With regard to internal, if in fact, we’re going to be preparing this time-weighted average, a number of daily time-weighted average, you have by category by year. Then we talked about that sample ^ in effect --

MR. GRIFFON: By plant by year.

DR. MAURO: Yeah, by plant by year. In effect, you’re going to do that. In other words you’re going to pull out --

MR. GRIFFON: That’s for one. That’s pre-’68 thorium.

DR. MAURO: That’s all I’m talking about.

Yeah, I'm trying to just get my mind around what's needed here. Now once that --

MR. GRIFFON: When we say data completeness for pre-'68 thorium, I can tell you, I'll do your job. There's no data.

DR. MAURO: There was some air sampling data, but you do --

MR. GRIFFON: There are some, right. But you're probably not going to use that. Anyway, that's why we defined it as uranium post-'68 thorium.

DR. MAURO: Okay, I didn't understand.

MR. GRIFFON: And then external, so we have, I have to merge, I updated a matrix, but so did Mark, and now I'm doing my edits on yours, but I'll make sure all those, the ones that Brad's reading now get included. But that's one that got overlooked. And I think, I mean, Arjun was at the last meeting when we were discussing this, and I think the --

DR. MAKHIJANI: Could I say something? Mark, could I say something about this? Sorry, I didn't pick up the whole conversation because a lot of the voices are quite faint. But regarding the uranium piece, there are two different issues that I think need to be addressed in setting up the completeness check.

One is how many people were monitored in different periods. And the second would be of the people who do have some bioassay data, how complete or incomplete is that data. How spotty is it or is it pretty regular? Is it once in six months and so on? Because my impression from looking at some of the records is that it's quite variable. Some people have lots and lots of data, and some people have quite spotty data, and it probably is time dependent.

MR. GRIFFON: And/or job dependent. It could be job dependent.

DR. MAKHIJANI: And job dependent, yes, both period and job dependent. I agree.

MR. GRIFFON: So I'm not asking you to propose any kind of plan now, Arjun, but that's good points. Maybe you can come back and SC&A can work on that sample strategy, and we should, you know, before you go anywhere with it, I think we want to run it by the work group. That's what we all committed to.

DR. MAKHIJANI: Yes, I remember the same as you. I think, you know, I guess a number of things were put on hold. I have not been working on this, but I think that we did say that we would at some point go to Harry, our statistician, and ask him to come up with a sampling plan on these various categories so that we would have an adequate sample for the various period job categories radionuclides that we were looking at.

MR. GRIFFON: That’s fine.

MR. CLAWSON: Okay, we’ve got another item here, and I believe this has been taken care of. NIOSH to outline approach to address an ingestion dose for thorium exposure white paper. Now, the reason I’m running through this, make sure we covered it. Because we kind of, we kind of jumped all kind of around.

MR. GRIFFON: That’s 4.3-9. I mean, that was, we talked about the thorium model. We didn’t specifically talk about ingestion, but it was --

DR. NETON: It was in Mark’s presentation.

MR. GRIFFON: Yeah, yeah, oh, okay.

DR. NETON: TIB-0009.

MR. GRIFFON: We have some follow-up actions on that anyway so I think we're okay with that.

MR. CLAWSON: And that was done on a white paper, and I believe we got the follow up on that.

NIOSH to, conducted interviews with former industrial hygienists and will post them on the O drive. Did they make it on there, the interviews with the --

MR. ROLFES: Yes, all the interviews that NIOSH has conducted have been placed on the O drive for the Advisory Board's review. There's an interview folder.

MR. CLAWSON: Yeah, I just went in, and I tried finding it earlier.

MR. GRIFFON: I mean, just to put that one in context, I think to go back -- what finding number was it?

MR. CLAWSON: 4.3-10.

MR. GRIFFON: I mean, I think it is worth mentioning. This came because of the air sampling, right? The concerns that one industrial hygienist raised about his memory of air sampling. I'm looking at 4.3-10, yeah, the number two, I think, on previous actions.

And I mean, I noted that you said your response, Mark, was that some of the DWE reports cited in the white paper were authored by the IH in question. And I put below it, so. I mean, I don't know, yeah, he authored some of those. I'm not sure that answers the root finding, you know, the root concern.

And Hans, step in here, we're just, we're on 4.3-10, this air sampling and industrial hygienist.

DR. BEHLING: Oh, yeah, yeah, I guess we still have some concerns about his accusations about falsifying air monitoring data. And I think it was stated that given the fact that he was a hygienist and he had years of experience, and even with Larry's testimony that he was a respectable person, one has to question to what extent his accusations may have wider implications about the quality of air monitoring data.

MR. GRIFFON: And the other thing is this response, if he authored some of these DWE reports, and we seem to be willing to accept those and model those as a coworker model, on one hand you're accepting his data as credible, and on the other hand his statements are being refuted.

MR. ROLFES: The individual wasn't asked to falsify data, but it was his impression that he was being asked to falsify data. He had indicated that he had collected seven samples because his supervisor didn't approve of the high air sample results. He wanted him to re-sample because it was a high sample result. He said go back and sample again, go back and sample again.

There was no indication that those data were destroyed. So we don't have any indication other than this individual's affidavit. That was just an interpretation of the affidavit. I don't see any indication that those data were destroyed and don't exist.

MR. GRIFFON: Well, implicit in his affidavit, I think, was that it was a concern, right? I mean, otherwise he wouldn't have written that kind of statement.

MR. CLAWSON: I believe the concern come back that he was told to go back and re-sample and re-sample until it was below the limit.

MR. GRIFFON: That may not be in --

MR. ROLFES: We can go back to the affidavit and look at it again. But ultimately, we're not going to be any further along than what we have already come to. I mean, we've been discussing this, this issue has been presented to the Advisory Board since a year ago, since February. And we presented what we found.

MR. GRIFFON: And I think, so there was an attempt to recover this IH's logbooks. Have there been any progress in any of that?

MR. ROLFES: We do certainly have some of his air sampling data. That is available, and I think we referred to at the last Advisory Board working group meeting. We did indicate that we had posted some of his air monitoring data --

MR. GRIFFON: I'm sorry. Some of this is, it's just that I don't remember.

MR. ROLFES: No problem. I just want to make sure --

MR. GRIFFON: So you have some of the logbook data. And did you crosswalk that in any way to see if the, I don't know where that air sampling data would be in terms of in, you said there’s no indication that it wasn’t recorded. Where would it have been recorded?

MR. ROLFES: It would have been recorded on an air sampling datasheet, on an air monitoring sheet. And we have air monitoring datasheets.

MR. GRIFFON: You have a spreadsheet with air monitoring data?

MR. ROLFES: We have lots of air monitoring data. We did not pull out the individuals’ air sampling data specifically. There’s multiple results. I don’t believe we were asked to go and recover all of his air sampling data specifically and pull that out. But we did post some sampling for his or some of the samples that he had collected we did post onto the O drive.

MR. GRIFFON: Yeah, I think that’s all we asked was the logbook stuff first. I’m just asking follow up.

DR. BEHLING: The implication, however, is that this may be one person who stepped forward and was a whistle blower. To what extent were there other people who did something very similar for whom we have no documentation, that they may have cooked the books a bit here in their air sampling methods. The issue is not necessarily looking at logbooks; the question is to what extent was this a prevalent practice that affected not only this individual but others as well over periods of time.

And I think we talked about some of the issues. Obviously, when I look at some of the documents, they did routine air monitoring data and then realized that they were either faced with shutting down the system at a time when they couldn't afford to do so.

And they contracted engineering people to look at modifications of the plant, very costly, and of course, in this case you can speculate -- I'm not saying I know -- but you can speculate that maybe he was asked to look at a facility that had been subject to significant modification, engineering modification, to see what impacts those modifications may have made.

And the people there said, oh my God, this didn't do anything. And now you go back and get the sample we're looking for so as to not get in trouble with the boss because we blew large sums of money.

I mean, it's one of those situations where you don't know what the driving force was behind this individual's claim that he was asked to go back many times or several times in order to get a lower value that would now support a boss in saying, well, the modification worked. I think it's just all speculation.

MR. ROLFES: Correct. It is all speculation and that's really all we have at the moment.

MR. FAUST (by Telephone): This is Leo again. Let's not forget that good health protection practice, if you got a high air sample, you probably will go back and re-sample just because it's high to verify it. And that's common practice.

DR. BEHLING: Well, if you read the affidavit you'll come to a different conclusion. I don't think he was referring to multiple samples to get a better statistic.

MR. CLAWSON: So we have put these interviews though on the O drive, correct?

DR. NETON: Correct.

MR. GRIFFON: The question I have, and this is really a refresher, but the air sampling in question here, is this air sampling data being used in any way for dose reconstruction?

MR. ROLFES: The uranium intakes --

MR. GRIFFON: Is it uranium air sampling that he was doing?

MR. ROLFES: That's correct. He was in Plant 5 is where the supposed data was collected. And for Plant 5 everything would be based on uranium, or excuse me, on uranium urinalyses and uranium intakes would be based on.

DR. MAURO: Oh, so this doesn't go toward thorium daily weighted average.

MR. GRIFFON: I mean, it doesn't take away from the concern about --

DR. BEHLING: No, but this is more a generic problem. If the issue involved uranium air monitoring then they're the same problem.

MR. GRIFFON: Could it also --

DR. BEHLING: Could it also translate into thorium air monitoring? It's a broader issue.

MR. CLAWSON: So we're kind of still ongoing on that to a point.

MR. GRIFFON: But I'm not sure there's any way to track the question of, you know, you said we had no indication that these were not recorded, and I don't know if there's any way to check that. I mean, you said we don't have any indication, but is there any way to crosswalk that. You found logbooks, I mean, you have logbooks from this time period in question?

MR. ROLFES: The individual was one of the individuals that took air samplings. We have air sampling data from him. Ultimately, I don't know how far it would get us along to compare any intakes derived from air monitoring data versus intakes based on urinalysis data.

MR. GRIFFON: No, no, no. That's not the point. I mean, you're dismissing the claim, the claim that he's making, you're dismissing it. But if we can look, and we see it. In fact, he was asked to go back seven times and you know this seventh one was recorded from his logbook into --

MR. ROLFES: I don't think there's enough data. I don't think he elaborated enough on what operation he was sampling and time period --

MR. GRIFFON: So we couldn't, that's my question.

MR. ROLFES: -- we'd be guessing -- I don't know -- a 40-year time period roughly as to where he had collected the samples.

MR. GRIFFON: Is the individual still available for --

MR. ROLFES: No, he's unfortunately unavailable to obtain any further information from.

MR. CLAWSON: Have we come to a conclusion on that or --

MR. CHEW: The industrial hygienist?

MR. ROLFES: Correct.

MR. CHEW: Just that thing about it's not systemic or not?

MR. ROLFES: That's correct. We did discuss this issue, and it's documented in our interviews with other industrial hygienists to see if this was, in fact, a systemic issue or if it was a widespread issue. And they had no knowledge that it ever was. They certainly --

and it's documented in our interview notes that the purpose of industrial hygiene, the purpose of the air sampling program was to find the highest air concentrations to which an individual --

MR. GRIFFON: Yeah, I understand, but you've also, I mean, you've just strengthened the affidavit in my opinion. You note that he's an author of these DWE reports. It wasn't just someone that showed up at Fernald for a few years and then was disgruntled and had, so for him to make these statements I think that, to me we have to at least try. Maybe we can't track it, but try.

DR. NETON: ^ interviewing the other hygienists or not and getting a feeling if it's pervasive. But it certainly looks ^ that issue. I don't know what else you can do.

MR. GRIFFON: Yeah, I know.

DR. NETON: You do what you can do here.

MR. GRIFFON: I think at this point there's no action on it. I'd like to look at some of the logbook data, and you posted it already.

MR. ROLFES: There's plenty of air sampling data to review.

MR. CLAWSON: Okay, we've got two more items to try to get through real quick. Number five is, and this is part of 4.4-2. NIOSH will post a model on underlying assumptions on the O drive. SC&A will review the model along with the underlying assumptions. And my understanding on 4.2, this comes back to the thorium in vivo model.

MR. GRIFFON: Which we just discussed.

MR. CLAWSON: Which we've just discussed. And we've got that so that's completed.

Okay, and then item six which is 4.5-1. NIOSH will attempt to identify procedures the quality assurance reports from the early time periods, 1953 to 1985 and make them available on the O drive. This goes to Finding 4.5-1, the Parker Report dated 1945 to give NIOSH the follow up. The Parker Report shows that three dosimeters performed were very well in measurements and exposure to. This is your follow up on it. That's page 21.

MR. ROLFES: Oh, I'm sorry. Are you waiting for me?

MR. CLAWSON: Well, I was just reading the response. NIOSH will attempt to identify these procedures. Have they been posted onto the O drive? It says in your response here, the Parker Report, SRD-433, shows that the three dosimeters performed very well in the measurements of exposure to uranium. The OR dosimeters were used for Fernald for several years and modified. Modifications were made to them.

MR. ROLFES: Leo Faust I believe is on the phone, and could you repeat? It was 4.5-1.

MR. CLAWSON: Dash-two, dash-one. I'm sorry. It's the bottom of page 21.

MR. ROLFES: I was looking through and every time I touched my keyboard the wrong way, it jumps back up to the top of the matrix. So just trying to --

Leo?

MR. FAUST (by Telephone): Yes.

MR. ROLFES: We're on 4.5-1, and this was in regards to the Parker Report. I think the question was, was the Parker Report provided? Is that the question? Was the Parker Report provided?

MR. CLAWSON: Well, it says NIOSH will attempt to identify procedures in quality assurance, reports from the early time period, 1953 to ’85, and make them available on the O drive. And the response back that I got was you’d posted the Parker Report to dosimetry.

MR. FAUST (by Telephone): Yeah, this report, what they did was they took the three different laboratories’ dosimeters and exposed them in a round robin, so to speak, and compared the results. The results all were recorded as very favorable, and that dosimeter was the one that was used at the Oak Ridge dosimeter, was the one that was used at Fernald for up until the early ‘80s. And, of course, it had been modified from time to time, but the workings of it were basically the same. There were other inter-comparisons done, but as far as I know, they weren’t reported per se.

MR. CLAWSON: So was this posted onto the O drive?

MR. FAUST (by Telephone): The report is on the O drive, yes.

MR. CLAWSON: Do you know what it’s listed under?

MR. ROLFES: It’s site research database

433. I'm sorry. We had two different, I was looking at two different versions of the matrix, I guess, and I had a little bit of difference.

MR. FAUST (by Telephone): It's 433.

MR. CHEW: It's in the matrix I sent you, Brad.

DR. BEHLING: Now you have to really go back to the findings. Sometimes I think we lose track of what the findings try to say. If you go back to my finding which was identified on page 112 under 4.5-1, I cite certain things that come out of the report, that I quote directly from the report that says, "There were no procedures available for the processing evaluation of personal dosimeters for these various periods of time."

Also, there was the issue of a person who was in charge of this program who had no formal training, no formal qualification and so forth and so forth. And that fact that you tested a dosimeter under controlled conditions in a round robin has very little to do with the questions that are raised under Finding 4.5-1.

MR. FAUST (by Telephone): That's not correct, Arjun.

DR. BEHLING: No, it's Hans.

MR. GRIFFON: Hello?

MR. FAUST (by Telephone): Yes?

DR. BEHLING: Yeah, I'm quoting for instance in my write up on that particular finding, I'm quoting from a report, and I've done this routinely here. I'm not making these things up. These are not opinions. But in one of the progress reports, a health physics report, it states that, quote, "Test dosimeters are not routinely processed; however, five to ten gamma of six or 11 beta and gamma calibrations films were processed" --

Okay, that's not the issue that I wanted to talk about, but the qualification and the failure to provide quality assurance. Again, I'm scanning through my own write up. But I had really tried to get in this particular finding was the limited qualification of the people in charge of the program, the limited quality assurance and programs that were in place to make sure that the instruments were calibrated properly, et cetera, et cetera.

And as I said, you have to read through the attachment that I quote from that raises the issue about the quality of personal dosimetry. And it has nothing to do with the dosimeter itself. I'm not questioning that. There are statements here about people leaving their film in the car and it heated up and the dashboard and those kinds of things. And as I said they have very little to do with what you're talking about here about a round robin test.

MR. FAUST (by Telephone): But there are several reports from the inspections that were done by the Oak Ridge Operations Office personnel. And their results or their appraisal write ups all indicate that the external dosimetry program was more than adequate.

MR. GRIFFON: Do you have, I mean, have those been provided to us, these several reports you mentioned?

MR. FAUST (by Telephone): They're there. Just one of them that I'm familiar with is the one that relates to the 1983 inspection and the answers back to it as the corrections that the Fernald people performed. And I do know that there is another similar, earlier one, or two actually. One's dated for 1961, and I believe the other one is that I'm aware of is 1963. And those numbers are on the SRDB. Mark probably has that actual number.

DR. BEHLING: Let me just briefly --

MR. FAUST (by Telephone): I'm not at home right now. I'm sitting in Las Vegas so I'm kind of at a loss for --

DR. BEHLING: This reference was made as a snapshot, but I'm quoting directly from a September 11, 1981, in response to dosimetry assessment fact sheet, and these are the statements of --

MR. FAUST (by Telephone): I understand. I know what you're talking about. That was a fact sheet that was filled out one afternoon by someone that really wasn't involved with the whole program.

MR. GRIFFON: Well, I think one thing that's helpful is, because if I remember right, one of our questions was looking at some of the quality assurance and/or procedures from the time periods in question, and I think one of the earlier items we had was only a real recent report. And this sounds like you have at least something from the ’61, ’63. Maybe you should try to find these and look at them and see, you know. Maybe they don’t get back to the root finding, but at least that’s a pathway --

DR. BEHLING: Well, this was a statement that caught my attention, statement number five. There were no specific training requirements for the film badge technician when this program began in 1951. The technician received on-the-job training. The technician has now --

MR. FAUST (by Telephone): I have to -- the early days, the whole external dosimetry program was actually administered by the HASL Laboratory for the first 18, at least the first 18 months of operation. And we have obtained on an O drive a complete set of their laboratory procedures including the calibration and evaluation of the film badges. Now that is on the O drive.

DR. BEHLING: Well, maybe we should strike this particular evaluation or fact sheet because he states here no procedures available for the processing-slash-evaluation of personal dosimeters. And he talks about this technician, the same technician has done this work since 1951 through the present time in 1981 who has no official training, et cetera, et cetera.

So we're not talking about a snapshot, but this particular document seems to imply that this has been a long-term issue. I'm not sure if this is an error here on somebody's part in filling out the fact sheet or what it is. But I identified it as a finding.

MR. FAUST (by Telephone): Now the health protection reviews that I was talking about, the 1961 has got a number on it of 1-1-1-8 which I think is some kind of a legal review. The one for 1963 is 1-1-2-1. The one for 1964 is 1-1-2-2.

MR. ROLFES: Leo, I believe you're referring to some of the plaintiff's exhibit files.

MR. FAUST (by Telephone): Right, yeah.

MR. CLAWSON: I don't see any of these on the O drive.

MR. FAUST (by Telephone): They're all part of one large package, Mark.

MR. ROLFES: Yeah, okay. Once again, we can copy everything that we have on the site research database to put it onto the O drive if that's what you would like to do. I mean, we're certainly it's going to complicate your ability to find a document. And, you know, the timeliness --

MS. BALDRIDGE: I have the cross-reference. If he tells me the documents, I can tell you what petition page it's on.

MR. ROLFES: It is, the document number's the plaintiff's exhibit files were 1-1-1-8 and 1-1-2-2.

DR. MAKHIJANI: This is Arjun. Could I make a request regarding site research database documents being posted on the O drive? It's a suggestion I don't know that others may or may not like. I find it hard to know what the document is if it just has the site research database document number. And when there are like 50 documents, it's very difficult to know without going through every one of them and find what you're looking for.

MR. FAUST (by Telephone): Correct. I agree.

DR. MAKHIJANI: And it would be helpful if the SRDB title were also copied into the O drive and then the research becomes much faster and more efficient.

MR. ROLFES: But still you need to open up every document in order to determine what the contents of that document are.

DR. MAKHIJANI: No, if the title could be posted next to the number on the O drive, it's very helpful.

MR. ROLFES: The way the files are named typically in our site research database their named with the reference ID number followed by the title of the document.

DR. MAKHIJANI: Right. And in the O drive the title of the document is not given usually, and it's quite hampering.

MR. ROLFES: Okay, there may have been some documents that were posted on there because as soon as we got them, we wanted to make them available to the Advisory Board. So there could have been an initial data capture series of documents that were put in an expeditious manner onto the O drive for your review. We can go back and remove those and replace those with the appropriate reference ID format followed by the title of the document.

DR. MAKHIJANI: Oh, thank you so much, Mark. That would make life very easy.

MR. CLAWSON: I guess once we get this information I'd like SC&A to be able to bring closure to this one for them, review.

MR. GRIFFON: And I think it is worth SC&A at least looking at those reports and seeing if that's in any way helpful to resolving the finding. I guess that's the, you know.

MR. CLAWSON: That completes this paper. I don't think by any means this does everything but... So now, do we have any questions with what everybody has been tasked to do? Do we need to run through that?

MR. GRIFFON: I'm not in a real good position to do that. But I mean, I have been taking notes real time so I should be able to get an updated matrix out fairly quickly, like early next week is fairly quickly I think because I have to merge the one I developed and this one.

DR. WADE: More than reasonable.

MR. GRIFFON: Then you'll have in that last column that you created, Mark, I added, and what I might, I'll probably just keep it in track changes mode so people can see the new stuff, right.

DR. WADE: Shall we get that from Mark? If you have any questions concerning the assignments, check with what Mark has. If that doesn't work, then give Brad a call.

MR. ROLFES: I think it would be a good idea for the Advisory Board working group to send what they specifically would like so that we're on the same page. That way we'll have any outstanding issues that we need to address documented so that we can address them fully. I know we've been re-discussing some of these issues over and over, and we've just been going in circles.

And I would like to move forward on these issues. I would like to resolve them rather than continue to discuss what has been done. I mean, a lot of what we're covering, you know, we need to provide updates on things, but much of what we've been discussing is just rehashing what's on the matrix and what has and hasn't been done.

And I feel that we have addressed what the Advisory Board working group has asked us to address. If there are some things that we haven't fully addressed, we'll be happy to go back and look into those, but I want to make sure that we do have a well-defined series of action items that are outstanding.

MR. GRIFFON: Yes. I mean, I think there's a couple large ones.

MR. CLAWSON: I'll follow up with that, and I'll correlate with SC&A and NIOSH and the rest of the Advisory Board for the Fernald group and make sure that we're all on the same page in where we're going if that's all right.

Okay, I think we're ready to adjourn.

DR. WADE: You ready to be done?

MR. CLAWSON: Yeah.

DR. WADE: Okay, well, we're done. I think we've reached a point of diminishing returns, certainly. Those of you on the line we wish you well in how you spend the rest of your day. Thank you for spending the time with us, and we should do this again real soon some time.

(Whereupon, the work group meeting adjourned at 4:45 p.m.)

CERTIFICATE 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 March 26, 2008; 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 30th day of December, 2008.

____

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