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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 Cincinnati, Ohio on November
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*STEVEN RAY GREEN AND ASSOCIATES
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-- "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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P R O C E E D I N G S

(9:00 a.m.)

1

2

WELCOME AND OPENING COMMENTSDR. LEWIS WADE, DFO

3

DR. WADE: Can you hear me out there? Is Mark Griffon with us?

4

5

MR. GRIFFON (by Telephone): Yeah, Lew, I'm here.

6

7

DR. WADE: And Robert Presley?

8

MR. PRESLEY (by Telephone): I'm here, Lew.

9

10

DR. WADE: Let's begin. This is the work group on the Fernald site profile and SEC petition. It's ably chaired by Brad Clawson, members: Griffon, Ziemer, Presley and Schofield. Clawson, Ziemer and Schofield are here in the room, and Griffon and Presley are on the telephone. So let's begin.

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Again, this is Lew Wade. I have the privilege of serving as the Designated Federal Official for the Advisory Board. Before we do our normal introductions and have our little talk about telephone etiquette, I'll remind everyone that we are talking from a matrix that hasn't been necessarily scrubbed for

1 Privacy Act information. So we should talk;
2 we should be guarded in our comments when we
3 come to the potential of sharing personal
4 identifiers. But I think everyone around the
5 table is well schooled in that etiquette.

6 We'll begin by going around the table
7 here for three purposes, introduction, if you
8 have any conflicts, please so state, we'll
9 also give people on the phone a chance to
10 establish they can hear everyone around the
11 table. So if during an introduction someone
12 out there in telephone land has difficulty
13 hearing, just shout out, and we'll make the
14 necessary adjustments either in volume or in
15 positioning of equipment.

16 This is Lew Wade, and I have the
17 privilege of the Advisory Board, and I work
18 for NIOSH.

19 **MS. HOWELL:** This is Emily Howell with HHS.

20 **DR. ZIEMER:** This is Paul Ziemer, member of
21 the work group and no conflicts at Fernald.

22 **DR. MAKHIJANI:** Arjun Makhijani, SC&A and
23 CDS -- CBCS said I have a conflict at Fernald.

24 **MR. SCHOFIELD:** Phillip Schofield, a Board
25 member and no conflicts.

1 **MR. ROLFES:** Mark Rolfes, NIOSH, Health
2 Physicist, no conflicts.

3 **MR. CHEW:** Mel Chew from the O-R-A-U team,
4 no conflict.

5 **MR. RICH:** Bryce Rich from the O-R-A-U team,
6 no conflicts.

7 **MR. MORRIS:** Robert Morris, O-R-A-U team, no
8 conflict.

9 **MR. CLAWSON:** Brad Clawson, work group
10 chair, no conflict.

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

13 **MS. BALDRIDGE:** Sandra Baldrige,
14 petitioner.

15 **MR. BEATTY:** Ray Beatty, former Fernald
16 worker.

17 **MS. KENT:** Karen Kent, O-R-A-U, no
18 conflicts.

19 **MR. HINNEFELD:** Stu Hinnefeld from
20 NIOSH/OCAS, and I am conflicted having worked
21 in management and salaried positions in
22 Radiation Safety and Health and Safety
23 departments at Fernald.

24 **MS. HOFF:** Jennifer Hoff, ORAU team, no
25 conflicts.

1 **MR. LEWIS:** Mark Lewis, ATL International
2 Outreach Specialist, no conflicts.

3 **DR. WADE:** Okay, let's go out to the
4 telephone and start with members of the NIOSH
5 and ORAU team. Please identify yourselves.

6 **MR. FAUST (by Telephone):** Leo Faust, ORAU
7 team, no conflict.

8 **MR. POTTER (by Telephone):** Gene Potter,
9 ORAU team, no conflict.

10 **MS. BRACKETT (by Telephone):** Liz Brackett,
11 ORAU team, no conflicts.

12 **DR. WADE:** Other NIOSH/ORAU team members?

13 **MS. CHANG (by Telephone):** Chia-Chia Chang,
14 NIOSH Director's Office, no conflicts.

15 **DR. WADE:** SC&A team?

16 **MS. BEHLING (by Telephone):** Kathy Behling,
17 SC&A, no conflict.

18 **DR. WADE:** Any other SC&A team members out
19 on the phone?

20 (no response)

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

23 **MR. WOOLS (ph):** Jessie Wools, Senator
24 Voinovich's office.

25 **DR. WADE:** Welcome.

1 **MR. KOTSCH (by Telephone):** Jeff Kotsch,
2 Department of Labor.

3 **DR. WADE:** Welcome, Jeff, as always.

4 **MS. HOMOKI-TITUS (by Telephone):** Liz
5 Homoki-Titus, HHS.

6 **DR. WADE:** Good morning, Liz.

7 Other feds working on this call?

8 (no response)

9 **DR. WADE:** Are there any other
10 representatives of members of Congress on the
11 call?

12 (no response)

13 **DR. WADE:** Workers, petitioners, their
14 representatives?

15 (no response)

16 **DR. WADE:** Is there anyone else on the call
17 who would like to be identified?

18 (no response)

19 **DR. WADE:** Okay, just a little bit about
20 phone etiquette. We were doing real well, but
21 we slipped on a call recently. So please
22 again, mute if you're not actively engaged in
23 a discussion. If you are engaged in a
24 discussion, try and use the hand set if at all
25 possible. It cuts down on background noise.

1 And be very mindful of your environment and
2 what happens if you put a call on hold. We
3 were inundated with background music the last
4 time.

5 And please be aware of the fact that
6 what might be commonplace noise to you can be
7 very disruptive to the work group in trying to
8 do its business. I think it's good that we
9 open these calls up to any and all and give
10 them telephone access, but please ensure that
11 we can continue to do that by exercising due
12 caution in terms of how you monitor the
13 environment around you.

14 Let me ask if there are any other
15 Board members on the call aside from Mark and
16 Robert Presley.

17 (no response)

18 **DR. WADE:** Okay, we don't have a quorum of
19 the Board, and that's appropriate for us to
20 conduct the business of the work group.

21 I guess, Brad, it's yours.

22 **INTRODUCTION BY CHAIR**

23 **DR. MAURO (by Telephone):** Brad, this is
24 John Mauro. I just joined you late. I'm
25 sorry for being a few minutes late, but I just

1 want to let you know I'm on the line also.

2 **MR. CLAWSON:** Thank you, John, we appreciate
3 that.

4 At the last meeting I believe that we
5 finished up with 4.3, at 4.3. So we're going
6 to start off in the matrix at 4.3-1, and I'll
7 turn it over to Hans.

8 **FINDING 4.3-1**

9 **DR. BEHLING:** Let me ask Mark, since you're
10 on the phone, if you had anything that you
11 wanted to discuss prior to starting with 4.3.
12 I know we've indicated on a couple issues, and
13 I just wanted to be sure before we start
14 whether or not you had some outstanding
15 issues, action items that you wanted to
16 discuss prior to starting at 4.3, Mark.

17 (no response)

18 **DR. BEHLING:** Mark Griffon, are you on the
19 phone?

20 (no response)

21 **DR. WADE:** Might be muted.

22 **DR. BEHLING:** Hello?

23 (no response)

24 **DR. BEHLING:** Well, okay, let me just
25 perhaps speak in his behalf. I think last

1 time we talked about something that involved
2 the very last finding, 4.2-3, which involved
3 the radon release model for the K-65 silos.
4 And I'm not sure whether or not we had asked
5 NIOSH to revisit that issue looking at
6 basically the disequilibrium between Radium-
7 226 and the two daughter products and perhaps
8 come up with a revised estimate about annual
9 releases. And I'm not sure whether you've had
10 a chance to look at that at this point.

11 **MR. GRIFFON (by Telephone):** Hey, Hans, this
12 is Mark Griffon. I'm sorry. I went to pick
13 up the handset and lost the call accidentally.
14 You were asking me something.

15 **DR. BEHLING:** You and I had discussed a
16 couple items in preparation for this meeting,
17 and I wasn't sure whether you wanted to
18 perhaps discuss some of those, a couple of
19 those items before we get started at 4.3
20 because that's --

21 **MR. GRIFFON (by Telephone):** Well, my, I
22 mentioned it to Brad, I talked to Brad earlier
23 this morning, and my sense was why don't we go
24 through the rest of the matrix and get through
25 it one time, and then maybe come back if we

1 exposures to individuals rather than a default
2 1,050 MAC hours. So our approach that we will
3 be using now for the early time period will be
4 based on air monitoring data associated with
5 the processes. And in the more recent time
6 periods the mobile in vivo results will be
7 used as well.

8 **DR. BEHLING:** And when will that revision,
9 or in what form will that revision take place,
10 that will be part of a revised TBD?

11 **MR. ROLFES:** I believe we can separate that
12 out in a white paper. I believe that's what
13 we've agreed to do. So we will --

14 **MR. RICH:** The TBD is in revision now.

15 **MR. ROLFES:** The TBD is, in fact, in
16 revision as well as we speak. So I believe we
17 had agreed to pull the thorium portion out as
18 a white paper for the Advisory Board members.

19 **DR. MAKHIJANI:** Can you describe the
20 conceptual approach at least that you're
21 taking? How are you taking into account the
22 high episodic air concentrations of thorium
23 like half a gram per cubic meter that has been
24 documented?

25 **MR. ROLFES:** Well, we have because we do

1 have data for that. We will be giving credit
2 to those high airborne concentrations. We
3 have a distribution of thorium air
4 concentrations for the early time period. I
5 believe, is it about 3,000 air monitoring
6 results that we have for the early time
7 period. And so we have quite a bit of data
8 that we feel is going to provide a good
9 distribution of the air concentrations to
10 which people were exposed.

11 Now, furthermore, when we do have
12 these higher concentrations, we are not
13 assuming any credit for respiratory
14 protection. We are not reducing air
15 concentrations based on particle size
16 distributions because many of the particles
17 which were airborne were not respirable size.
18 And plus, we are also assigning a 2,000 hour
19 per year exposure to thorium for an entire
20 year as a chronic exposure. So we feel that
21 what we are doing is certainly very claimant
22 favorable and will be a bounding analysis of a
23 person's exposures to thorium.

24 **DR. MAKHIJANI:** I guess I didn't address my
25 question well. How does a distribution of

1 3,000 air samples take care of an episodic
2 exposure to an individual?

3 **MR. ROLFES:** Well, we could look at that
4 specific air sample, but we wouldn't assume
5 that that person was exposed to that high air
6 concentration for 2,000 hours per year.

7 **DR. MAKHIJANI:** Yeah, no, no. That's
8 exactly the problem that I'm talking about.
9 The distribution doesn't take care of that,
10 and we don't know the names of the individuals
11 who were involved. We should just wait for
12 the --

13 **DR. BEHLING:** I think that's going to come
14 up in the next finding essentially because it
15 does raise questions that you are addressing
16 here.

17 **DR. MAKHIJANI:** Okay.

18 **DR. ZIEMER:** One other question, this is
19 Ziemer. What years are covered by this set of
20 samples?

21 **MR. ROLFES:** This would be from, I believe,
22 beginning in 1953 through -- well, for the air
23 monitoring data? Is that what you're
24 referring to specifically?

25 **DR. ZIEMER:** Well, this thorium data that

1 you're talking about.

2 **MR. ROLFES:** The thorium air monitoring
3 data, the majority of it is in the early time
4 period because that's what we had focused on
5 because that was prior to the time period
6 where we had the mobile in vivo radiation
7 monitoring lab results in '68. So we focused
8 our initial data gathering on the time period
9 from, I believe, '53 through '68. And we are
10 revisiting those records to make sure that
11 we've captured all the thorium air monitoring
12 data that we can. We are also looking for the
13 more recent time period as well.

14 **MR. CLAWSON:** Well, this thorium data that
15 you've got, this is Brad, is this general area
16 or is this personnel or where was this sample
17 on the O drive? I'm just questioning some of
18 the, how were they being taken?

19 **MR. ROLFES:** There's a sampling of both
20 breathing zone samples as well as general area
21 air monitoring results. So there's a wide
22 distribution of air monitoring results that
23 are taken associated with the individual's
24 breathing zone while he was working with the
25 materials. And there are also general area

1 plant monitors distributed throughout the
2 plants and processing areas.

3 **MR. MORRIS:** This is Bob Morris. There's a
4 third set of data that we didn't use which is
5 the process sampling where the intent was to
6 get inside the (unintelligible) or right at
7 the point of generation to actually capture
8 the worst concentration that existed. And so
9 that the plant had three sampling protocols,
10 general area, breathing zone where the sample
11 was held near the person's face, and then the
12 process samples. We used the, we excluded the
13 process samples from these calculations and
14 used the general area and the breathing zone
15 samples to represent the intake rates.

16 **DR. MAURO (by Telephone):** Mark, this is
17 John Mauro. Quick question. When you provide
18 the white paper, will there also be these
19 datasets, the 3,000 air sampling measurements,
20 put on the O drive as supporting material?

21 **MR. ROLFES:** They've already been provided.

22 **DR. ZIEMER:** They're there, John.

23 **DR. MAURO (by Telephone):** Thank you.

24 **MR. RICH:** This is Bryce Rich. We might
25 just mention again that, I think Mark

1 mentioned at the last meeting, that we have
2 become aware through additional research that
3 there were a number of careful attempts to
4 look at intake or deposition through a thoron
5 breath analysis and through accounting by
6 Hirsch and others throughout this early
7 period. And the results of those studies
8 indicated that the body depositions of the
9 highest exposed people were less than maximum
10 permissible lung burdens at that time.

11 **MR. ROLFES:** Correct, thank you, Bryce. I
12 did forget about that. I wanted to point that
13 out, I guess, as we moved through the matrix.
14 I figured we'd be discussing thorium for quite
15 awhile, and it is very important to note that
16 several individuals from Fernald who had been
17 previously exposed or currently exposed to
18 thorium in the process at Fernald were sent
19 offsite because the Health and Safety Division
20 or the Industrial Hygiene and Radiation
21 Department wanted to characterize who had been
22 exposed to thorium and how much thorium the
23 body was retaining.

24 So I believe beginning in 1961 there
25 were a couple of individuals that were sent to

1 the University of Rochester to Dr. John
2 Hirsch, I believe was his name. And he had
3 done in vivo counts, lung counts, of the two
4 individuals and was unable to detect any
5 thorium in the individuals' bodies at that
6 time.

7 So he had also requested thoron breath
8 samples from the individuals, and he was able
9 to detect some thorium progeny, some thoron.
10 And the amount he interpreted was about I
11 believe, let's see, was about 1.6 picocuries
12 per liter of thoron which was the higher
13 result. From that he said that that was
14 approximately a ten percent of maximum
15 permissible lung burden.

16 So that was the first of a series of
17 studies where individuals from Fernald who had
18 previously not been monitored in vivo for
19 thorium exposures were, in fact, being
20 monitored. Now the second was I believe a
21 couple years later, and I'd have to take a
22 look back at my notes, but another handful of
23 individuals was sent to Wright Patterson Air
24 Force Base who had an in vivo set up, and I
25 believe those same individuals also gave urine

1 samples to determine whether they could detect
2 thorium in urine using neutron activation
3 analysis of their urine. They were able to
4 detect some thorium in one individual's urine.

5 I believe a handful of people were
6 also sent to Y-12, and I believe some of the
7 same individuals that had gone to Wright
8 Patterson Air Force Base also were sent to Y-
9 12. Those individuals at Y-12 were given lung
10 counts as well, and I'd have to take a look
11 back at the data, but I do believe they may
12 have detected some thorium in the one
13 individual, but it was still less than the
14 maximum permissible lung burden.

15 **MS. BALDRIDGE:** Question, Mark. Did the
16 Hirsch report say what means they used to try
17 to determine whether there was thorium?

18 **MR. ROLFES:** Yes.

19 **MS. BALDRIDGE:** And are there other methods
20 available today that would have been more
21 precise? Is it possible that there was
22 thorium present, that the means that they used
23 to try to detect it didn't work?

24 **MR. ROLFES:** Sure. The NIOSH approach that
25 would be taken if there was a sample result

1 that didn't have a detectable amount of
2 thorium, NIOSH would assume that there was a
3 missed intake that would have been incurred
4 but not detectable by the equipment at the
5 time. So it is very possible. We're not
6 saying that there was no thorium exposure.
7 What we would interpret this as is that there
8 could have been exposure, but it was less than
9 the detection limit.

10 **MR. RICH:** Mark, you probably have to say in
11 addition that we have a high level of
12 confidence as a result of these studies that
13 the air sampling default values for intake are
14 enormously high.

15 **MR. ROLFES:** Yes. They certainly are.

16 **DR. ZIEMER:** Compared to the in vivo
17 results?

18 **MR. RICH:** Yes.

19 **MR. ROLFES:** Correct, yes, probably a couple
20 of orders of magnitude higher than the actual
21 in vivo data.

22 **DR. BEHLING:** When we talk about the Hirsch
23 study that he attempted to actually establish
24 the in vivo body burdens of thorium, which
25 kind of technique did he use? I mean, it

1 wasn't until years later I assume that the
2 mobile in vivo laboratory analysis was
3 conducted, and that's a fairly sophisticated
4 system which leaves me to question whether or
5 not this individual, Dr. Hirsch, had the
6 capability of doing in vivo studies.

7 **MR. ROLFES:** Well, he was at the University
8 of Rochester. I'd have to take a look at the
9 data to make a determination on what he did.
10 But just given the fact that the workers were
11 sent there for counts, and that there were no
12 detectable quantities of thorium in the
13 workers, he didn't believe that that was as
14 sensitive a measurement as possible. So he
15 used another method, the thoron breath
16 analysis, and was able to detect a little bit
17 of thoron indicative of a thorium exposure.

18 **DR. BEHLING:** But you mentioned that he had
19 concluded that the body burden was less than
20 ten percent of the maximum permissible lung
21 burden. And that means he must have
22 understood how to convert thorium, thoron in
23 breath to body burden. And again, that
24 requires a very detailed understanding of the
25 biokinetics, retention and elimination rates

1 and all these things which, again, I don't
2 know if Dr. Hirsch is a medical doctor, and
3 not to speak disparagingly of the medical
4 profession, but my experience has been that
5 they understand very little about these very
6 esoteric items and issues that are coming into
7 play here.

8 **MR. ROLFES:** Dr. John Hirsch was very
9 involved in other radon breath analyses. He
10 was very involved at the University of
11 Rochester and had quite a detailed knowledge
12 of bioassay methodologies. He did discuss
13 some of his assumption in the report that I
14 have regarding the thoron breath analyses, and
15 I'd be happy to provide that. I actually do
16 believe I have provided it to the Advisory
17 Board members.

18 **MR. RICH:** They did have a major thorium
19 study going on. That's where the genesis of
20 this, the bioassay work was started there.

21 **DR. MAKHIJANI:** It might be useful to look
22 at the caveats that they put on their own
23 measurements. Here's what they said. I'm
24 reading from a document, quote, "Results of
25 these tests were interpreted as showing not

1 more than five to ten percent of a permissible
2 body concentration of thorium." That's what
3 we were talking about, right?

4 Continuing with the quote, "In
5 arriving at these results, certain assumptions
6 had to be made concerning the presence of
7 radium daughters with the thorium in the lung
8 and the percentage of the total thoron
9 generated in the lung which is exhaled in the
10 breath. The breath thoron technique, if it is
11 to be useful, clearly requires some
12 refinement." So they're quite sure, this
13 seems to indicate that they didn't think this
14 was very useful, and that to be useful it
15 would require some refinement. At least
16 that's how I read the English. Maybe English
17 is a complicated language so probably other
18 people may read it differently.

19 They put together a pretty cheap
20 apparatus for doing this which is described a
21 little bit here. So I think it would be
22 worthwhile to note, it's at least worthwhile
23 to note that these people were skeptical about
24 their own measurements and their utility in
25 saying how much thorium was in the body.

1 **DR. BEHLING:** And am I correct in concluding
2 that your assumption was that the source term
3 was strictly radium in the lung as the source
4 term for the thoron that's being exhaled?

5 **DR. MAKHIJANI:** I haven't read the whole
6 report.

7 **DR. BEHLING:** And there was no other source
8 term in the body?

9 **MR. ROLFES:** I think it's very important to
10 note also that in the same report it does say
11 a second question arises as to the precision
12 of the thoron measurement. An error here
13 would be in the nature of an overestimate.

14 **DR. MAKHIJANI:** Well, clearly, this requires
15 some very careful analysis, and it would be
16 useful I think to have more details on their
17 equipment and their own assessment of their
18 accuracy.

19 **MR. RICH:** Could I just say this was a
20 quality program at the leading edge of
21 research and development in this particular
22 area. We're not indicating that that is going
23 to be used for dose reconstruction. It just
24 is a valid measurement to indicate that the
25 deposition in the lung was not extreme as the

1 air sampling, the use of air sampling results
2 will, we're sure, will give a bounding that
3 will probably be in the couple of orders of
4 magnitude high. That's all we're saying.

5 **DR. BEHLING:** And how would these
6 individuals who were assessed by Dr. Hirsch
7 selected for this evaluation? Is there, I
8 haven't seen the paper so I'm talking
9 basically on a blind level, but how were these
10 individuals selected? Were these people who
11 were considered at the top end of the exposure
12 group?

13 **MR. ROLFES:** Yes, I do believe so. One was
14 a chemical operator, and I believe the both of
15 them may have been chemical operators. I know
16 the one individual was involved in the early
17 production runs in 1954 in Plant 9.

18 **DR. MAKHIJANI:** Well, this paper is from
19 1965 and to the extent that I'm familiar with
20 the thorium air data, and I went through all
21 3,000 samples, the highest measurements of
22 thorium were in the '50s and early '60s by far
23 to my recollection. So it could be easily two
24 orders of magnitude higher.

25 So you're talking about, I think we're

1 comparing apples and oranges. We have two
2 individuals from 1965 with a method that was
3 regarded as questionable by the people who did
4 it themselves that are being talked about
5 bounding doses for air concentrations for the
6 '50s and '60s that were one or two orders of
7 magnitude higher than were measured in the
8 mid- to late '60s. Well, it might be useful
9 to see the white paper and what element of
10 temporal analysis there is in the various
11 periods within the air monitoring.

12 **DR. ZIEMER:** I agree we should look at the
13 paper, but I also would point out that those
14 caveats are not any different than almost any
15 scientist puts in this kind of a paper because
16 you always have those issues. It's always
17 based on what assumptions you're using so that
18 does not imply that these are not useful. I
19 think your conclusion, Arjun, may be
20 questionable there. It does not imply that
21 they did not believe that their method was
22 useful. I think it's the normal caveat
23 scientists put in. I would do that. Hans
24 would do that. You would do that.

25 **DR. MAKHIJANI:** I don't think I had a

1 conclusion. I more put a question on the
2 table that as to what interpretation of a
3 paper in which people had reservations about
4 their own measurements. That was point number
5 one.

6 **DR. ZIEMER:** No, no, I'm saying that does
7 not imply reservations. That's what I'm
8 saying. That's the usual caveat.

9 **DR. MAKHIJANI:** If it is to be useful, I
10 would not put, you said what I would do in a
11 paper that was I was writing. If I had made a
12 good measurement, I would not put a caveat if
13 it is to be useful if I were confident that
14 the --

15 **DR. ZIEMER:** No, no, I think you would put
16 the limitations of that reading. All readings
17 have limitations. All readings do.

18 **DR. MAKHIJANI:** Right, but if the limitation
19 if it is to be useful, I believe that it
20 deserves careful scrutiny (unintelligible) its
21 utility.

22 **DR. ZIEMER:** Oh, I don't disagree with that.
23 I'm just saying all measurements have their
24 limitations and you need to know what they
25 are. And then you can determine whether you

1 can use that for bounding.

2 **DR. MAKHIJANI:** And the more important
3 point, conclusion, that I'm putting forward,
4 I'm not putting forward a conclusion about the
5 utility of this, is that you've got people
6 from 1965, two individuals, and a claim has
7 been made --

8 **MR. ROLFES:** Nineteen sixty-two, I wanted to
9 correct.

10 **DR. MAKHIJANI:** -- claim has been made that
11 they are bounding. And we need to know what
12 air concentrations they were exposed to
13 because the air concentration variations in
14 the '50s, from '54 to '61 as I remember in
15 that period were much, much higher than in
16 later periods. Now if we can establish what
17 these people were exposed to in the workplace,
18 there would be some basis to say that these
19 results show that the air concentrations are
20 bounding. But I think unless that can be
21 done, I would question whether these two
22 individual measurements, even if they were
23 valid, meant anything.

24 **DR. BEHLING:** I think the issue is one of
25 timing, too. The fact that these potentially

1 large exposures may have taken place years
2 earlier, to what extent can you assess that
3 years later by a exhalation of thoron.
4 Obviously, even a highly insoluble material
5 will ultimately be purged from the lung; and
6 therefore, the question is how do you account
7 for the time element here. If their exposures
8 took place in the middle '50s or early '50s,
9 what is the validity of a 1961, '62
10 measurement, and how do you account for that
11 time gap?

12 **MR. ROLFES:** Was that a question or --

13 **DR. BEHLING:** No, it's just a question that
14 again, what is the validity of using that data
15 in trying to establish a bounding value?

16 **MR. ROLFES:** Our objective from this is just
17 to show that we feel that there was a concern
18 in the workplace that these individuals had
19 previously been exposed to thorium. And this
20 is an attempt, and it was a good attempt in my
21 opinion, to determine if there were any
22 significant exposures to thorium previously.

23 **MR. RICH:** They did make an effort to choose
24 those that had been exposed, before the
25 special study, to choose those that had been

1 the highest exposed during the 1952 period.

2 **DR. MAKHIJANI:** 'Sixty-two.

3 **MR. RICH:** 'Fifty-two, those that had been
4 exposed at the highest levels. The people at
5 the plant made the decision to send people,
6 operators, chemical operators, for analysis
7 that had the highest potential exposure
8 stemming back from the early period.

9 **DR. MAKHIJANI:** I didn't understand the
10 reference to '52. I thought thorium started
11 in '54.

12 **MR. ROLFES:** We're referring to '54, '55
13 time period is what we're referring to.

14 **MR. RICH:** I misspoke, '54.

15 And in addition to that at the very
16 early time it was well known that thorium,
17 where it was inhaled, it did not, it's very
18 difficult to use urinalysis. It did not
19 become systemic to the standpoint of being
20 excreted as uranium and other materials were.
21 They knew that, and as a consequence they
22 knew, Hirsch and others at the university had,
23 the front end of the studies in relationship
24 to thorium bioassay and other processes.
25 That's where it began.

1 **DR. MAKHIJANI:** I compiled the air
2 concentration data in the review of the
3 Fernald TBD that I did. Obviously, you have a
4 lot more data, but in the 1950s you had some
5 data in Plant 9 that were as low as one times
6 MAC, four times MAC and then a hundred, 353,
7 3,500 times MAC. It's all over the map.

8 Whereas, the range in the '60s was a
9 little bit lower. There were some high
10 samples in the '60s, but as I say, you have to
11 know, you can't just presume that they were
12 sending the people who were exposed to the
13 highest concentrations because the
14 concentrations varied from four to 1,260. You
15 have to know which worker it was, and when
16 they were exposed.

17 **MR. RICH:** They were a relatively small
18 group of workers that were working in the
19 thorium processes.

20 **MR. ROLFES:** A very small population of
21 workers.

22 **DR. MAKHIJANI:** Do we know who they are from
23 the '54 to '68 period?

24 **MR. RICH:** We have listings of them that
25 identifies them as potential thorium workers.

1 **MR. ROLFES:** And there was a study that was
2 done before the mobile in vivo radiation
3 monitoring lab came in at Fernald in 1968.
4 There was an attempt to determine who had
5 previously been exposed to thorium. And those
6 individuals that had been exposed to thorium
7 were some of the very first people to be
8 counted in the in vivo lab.

9 **DR. MAKHIJANI:** Well, I guess I just have to
10 look at the paper.

11 **MR. SCHOFIELD:** What about did they account
12 for the crafts that might be in the vicinity
13 during these high concentrations? Were they
14 also monitored?

15 **MR. ROLFES:** During the time period when the
16 mobile in vivo unit did come in, yes, there
17 were some individuals from crafts who were
18 potentially exposed. They were counted. Not
19 as routinely as the chemical operators, but,
20 yes, they still were counted.

21 There are some notes on some of the
22 air monitoring results from the early time
23 period that, for example, our general area air
24 monitoring results associated with like a
25 guard station. And they said that this is a

1 general area air monitoring result for the
2 guard, but it's probably representative of the
3 guard's breathing zone.

4 So he wasn't directly involved in the
5 processing but was potentially exposed to
6 background, I guess elevated air
7 concentrations. They just note that on a lot
8 of the air monitoring results.

9 **MR. MORRIS:** Just a second. I'll give you a
10 site research database reference number for
11 this document I'm going to refer to. Bob
12 Morris, here.

13 It's a letter from R.C. Heatherton to
14 all employees. It's essentially introducing
15 the first use of the mobile in vivo lung
16 counting system, and he says, "Each employees'
17 potential for inhaling uranium or thorium
18 determines if and how often they will be
19 counted. For example, a water plant worker's
20 potential for exposure is practically nil, and
21 they are not included in the routine in vivo
22 counting program.

23 Chemical operators who work daily with
24 uranium or thorium have the greatest chance of
25 accidentally inhaling these materials and are

1 counted at least once each year. Workers with
2 only a slight possibility for such exposure
3 such as mechanical employees are monitored
4 about every other year.

5 Of course, any employee regardless of
6 classification would be counted if air dust
7 data or urine results indicated elevated
8 exposure levels. If an employee was involved
9 in an incident which might have caused
10 significant exposure to uranium, airborne
11 uranium or thorium, they would also be
12 counted."

13 He goes on to cite the recounting
14 protocol, what would prompt a second recount.
15 But this was a letter to all employees,
16 introducing a new technology into the system.
17 So I think you can find more details and for
18 the record in just a minute I'll tell you what
19 the site research database number was on that.

20 **MR. KISPERT:** What's the date of that
21 letter?

22 **MR. MORRIS:** It's not dated specifically,
23 but it's clear that it was early in the
24 process, '67, '68.

25 **MR. RICH:** It was preliminary to the mobile

1 laboratory, so it would be in the mid- to late
2 '60s.

3 **MR. ROLFES:** Arjun, you can address your
4 question about the episodic (unintelligible).

5 **DR. BEHLING:** The episodic issue we can
6 address it in Finding 4.3-1, and if we're
7 ready to go on we can discuss Finding 4.3-1
8 which is described on page 52 of SC&A's
9 report. And it is basically a discussion that
10 is not confined to thorium, but it's a generic
11 issue which at this point obviously has some
12 real implications because before the in vivo
13 measurements were taken, it is the air
14 monitoring that is, in fact, going to be used
15 for dose reconstruction.

16 And 4.3-1 discusses the generic
17 limitations on certainly associated with air
18 sampling. And I provide a significant number
19 of attachments and examples that define the
20 variability of air sampling data as a function
21 of time and location, time and space. And
22 also the issue of using general air sampling
23 as opposed to breathing zone. And on page 52
24 of the report I provide some data. These are
25 empirical data that were procured at the

1 Nuclear Materials and Equipment Corporation,
2 NUMEC, back in that timeframe.

3 And what it shows is that the ratio
4 between general air and BZ is one that is not
5 a static ratio but actually increases as the
6 air concentration increases. And that's
7 likely due to the fact that when you have
8 discrete source terms, Mark had previously
9 mentioned the issue of breathing zone for
10 guard shacks.

11 Obviously, one could make a reasonable
12 assumption that when the source term is at a
13 great distance from the people that you're
14 trying to monitor, a general air sample is
15 very accurate in defining a breathing zone
16 because obviously it's not going to vary as a
17 function of (unintelligible)square or some
18 other value which is obviously the case when
19 you deal with work location such as a hopper
20 and so forth that is a source term for
21 breathing zone air sample and having a general
22 air sample that's 20 feet removed.

23 We know from empirical studies that
24 even five feet can make a several fold
25 difference in air concentration. What this

1 whole discussion's about, and you will see
2 some examples that I cite on page 52, 54 and
3 in attachments, is how variable these things
4 are. And it also touches on episodic events
5 such as obviously radiological incidents.

6 And I give examples where on page 53,
7 for instance, where you have air
8 concentrations for various discrete locations
9 over a 30-minute time interval. And it goes
10 from 355 dpm per cubic meter to 140,000 over a
11 half hour timeframe. And these are things
12 that you see throughout when you look at the
13 air monitoring data.

14 And even when you look at BZ samples,
15 oftentimes a person will take three
16 consecutive measurements at the same location
17 for the same individual, and we'll see a high
18 and low for three samples that are orders of
19 magnitude apart. And so the question comes
20 into play which numbers are accurate and how
21 do you apply that to people whose work
22 location or job location you're not even sure.

23 We have roving maintenance people. We
24 have people who go from one location to the
25 other. And how do you assign air sampling

1 data under these circumstances where we have
2 already problems associated with even defining
3 what the air concentration is in time and
4 space, but you don't even know who these
5 people are especially when we're dealing with
6 roving maintenance people and laborers who
7 were assigned almost on a daily basis to
8 different jobs.

9 So the generic question here is how
10 well do you define an internal exposure based
11 on thorium air sampling data that mixes BZ
12 sampling with general air sampling. And over
13 time and space you have to somehow or other
14 get your hands around a bounding estimate when
15 you don't have a clue as to who these people
16 were and where they worked in time and space.

17 **MR. ROLFES:** We certainly feel that our use
18 of these air sampling results will provide a
19 bounding analysis of the potential exposures
20 given the additional process knowledge that
21 we've obtained based on records retrievals,
22 document searches, worker interviews. We also
23 know that based on the processes these were
24 typically campaign-type processes rather than
25 continuous production operations.

1 So by us using these higher
2 concentrations for 2,000 hours per year
3 without respiratory protection factors being
4 credited and without any other adjustments to
5 the air sampling data, we feel that we are
6 assigning a very claimant favorable intake by
7 assuming that this concentration existed for
8 2,000 hours per year. Based on information
9 some of these operations lasted a day, so by
10 us assuming that an individual was exposed to
11 2,000 hours per year at a high air
12 concentration is very claimant favorable.

13 Getting back to what we were
14 discussing before about the thorium bioassay
15 investigations I have a letter dated November
16 2nd, 1965, and this was in regards to the
17 people that were chosen for quantifying
18 thorium exposures in vivo. It's titled
19 "Thorium Bioassay Investigations", and it
20 says, "During the past year there has been a
21 small thorium operation at the pilot plant in
22 which about 25 people have been receiving
23 exposure to airborne thorium. It's understood
24 that there is a good possibility that there
25 will be a larger operation in the refinery..."

1 and there's some discussion about crushing
2 thorium in the plant.

3 Let's see, let me get on to, they had
4 chosen two of the foremen who were employed --
5 that's the earlier time period. This refers
6 back to the earlier total body counting that
7 was completed. The two individuals that were
8 sent to the University of Rochester, two
9 foremen, were employed in Plant 9 thorium
10 operations were counted in the whole body
11 counter at the University of Rochester on
12 November 30th, 1962. At that time Dr. Hirsch
13 interpreted the body results to show that
14 there was not a permissible concentration of
15 thorium in either of the employees.

16 It goes on to say if the results show
17 that these persons had a detectible quantity
18 of thorium in the body, we would want to have
19 other persons with thorium exposures counted
20 with the possibility that we would eventually
21 count all of our employees who are exposed to
22 thorium. This would involve a total of about
23 30 people, it appears, or 80 I think. But it
24 appears to be 80 people. So it does show
25 there was some attempt to quantify historical

1 thorium and current thorium exposures.

2 **MR. BEATTY:** May I ask a question, please?
3 This is Ray Beatty. You mention in that story
4 that this was two supervisors tested. I
5 really question why would they send
6 administrative personnel when the chemical
7 operators and maintenance people would have
8 been the most highly likely to be involved in
9 an incident at work.

10 **MR. ROLFES:** The one individual I know was
11 in Plant 9 and was associated with the thorium
12 blender operation, the explosion that occurred
13 in Plant 9. He was one of the first
14 individuals that had gone back into the area.

15 **MR. BEATTY:** My concern would be that the
16 persons that were right there at the incident
17 would be the ones that should have been
18 tested. And I hear this a lot from claimants
19 that supervisory personnel being in an office
20 setting most of the time or administration
21 areas, well, I just see a little problem with
22 it.

23 **DR. BEHLING:** I guess, again, the question
24 is obviously in the process of revising the
25 TBD and I guess we're going to be looking to

1 you to tell us when you finalize some of these
2 issues in establishing a new database and
3 drawing your conclusions from some of that
4 data. And can we expect to see the revision
5 to the TBD any time in the near future?

6 **MR. ROLFES:** Bryce, do you have a feeling
7 for the time period that we'll be able to
8 produce the white paper?

9 **MR. RICH:** The time period, a couple weeks I
10 would imagine. We're in the final phases I
11 think even though we're still developing
12 information. That's the reason I hesitate
13 just a little bit.

14 **MR. ROLFES:** But, yes, as soon as it's
15 available we will make it available to the
16 Advisory Board work group members.

17 **DR. MAKHIJANI:** Including the whole model
18 and all the information. Are you still
19 researching information and doing interim
20 white paper or --

21 **MR. RICH:** The answer is yes.

22 **DR. MAURO (by Telephone):** Mark, this is
23 John. I recently reviewed some work dealing
24 with Bridgeport Brass. And I was looking at a
25 similar situation where you have air sampling

1 data, and you're going to use that data as
2 your primary basis for constructing exposure
3 matrix. I bring this up just because I notice
4 certain approaches that were taken there have
5 raised some questions in my mind, and I
6 thought may be valuable to alert you at this
7 time some of the things that I and we would be
8 looking at.

9 And I noticed in the Bridgeport Brass
10 there was a lot of pooling of air sampling
11 data whereby you may have taken data from
12 several years and across operations and from
13 that built a distribution and selected the
14 upper 95th percentile.

15 Now one of the concerns is that when
16 you, these datasets that you work with -- and
17 it sounds like that, Arjun, you've already
18 looked at some of this -- to what degree do
19 you try to construct some granularity where
20 your distributions, the datasets, are grouped
21 by time, campaign, location, type of
22 operation, and have different distributions
23 for these different, I guess, segments whether
24 it's in time and operation.

25 And then from there select the

1 percentile that you're going to treat as being
2 your bounding number for different groups of
3 workers. Could you give, you may have already
4 covered this, but have you broken it down in a
5 finer way or used pool data?

6 **MR. ROLFES:** Bob.

7 **MR. MORRIS:** Bob Morris. The data for
8 thorium air sampling from in the '50s and '60s
9 is broken down by individual calendar year.
10 We could have in some years subdivided two
11 different operational locations, but in most
12 years the operations were focused at one
13 operating location. So I suppose we could
14 have subdivided two or potentially three of
15 the years into different operating locations,
16 but we chose not to. Now that's a choice that
17 could easily be reversed if you think that's
18 necessary, John.

19 **DR. MAURO (by Telephone):** Well, no. I only
20 bring it up, I'm not saying it's necessary,
21 but when you pool data, whether it's, you
22 know, for example, in this case it sounds like
23 you are breaking it down by time. But if you
24 are taking data from a number of different
25 operations and you pool it, what happens is

1 that would work if you knew your workers that
2 were working were, in fact, being cycling
3 through these different operations.

4 So therefore, but if it turns out one
5 particular operation might be a little bit
6 more severe, and this goes without speaking to
7 the incident issue. That's, of course, a
8 separate issue. I'm looking at more of a
9 chronic situation and you're going to try to
10 place a bound. The degree to which your white
11 paper addresses the need for granularity in
12 different job locations and job types in a
13 given time period, I'm not saying that you
14 need to break it up that way, but if you don't
15 break it up that way, a case needs to be made
16 that you have, your distribution that you are
17 using does, in fact, reflect what would be
18 considered the upper end operation that took
19 place.

20 So I just say that because later on we
21 are going to come back to this when we see the
22 white paper. I know this is going to be in my
23 mind when I look at that data.

24 **MR. CLAWSON:** I had one question. When
25 we're talking about the TBD is being rewritten

1 and so forth and then the white paper, is this
2 what we're going to receive back from it or is
3 this two different --

4 **MR. ROLFES:** Can you repeat that one more
5 time, please?

6 **MR. CLAWSON:** Well, we've been discussing
7 that the TBD's going to be somewhat rewritten,
8 and you're going to produce that to us in a
9 white paper.

10 **MR. ROLFES:** That's correct. We're going to
11 separate the thorium exposure model
12 essentially out from the TBD so that we can
13 get it to the Advisory Board members in
14 advance of the technical basis document. It's
15 typically a little bit easier to get pieces
16 out to the Advisory Board rather than the
17 entire document as a whole.

18 **MR. CLAWSON:** On the sampling of this -- and
19 forgive my ignorance and so forth -- but
20 whenever we pull air samples and so forth like
21 that we have a calibrator that's telling us
22 exactly what the air flow is. That's a prime
23 thing, and we really haven't had calibrated
24 instruments until about ten years ago. And if
25 you go back and look at our data, it could be

1 off. We were using a vacuum cleaner. What
2 type of system was being set up that we're
3 relying on these air samples to be correct?
4 And where did they come up with the number for
5 the air?

6 **MR. RICH:** Even in the very early days of
7 the, you know, using the vacuum cleaners, we
8 used Filter Queens, for example, in the very
9 early days, but we did air flow measurements.
10 In other words we had, and we were aware that
11 the air flow at the beginning of the period
12 was considerably less as the filter low. And
13 so there was a measurement pre- and post-
14 sample. And during the early days we
15 averaged. We took the average flow. So even
16 in these early days there was an awareness and
17 a full measurement made on the air sampling
18 devices.

19 **DR. MAKHIJANI:** Are you talking about Idaho
20 or Fernald?

21 **MR. RICH:** Yes.

22 **DR. MAKHIJANI:** Both?

23 **MR. RICH:** Idaho I know about and Livermore
24 and the other places I've worked at.

25 **DR. MAKHIJANI:** Well, I certainly recall

1 stack monitors that had not been calibrated at
2 Fernald for decades. This is from memory, but
3 I would wager that it's pretty good memory,
4 and I would produce the document.

5 **MR. CLAWSON:** The reason I was wondering is
6 I've been through the O drive and so forth on
7 that, and I was checking. And it seems like
8 they used one data point for all the air
9 flows. And you can go from one sampling
10 process to another and it's going to be off.

11 **MR. RICH:** Normally what they tried to do,
12 for example, for constant air monitors or
13 other devices, they tried to set them so that
14 they sample at five cubic feet per minute as
15 the air sampling rate for general air samples
16 or one cubic foot per minute or whatever the
17 air flow measurement is, they tried to tune
18 the restriction so you get the air flow
19 measurement that you desire. It makes the
20 calculations easier.

21 **MR. CLAWSON:** And I understand that. My
22 issue and my point that I'm trying to get to
23 and especially even on these air samplings,
24 breathing zone, whatever and so forth like
25 that, you've got to assure the data integrity

1 of this. And just with my layman's brain
2 going through it, we're using a set point
3 there. And it seems like to me that it's an
4 over-bounding one.

5 I'd like to be able to see where, you
6 know, the post- and so forth because I've seen
7 what you were talking about of checking what
8 the air flow was. But I know that in my world
9 it was not done that much. I guess I'm just
10 looking at I want to make sure that if we're
11 going to be using this air sample data that I
12 want to be able to make sure that it is
13 correct and how it was done.

14 **MR. MORRIS:** All you're really talking about
15 is an uncertainty analysis. Isn't that right?
16 This is just one of the parameters that goes
17 into the final answer. It's two liters per
18 minute plus or minus a half liter a minute or
19 five cubic feet per minute plus or minus one
20 cubic foot per minute. I mean, fundamentally
21 you've got a vacuum cleaner that's got a fixed
22 amperage going through it. And you've got a
23 new filter because these were 30 minute long
24 samples.

25 So the reproduce-ability of a lot of

1 equipment they used.

2 **MR. ROLFES:** There are procedures
3 documented, and there is indication in the
4 Industrial Hygiene and the Radiation weekly
5 reports in that early time period that the
6 various pieces of equipment were tested,
7 calibrated, and there were quality control
8 procedures in place. Also, on the air sample
9 results that we have, we also do have
10 documentation of the air sample volume that is
11 pooled, the time that the sample was drawn, as
12 well as the total counts and the counts per
13 minute, and then a conversion to
14 (unintelligible) per minute per cubic meter.

15 **MR. CLAWSON:** So you do have documentation
16 showing that these were calibrated so that
17 they were checking the air flows.

18 **MR. ROLFES:** Yes. I don't know if we have
19 every report, but there are early reports that
20 do indicate that the air samplers and other
21 laboratory equipment was, in fact, calibrated.

22 **MR. CLAWSON:** What timeframe are we talking,
23 the early or --

24 **MR. ROLFES:** Back in the early '50s. I know
25 of '53 off the top of my head so it's very

1 close to the early time period.

2 **MR. RICH:** Could I add just one other point?
3 Hans, you mentioned the uncertainties
4 associated with doing intake based on air flow
5 our air sampling data. That's well
6 understood. Just as an example I remember we
7 did a, we had a little contract to do some
8 research and development for NRC. And one of
9 the studies involved putting a breathing zone
10 sample on both lapels of a welder that was
11 doing some Plasmarc welding on a contaminated
12 piece of equipment. And we got a factor of
13 five difference on between the two lapels.

14 So and for that reason there are
15 enormous uncertainties associated with doing
16 dose reconstruction or determining the intake
17 and then the deposition of what stays in the
18 body using air sampling data. We recognize
19 that that is the least accurate. There's
20 enormous uncertainties. But -- and it's been
21 mentioned here, we're not assuming taking
22 credit for respiratory use.

23 If you used any type of a respirator
24 that uses a high efficiency filter, you get
25 99.97 percent of filtering efficiency which is

1 three times ten to the minus four, not ten.
2 And that's at the low point, 0.3 microns. The
3 filtering efficiency is higher on either end.
4 And so as a consequence you got four as a
5 magnitude conservatism if you're wearing a
6 respirator. I'm not assuming that they wore a
7 respirator.

8 And in addition to that the respirable
9 particles in most operations you get a major
10 share of the particulate distribution that's
11 non-respirable. And so as a consequence we
12 will default to in vivo measurements where
13 measurements are made that's actually
14 deposited in the body or it can be
15 reconstructed by urine or fecal analysis which
16 is a more direct measurement.

17 Now what I would say that in using air
18 sampling data to reconstruct intake, you're
19 generally going to come up significantly on
20 the conservative side. And that's the only
21 thing that we're saying here is that we feel
22 that in these very early time periods, if we
23 have a decent distribution of air sampling
24 data, we're going to err on, in a very
25 conservative fashion. And that's

1 fundamentally all I wanted to mention.

2 **DR. MAKHIJANI:** Well, your conservatism
3 about respirators would only be true if they
4 were wearing respirators.

5 **MR. RICH:** I said that already.

6 **DR. MAKHIJANI:** Well, let me review, but
7 lots of evidence that a lot of people didn't
8 wear respirators. Here's a document from
9 1954.

10 **MR. RICH:** You're assuming that they all ---

11 **DR. MAKHIJANI:** I'm not. This is an SEC
12 thing that applies to any worker in the group,
13 right? And here's a document from 1954 that
14 deals with respirators and also a particle
15 size. It talks about thorium fumes so you
16 could have some micron particles there.

17 **MR. RICH:** Go on.

18 **DR. MAKHIJANI:** Quote, "cutting thorium
19 derby in half by hacksaw, the operation is
20 done dry and releases a considerable amount of
21 fume in the area. Saw operator was without
22 any type of respirator." Okay, so there is
23 some evidence that respirators were used some
24 of the time, and there's some evidence that
25 they were not used some of the time. So that

1 actually assuming no respirator use is not a
2 conservatism, it's simply applied to the
3 manner of work of many workers and in many
4 periods.

5 Moreover, assuming that your applied
6 micron particle size would not necessarily be
7 conservative for thorium fumes when you're
8 cutting dry by hacksaw, and you could have 0.3
9 or 0.4 micron particles. So I think, well, I
10 guess I won't say more. Maybe it's necessary
11 to see the white paper. How general area
12 samples are handled. How fumes are handled.
13 How particle sizes are --

14 **DR. BEHLING:** When respirators were used,
15 obviously, I looked at a lot of memoranda that
16 talked about the respirator issue, and again,
17 I'm comparing it with today's methodologies
18 and protocols for assigning respirators where
19 you fit test, where you clean these things to
20 specification.

21 And repeated memoranda talk about
22 respirators that were so filthy that people
23 didn't even bother using them, and they
24 clearly were not fit tested. They were not
25 monitored for good seals and any of those

1 things. Today when you go into a radiological
2 environment, a minor amount of one day or two
3 days worth of facial hair is an issue that has
4 you sending back to the bathroom for a shave.
5 In those days I'm sure none of that existed.
6 So you have to be careful about applying
7 today's standards to periods of time when
8 people simply didn't care.

9 **DR. WADE:** Question.

10 **MR. GRIFFON (by Telephone):** Hey, Brad?

11 **DR. WADE:** Hold on, Mark.

12 **MS. BALDRIDGE:** One of the documents that I
13 read from old documents says since work
14 practices are a primary determiner of exposure
15 and is not a measurable factor, how are you
16 taking into account the different work
17 processes of people? I mean, if one man is
18 really careful about how he does, you know,
19 that he's conscious that he could get exposure
20 and somebody else has been basically told
21 there's no danger, he can just do whatever's
22 necessary, how are you making the distinction
23 there, and particularly when the two samplings
24 that were evaluated were management? These
25 are people who were not in there grinding,

1 cutting, whatever, you know, their inhalation
2 rate is going to be significantly different
3 than somebody who's on a grinder.

4 **MR. RICH:** At that point we're assuming the
5 worst in all cases, the maximum --

6 **MS. BALDRIDGE:** How can you make that
7 assumption based on two people who weren't in
8 there grinding, filing, inhaling the fumes
9 that were basically, you know, in, if they
10 were on the floor, they were in a mobile
11 situation where they were moving, checking
12 from one area to another or doing their
13 paperwork.

14 **MR. RICH:** Those are just two people who
15 were mentioned that were taken, but there were
16 others.

17 **MR. ROLFES:** If an individual entered the
18 area and was potentially exposed to high air
19 concentrations and then left the area, our
20 results would certainly be bounding for that
21 individual by applying a 2,000 hour per year
22 inhalation at that high air concentration.

23 So our approach, if a person was only
24 casually or based on air monitoring data, if a
25 person only casually entered the area without

1 respiratory protection for a short amount of
2 time, by us assuming that the individual was
3 in there for the 2,000 hours per year without
4 respiratory protection, our dose
5 reconstruction results would be very claimant
6 favorable for that individual.

7 **MS. BALDRIDGE:** Now the data that you have
8 now, are there still gaps in that? I mean,
9 initially when the technical basis document
10 was developed, there were gaps where that was
11 reconstructed. Are there still gaps that
12 exist that you're using to reconstruct the
13 data for?

14 **MR. ROLFES:** I think it's important to
15 clarify that for a technical basis document
16 there's not supposed to have every piece of
17 information in it. There's always going to be
18 things that we're not aware of. However,
19 those pieces of information are frequently
20 documented in a person's dosimetry files, and
21 it's usually those dosimetry files that are
22 the most important piece of information for us
23 in a dose reconstruction. So if we would look
24 into our dosimetry files when we looked at a
25 dose reconstruction, if we saw that we had a

1 gap in dosimetry data, for example, we could
2 go to the technical basis document to learn
3 how to interpret that gap and to assign a
4 claimant favorable missed dose or unmonitored
5 dose for that. And so we feel we have a very
6 comprehensive approach to dose reconstruction
7 based on the dosimetry results that we have
8 for individuals in combination with our site
9 profile documents.

10 **MS. BALDRIDGE:** Weren't they measuring
11 thorium with (inaudible)?

12 **MR. ROLFES:** External exposures from thorium
13 would, in fact, have been measured by
14 dosimetry.

15 **MS. BALDRIDGE:** When would that have
16 started?

17 **MR. ROLFES:** Nineteen fifty-one, if there
18 was thorium at the site in 1951 so it
19 certainly would have been, it's much easier to
20 detect penetrating exposures from thorium than
21 it is uranium.

22 **MR. CLAWSON:** That brings up a question of,
23 I know that I bring up Rocky Flats, but have
24 we checked into the information in each
25 person's dosimetry of, didn't we go back at

1 Rocky Flats, have to kind of check the
2 information on that? What's in each person's
3 file for the reconstruction?

4 **DR. MAKHIJANI:** Brad, we did that when at
5 first there was a discussion around the
6 completeness of the HIS-20 database, the
7 computerized data file. And then that was
8 found to have some gaps, and then at that
9 point we did, NIOSH stated that they were
10 going to rely on the individual dosimetry
11 files. And at that point we did an
12 investigation of the completeness of the
13 individual. But we have not done that.

14 **MR. CLAWSON:** We have not done that with
15 Fernald.

16 **DR. MAKHIJANI:** So far as I know. Hans may
17 have -- No, I don't believe we have done that.

18 **MR. CLAWSON:** I think to have something, you
19 know, as we're going into this, but we, for
20 our own reliability we better be sure that we
21 check into that. I don't want to get down the
22 road and have to revisit this issue. So
23 that's something we may want to check into.

24 Did you hear that?

25 **MR. GRIFFON (by Telephone):** Yeah, Brad, I

1 agree with that. I just think, you know, the
2 last couple meetings I've been trying to in my
3 mind scope how we would do that, and I'm not
4 sure exactly until we see. We don't have all
5 the pieces for NIOSH's approaches yet. That's
6 what I've been trying to piece together in my
7 mind.

8 And I was just, had a question for
9 Mark on the statement he just made. I mean,
10 maybe this is something, again, going back to
11 the individual files versus the sort of
12 database approach here. For thorium we have
13 all this air sampling data which I've been
14 flipping through here while you've been
15 talking. And your response a few minutes ago
16 suggested to me that some of this was in the
17 individuals' files as well, or not the air
18 sampling data you were referencing, just broad
19 dosimetry data?

20 **MR. ROLFES:** Typically, the air monitoring
21 data is not associated with specific
22 individuals' files.

23 **MR. GRIFFON (by Telephone):** So even the BZ
24 stuff wouldn't be --

25 **MR. ROLFES:** Correct, even the BZ --

1 **MR. GRIFFON (by Telephone):** No, I just
2 wanted to clarify that. Yeah, I agree, Brad,
3 in general. I think we need to consider
4 having that --

5 **MR. ROLFES:** There are some exceptions to
6 that, Mark. For incident reports there is
7 sometimes some air sampling data associated
8 with that.

9 **MR. GRIFFON (by Telephone):** Okay, thank
10 you.

11 Can I just say one thing on this
12 whole, I think, 43.1 through five actually.
13 I'll track these actions again today. I think
14 it's sort of already an action, but this white
15 paper everyone seems to be bringing up again
16 that we really have to wait to see the white
17 paper. I think we can talk in circles on this
18 until we have something more specific to react
19 to.

20 But I would ask that in the, if it
21 doesn't already address it, in the white paper
22 I would hope the question of what buildings
23 are covered and the one that John brought up
24 are you going to break it out by building or
25 is it going to be sort of a site, across the

1 site approach where the one model fits all
2 areas? But also just the, you know, what
3 buildings are considered, quote/unquote,
4 thorium buildings for the application of this
5 model for assigning internal dose.

6 And the second question is, and I
7 think it's already listed sort of in 43-2, or
8 I'm sorry, three, the question of how you're
9 going to deal with the different jobs. And I
10 think you've already probably got that in your
11 draft, but I think those things need to be in
12 that white paper somewhere so we can
13 understand those.

14 And the last question I would have and
15 then I'll shut up for a little while because
16 it's a little harder to participate on the
17 phone here, but the last question I had, Mark,
18 you mentioned again a few minutes ago that you
19 have some Health Physics or whatever type of
20 weekly or monthly reports from the early
21 years?

22 **MR. ROLFES:** Yes.

23 **MR. GRIFFON (by Telephone):** You were
24 responding to Brad's question about the
25 calibration of the air samplers. I think we

1 brought this up once before, and I was
2 wondering if these, because at one point
3 someone indicated there were all these monthly
4 reports somewhere. And I think you had said
5 that you were still looking for some of them.

6 **MR. ROLFES:** Yes.

7 **MR. GRIFFON (by Telephone):** Are those all
8 on the O drive or are those, can those be, or
9 even if they're not specifically put in the AB
10 document area, if you can give us like the
11 names so we can find them on the site research
12 database.

13 **MR. ROLFES:** There's quite a number of them,
14 Mark, but there have been some put on from the
15 earlier years beginning in the '50s. We have,
16 I don't want to say hundreds of them, but I've
17 probably seen at least 50.

18 **MR. GRIFFON (by Telephone):** Are they all on
19 the site research database?

20 **MR. ROLFES:** Correct.

21 **MR. GRIFFON (by Telephone):** And do they
22 have a name that we could search by that would
23 help find some of these? Are they Health
24 Physics reports? Are they, you know.

25 **MR. ROLFES:** This one in front of me is IH&R

1 Department Monthly Report. So maybe IH&R
2 might be the easiest way to find it in the
3 site research database.

4 **MR. RICH:** There are several names.

5 **MR. ROLFES:** Yeah, they're also referred to
6 as the Health and Safety Reports, Radiation
7 Safety, Fire Safety --

8 **MR. GRIFFON (by Telephone):** So a broad
9 number of names which always happens at these
10 sites.

11 **MR. RICH:** Otherwise we'd have them all in
12 front of us.

13 **MR. ROLFES:** It can be tricky locating them
14 sometimes in the site research database.

15 **MR. GRIFFON (by Telephone):** And in your --
16 this is a little off the current discussion,
17 but we had talked about some of these early
18 reports sometimes have summary statistics that
19 are helpful when you're looking at the
20 validation of the electronic databases. Do
21 any of these reports have that kind of like
22 summary? You know, for this quarter we had
23 400 thorium samples taken?

24 **MR. ROLFES:** Yes. I don't believe I have
25 one in front of me, but for example, in the

1 early time period in, say, 1954, one of the
2 Industrial Hygiene and Radiation Reports had
3 the number of film badges that were assigned,
4 the number that were read, the number of
5 uranium urinalyses that were collected from
6 employees, the number of clinical urinalysis
7 results that were collected from employees,
8 the number of accidents that occurred, the
9 number of visits that were made to the clinic
10 onsite for either occupational-related
11 diseases or non-occupationally-related
12 diseases. And they also had the number of
13 radon breath analyses collected. So something
14 else that I'm sure I've forgotten.

15 **MR. CHEW:** Brad, I want to make sure we
16 don't lose your question because you asked
17 about the data gaps here related to the call
18 at Rocky Flats. Just to refresh our memory
19 that was about the 1969 time period and Arjun
20 was talking about the data gap that you were
21 discussing that was missing at Rocky Flats was
22 external and there were some issues of why
23 some badges were not read and some people were
24 not wearing badges because (inaudible). I
25 want to make sure we don't mix up what we're

1 talking about. We're talking about internal
2 versus external data gaps.

3 **MR. CLAWSON:** Well actually, what I was
4 talking about is that we had been halfway
5 through Rocky Flats and then we kind of had to
6 back track to be able to go back and look at
7 the claimants' individual files for
8 completeness, and it kind of seemed like we
9 have to back track. It covered everything on
10 that if I wasn't correct. There was large
11 gaps and so forth. Now I didn't want to get
12 three-fourths of the way down the road and end
13 up having to come back and look at those
14 things. I wanted to be able to address that
15 right up front for the completeness of the
16 individuals' files.

17 **MR. CHEW:** I think we need to have the
18 question exactly posed to searching for what
19 you're looking for.

20 **MR. GRIFFON:** Yeah, I think the notion here
21 should be that we need to have the work group
22 and the Board independently need to sort of
23 have a sense of, you know, because we've
24 heard, much like the Rocky Flats scenario,
25 that you have a couple coworker models, you

1 just provided the one for uranium. But you've
2 indicated that there is probably very little
3 reliance on that because most individuals have
4 sufficient data in their files to be able to
5 reconstruct their personal doses from their
6 personal records.

7 And I think we want to do, we want
8 just to verify that, and I would think it
9 would be a worthwhile task for SC&A to do,
10 again, emphasis on small but statistically
11 significant. A small sample to sort of say,
12 yes, we agree or, no, we don't agree that the
13 data is there in the individuals' files to
14 allow for internal and external DR.

15 **MR. RICH:** This is Bryce Rich again. Based
16 on the record keeping requirements you would
17 expect the personnel dosimetry files to be
18 (inaudible) gaps. That'll be good data. All
19 of the personnel dosimetry data will be in the
20 file. To say that we don't have gaps in the
21 air sampling data is incorrect. The air
22 sampling data was not kept with the same
23 regularity as the personnel dosimetry data.
24 So there are gaps that we're trying to fill by
25 the way. But we do have a large number of air

1 sampling data with a wide distribution and a
2 very conservative, I'm convinced, dose
3 reconstruction.

4 **DR. ZIEMER:** But those are not associated
5 with individual claimants --

6 **MR. RICH:** They are not.

7 **DR. ZIEMER:** -- as I understand it.

8 **MR. ROLFES:** They're not in the dosimetry
9 records; however, there are some BZ samples
10 listed as, you know, so-and-so was doing this
11 operation, and this is a BZ sample from this
12 operation for him.

13 **DR. ZIEMER:** For that person.

14 **MR. RICH:** An individual associated with a
15 major incident, and then the report would be
16 in his file.

17 **MR. ROLFES:** For an incident report that may
18 be in the individual's file, but for, I was
19 just making the point that oftentimes the BZ
20 air sample results do have an individual's
21 name associated with the sample results.

22 **MR. CLAWSON:** Well, I just want to make sure
23 that, because I know that we're going to be
24 discussed with this several different people
25 as their data integrity and so forth for their

1 individual dose.

2 **DR. ZIEMER:** Could you help me recall? Did
3 we have SC&A -- did your statistician suggest
4 a number of random samples from the Rocky
5 database? Or how did we proceed on that? I'm
6 trying to remember, or, Mark, do you recall
7 that?

8 **DR. MAKHIJANI:** Mark, do you want to --

9 **MR. GRIFFON (by Telephone):** Arjun, you can
10 describe it.

11 **DR. MAKHIJANI:** We took an initial look at a
12 few and found there were periods where workers
13 were not monitored, and then we went to our
14 statistician to design a sampling program that
15 would enable us to say with confidence that
16 since we took, I think in all there were 32
17 cases, individual dosimetry records we looked
18 at, internal and external.

19 **DR. ZIEMER:** In detail.

20 **DR. MAKHIJANI:** In detail. And then since
21 there were periods for which some of the
22 workers were not monitored, including some
23 periods where many or most workers were not
24 monitored for, as I remember, external
25 (inaudible). Then we had, at Rocky Flats we

1 had the particular situation of a group of
2 workers that were retrospectively determined
3 to be high exposed workers and were called
4 back for review.

5 And we picked 20 of them to look for
6 completeness of data in their files in order
7 to judge whether a coworker model could be
8 built from that. And so we did two different
9 completeness investigations, one for workers
10 that were thought to be highly exposed
11 retrospectively looking back from the '90s
12 cumulatively, and then one random sampling.

13 **MR. CLAWSON:** Well, I just wanted to bring
14 that up. And somehow we've got to be able to
15 look into that and capture it. I want to get
16 this started now instead of halfway --

17 **DR. MAKHIJANI:** Is that something that you
18 would want us to look into, the uranium paper?
19 Because the thorium paper's obviously not
20 complete.

21 **MR. GRIFFON (by Telephone):** Yeah, I think
22 the thorium, and it's also clear that the
23 thorium, you know, as far as personal files,
24 it's not a completeness issue.

25 **DR. MAKHIJANI:** Right, true.

1 **MR. GRIFFON (by Telephone):** I mean, you've
2 got a separate model going on. But I would
3 say you want to do, I think, maybe a task, a
4 good task would be to have SC&A come back with
5 a sampling plan first before we just go hog
6 wild into it. Let's get a sense of what you
7 think, you know, again, Arjun, just like we
8 did at Rocky, go back with your statistics
9 folks.

10 And I would think we would focus on
11 internal uranium and external and look at, and
12 I would give you, I mean, my feeling is the
13 similar factors that we outlined for Rocky
14 apply here as well. Like I think we'd want to
15 sample the workers from the different decades
16 but also maybe workers from different job
17 types, you know, operations, supervisory,
18 administrative, maintenance.

19 But I think that would be a starting
20 point as come back to the work group with an
21 approach on how we might do that. And then we
22 can talk through it more.

23 **DR. MAKHIJANI:** Yeah, Hans and I can
24 certainly get together and think up something,
25 talk with Harry about it. Now at Rocky Flats

1 we did not do job types or sample by building.
2 We did a more crude approach because, as you
3 recall, there was a considerable amount of
4 discussion and a desire by the working group
5 to limit the amount of investigation that we
6 did. So as a result the end product did not
7 tell us lots of things and did tell us lots of
8 things. And because the sample size was not
9 defined by building, job type and, it was
10 defined by two broad periods basically.
11 That's it.

12 **DR. ZIEMER:** I would think the plan itself
13 would address whether we need to do it by job
14 titles or by buildings or what. That could be
15 part of the plan, could it not?

16 **DR. MAKHIJANI:** We could look at what it
17 would take to do it by job types and building.

18 **DR. ZIEMER:** If that's even needed.

19 **MR. CLAWSON:** I guess the thing is you need
20 to --

21 **DR. ZIEMER:** Develop the plan.

22 **MR. CLAWSON:** -- develop the plan and let's
23 sit down and take a look at it. I guess
24 because some of the points of interest to me
25 is going through the TBD and so forth there

1 was a lot of interesting information to me
2 like the clothing worker, so forth like that
3 of all of a sudden coming back. Also, how
4 they issued a lot of different clothes. I
5 think what I'd like to do is be able to have
6 you guys bring us back a plan. We'll discuss
7 that, and then we'll continue on. We'll make
8 a decision at that time.

9 **MR. GRIFFON (by Telephone):** And I think we
10 did -- I'm sorry -- I think we did for Rocky.
11 We sort of, like you said, Arjun, we did one
12 subset of production workers, but then we
13 looked at a larger, and that was just random
14 across, you know. And I guess the idea there
15 was that, or the issue we were trying to get
16 at there was that we wanted to see if the
17 production workers certainly were all sampled
18 or had complete data. But also we wanted to
19 see if sort of all job types so that was the
20 random --

21 **DR. MAKHIJANI:** And we did have some fine
22 grain things show up even in this. We
23 discovered that uranium workers were not
24 monitored in a certain period whereas
25 plutonium workers were more completely

1 monitored. So we were able to tell a lot of
2 things and because the sample size was --

3 **MR. GRIFFON (by Telephone):** Yeah, and in
4 your plan if you can sort of think about the
5 purpose of each piece that would be helpful,
6 too. For instance, we have to think about how
7 we're doing dose reconstruction for these
8 individuals and if you have uranium, you may
9 not have -- well, I guess I would leave it up
10 to you.

11 But in my mind there's a couple
12 questions for if I looked at an individual's
13 file for their uranium samples, one thing I'd
14 want to know is, okay, given their job type
15 were they on the schedule that they were
16 supposed to be. So if they were an operator
17 in a certain building, and the procedure said
18 they got monthly sampling, were they, in fact,
19 getting monthly sampling?

20 But the other question is, and
21 probably the sort of bottom line question
22 would be did they have a uranium urinalysis
23 toward the end of their career? Because in
24 many ways you could really use that as a
25 bounding measurement to bound their dose over

1 their entire career if --

2 **DR. ZIEMER:** A close-out sample.

3 **MR. GRIFFON (by Telephone):** -- right,
4 right, close-out sample kind of thing. That
5 would be essential, and that's one thing we
6 found in Rocky Flats, and they actually had to
7 revise the coworker model because during the
8 D&D period we did not have that urinalysis
9 data for as many people as they did during the
10 production years. So we had to extend that
11 coworker model. I guess those are the
12 questions maybe to incorporate in your plan.

13 **DR. WADE:** This is an important issue, and
14 maybe we could talk about it just for a
15 minute, but I think we really need to proceed
16 in stages here to get this right. I would
17 propose that the first thing that happens is
18 that SC&A thinks about this and then comes
19 back to the work group and says we're going to
20 develop a plan to include these factors. And
21 you sort of lay out the variety that you're
22 going to --

23 **DR. ZIEMER:** In your plan, is that --

24 **DR. WADE:** -- then the work group can
25 comment upon that. And then based upon the

1 work group comments you develop the plan. If
2 we don't do that, we're going to do that
3 eventually anyway.

4 **MR. CLAWSON:** I just passed déjà vu or
5 whatever. I just wanted to make sure we
6 addressed this up front. But, Hans, --

7 **DR. BEHLING:** Yeah, I think Mark has already
8 touched on it. We have Finding 4.3-2, 4.3-3,
9 4.3-4 and they all basically touch on the
10 common theme, and that is we've come to the
11 conclusion here that for thorium internal dose
12 reconstruction there's likely to be very
13 little, if any, data in the personal files.
14 Mainly, we're going to have to rely on your
15 white paper that will define what is the
16 potential upper value that we may have to
17 assign to these people in the absence of
18 information.

19 And I guess I have multiple things
20 that I want to discuss here on that issue when
21 you develop this plan. One is obviously to
22 always make a distinction between what do we
23 assign to a person who is likely to be
24 compensated, and we have to rely on a best
25 estimate.

1 And frequently our approach to doing
2 dose reconstruction based on generic
3 information may differ significantly from one
4 where we have a maximized dose estimate. So I
5 would like to ask you to keep that in mind
6 when you do a white paper and distinguish
7 between best estimates as opposed to maximized
8 dose.

9 And also, talk about the issues that
10 are identified here as the various findings
11 here. We've already discussed 4.3-2, and from
12 what I gather we're going to dismiss or
13 discard the issue of the 1,050 MAC hours as a
14 default value for a bounding intake.

15 We are also in 4.3-3 I want to again
16 make sure that when we talk about the issue of
17 identifying a person even though he may have
18 some cards in his file that says he was a
19 certain process worker or chemical plant
20 worker on a job location. If you look at 4.3-
21 3, we identified problems with that, too,
22 because I've identified numerous attachments
23 that talk about maintenance people, project
24 labor pool.

25 And so you're going to deal with a lot

1 of unknowns for a lot of people in terms of
2 where were they working, and what were they
3 doing. So when you develop a protocol that
4 will probably have generic applications for
5 all workers regarding the internal exposure to
6 thorium, you're going to have to keep all
7 these issues in mind.

8 Because as Arjun, and as the
9 regulations require, you're to basically
10 identify all individuals for their potential
11 exposure. We're not looking for what is a
12 best average exposure, but what is the
13 potential maximum exposure because we're here
14 to protect every person, not just the average
15 person.

16 **FINDING 4.3-4**

17 And so I think we can probably go
18 through the next several issues that go all
19 the way including 4.3-4, the inability to
20 account for internal exposures associated with
21 radiological thorium intakes. And again here
22 I had provided a significant amount of
23 documentation. I talk about the frequency of
24 these events, and they were not infrequent
25 when we talk about, for instance, Attachment

1 4.3-4 on page 71 where we talk about fires and
2 other incidences that would have given rise to
3 significant elevations in exposures.

4 So rather than belabor all these
5 issues at a time when we don't have your white
6 paper, I would just like to at least make you
7 aware that these issues will be looked at in
8 the context of your white paper. And we will
9 assess your white paper in the context of
10 identifying the problems associated with where
11 did this worker work. Was he a member of a
12 project labor pool, a roving maintenance
13 person? Was he potentially exposed to
14 incidents that are not documented in the light
15 of his personal file, et cetera, et cetera.

16 So if everyone agrees, we can probably
17 postpone the next several attachments and
18 postpone further discussion until we have your
19 white paper. And then we will go back again
20 and look at these specific issues to be sure
21 that we are satisfied with the fact that they
22 have been addressed.

23 **MR. ROLFES:** Hans, I did want to clarify
24 that we do have thorium exposure information
25 associated with individual claims beginning in

1 1968 with the mobile in vivo radiation
2 monitoring lab results.

3 **DR. BEHLING:** Well, yes, that's a new
4 threshold, and maybe '65's a little early
5 because there were just a handful, but '68 is
6 really, marks a threshold for potentially
7 applying a person-specific data that are
8 obviously in that person's file. But up until
9 '65, '68 timeframe, obviously the application
10 of the generic thorium air monitoring data may
11 have to suffice.

12 And we just want to be sure that we're
13 talking about a comprehensive review of all of
14 the variables that come into play here and
15 assure ourselves that we're not leaving people
16 high and dry who may be very well at the upper
17 end of that. We have, for instance,
18 documentation as Arjun already pointed out in
19 some of the memoranda where people were
20 exposed to 1,200 MCGs that translate to more
21 than 1,800 MAC hours who were not wearing a
22 respirator.

23 And when you talk about what is his
24 potential exposure for any given year, well,
25 it's going to be pretty high. We have no clue

1 as to what he was exposed to even during that
2 evolution. But it's clear that if we were
3 even assured that he was taken to a lower
4 exposure environment what that might be. It's
5 likely that he was not transferred to mahogany
6 row and taken a desk job. We just don't know
7 what happened to that individual.

8 **DR. WADE:** Let's keep our issues straight.
9 Hans, took us back to thorium. We want to
10 close on the uranium issue in terms of the
11 completeness of the data.

12 So are you comfortable now that the
13 instruction has been given to SC&A that you
14 want, Brad?

15 **MR. CLAWSON:** Yes, I want --

16 Is it clear to you?

17 **DR. MAKHIJANI:** What I wrote down was what
18 Dr. Wade said at the end that you want this
19 plan developed in two stages. First -- at
20 least that's what Dr. Wade proposed. I didn't
21 see an assent from --

22 **DR. WADE:** What I'm suggesting is SC&A comes
23 back to us and says these are the factors
24 we're going to look at. How we're dealing
25 with uranium internal and external monitoring,

1 the entire period at the facility.

2 **DR. MAKHIJANI:** External (unintelligible)
3 and then uranium for internal.

4 **DR. WADE:** And then we come back and say
5 these are the factors we're going to take into
6 account as we develop our plan. The work
7 group will modify that, give you instructions,
8 then you'll develop the monitoring --

9 **DR. MAKHIJANI:** Then we'll go to the
10 statistician. So the first step will be a
11 kind of a technical review. I guess Hans and
12 some of us can sit down and talk about what
13 factors and work with you in developing that,
14 and then we will go to the statistician.

15 **MR. GRIFFON (by Telephone):** Lew, I agree
16 with your outline of the approach. The only
17 one thing I might ask, and this is a question,
18 it's uranium internal and the external. But
19 I'm just listening for the, I also included
20 thorium post-1968 because are you relying on
21 individual data at that point, Mark? Is that
22 correct?

23 **MR. ROLFES:** That's correct.

24 **MR. GRIFFON (by Telephone):** So I would add
25 in thorium post -- and do I have the date

1 right, 1968?

2 **MR. ROLFES:** 'Sixty-eight.

3 **MR. GRIFFON (by Telephone):** 'Sixty-eight,
4 right.

5 **DR. MAKHIJANI:** I got that.

6 **DR. WADE:** So, Brad, would you expect to see
7 something from SC&A and then you would convene
8 a work group meeting to deal with it before
9 this goes forward? Is that your --

10 **MR. CLAWSON:** Yes, that'd be my, we'd like
11 to be able to sit down and discuss with being
12 in the process of being able to look at it and
13 make sure it's covering what --

14 **DR. WADE:** So then John or Hans or Arjun, a
15 sense of when we might have that sort of
16 preliminary thought piece that the work group
17 could then react to before you develop your
18 detail plan. You can think about that this
19 morning and maybe after lunch --

20 **DR. BEHLING:** We need to talk with John and
21 Arjun.

22 **MR. CLAWSON:** While we're thinking about
23 that, more on that, there may be required a
24 comfort break here. If we could have a kind
25 of a comfort break and convene back in 15

1 minutes. If that'd be all right --

2 **DR. WADE:** We're not going to break the
3 line. We're just going to mute the phone.

4 (Whereupon, the working group took a break
5 from 10:45 a.m. until 11:00 a.m.)

6 **DR. WADE:** We're back in session.

7 **MR. CLAWSON:** First of all you wanted to
8 read into the minutes the reference document
9 that you had used.

10 **MR. MORRIS:** Yeah, this is Bob Morris. I
11 referred to a document by Heatherington (ph)
12 regarding the mobile in vivo radiation
13 monitoring laboratory first use. It's SRDB
14 reference number 2932.

15 **MR. CLAWSON:** Great. Now several of these
16 are going to be covered with the new white
17 paper coming out, so we're going to kind of
18 skip over some of these in the matrix.

19 **DR. BEHLING:** Yeah, I think what I'd like to
20 do is just again, continue.

21 **FINDING 4.3-6**

22 We talked about 4-3.2, three, four and five,
23 and also just briefly touch on 4.2 (sic)-6
24 which talks about the need to potentially
25 address thorium exposures during post-

1 production periods, meaning that there were
2 discrete periods of time during which thorium
3 was processed at a given plant.

4 However, one has to come to a
5 realization that residual contamination of
6 thorium after the last production takes place
7 will remain in that facility and there'll be
8 resuspension and inhalation and to what extent
9 one may have to look at that and sort of say
10 post-production air monitoring.

11 And since you're really only measuring
12 gross alpha, how do you know whether that
13 gross alpha is a uranium daughter or uranium
14 or is it a thorium, and to what extent during
15 this transition period between production of
16 thorium and resumption of uranium are there
17 potential data points where you may have to be
18 careful about assigning that gross alpha as
19 strictly uranium as opposed to thorium? And
20 that's really due to the fact that the dose
21 conversion values are considerably different
22 between thorium and uranium. And that's just
23 a point that I wanted to bring up here.

24 **DR. MAURO (by Telephone):** Brad and Hans,
25 this is John. Before we move on, during the

1 break I was thinking a little bit about the
2 conversation we just had regarding the white
3 paper, and I just had an idea. And I'd like
4 to just put it on the table. It seems to me
5 that a recurring theme that we always run into
6 is the construction of these coworker models
7 and their granularity in terms of time and
8 space, et cetera, et cetera.

9 And it's not until we get to this
10 point in the process where we engage that
11 issue whereby we have all these data. And
12 then we look at the data and see, okay, how
13 well does the data serve us and be able to
14 build these coworker models at the level of
15 granularity necessary to support some decision
16 regarding SEC.

17 What I was thinking about was it seems
18 to me that recognizing that we're always going
19 to have to deal with this kind of issue, it
20 seems to me that when the site profile is
21 prepared, and you're preparing chapter two
22 which describes the site, right now there's a
23 ton of information that summarizes activities
24 at the site.

25 I would suggest that while that

1 section is being prepared it is prepared with
2 an eye toward what are the different sub-
3 compartments of activities, job
4 responsibilities, time periods, campaigns, et
5 cetera, where you would say these represent
6 different cohorts of people. I use the term
7 cohort not in the SEC sense, but in just the
8 sense of what a cohort is.

9 Whereby if you are going to create a
10 coworker approach because you don't have
11 complete data, you need to build it around
12 these different cohorts because the nature of
13 the activities, the nature of the exposures
14 were of substantially different -- Now we're
15 dealing with different populations of workers
16 in effect. And so it's almost like we should
17 front-end this question and to be dealt with
18 before you actually get into the data.

19 When you're at the front end in
20 principle you should be able to say, you know,
21 we understand the operations and how the high
22 level of resolution, and we also understand
23 that if you are going to develop some type of
24 coworker model, it has to be developed at this
25 level of granularity in order for it to be

1 functional for you to do dose reconstruction.

2 So I guess I just want to put that on,
3 it's almost as if that issue could be
4 addressed in the front end before you actually
5 get to the data, then when you get to the data
6 you could pose questions to the data. That
7 is, are the data of sufficient resolution that
8 allows you to build the coworker models at the
9 level that you need.

10 So I'd like to just put that on the
11 table because I think we're going to run into
12 this time and time again, and I realize it
13 doesn't really apply, it applies to everything
14 we're doing. And I wanted to unload that
15 because I was thinking about that during the
16 break.

17 **MR. CLAWSON:** I understand and appreciate
18 that, John.

19 **DR. BEHLING:** I do want to make a comment,
20 John. This is really not a coworker model
21 since obviously this applies to just about
22 everybody. In the case of the thorium air
23 monitoring data, we don't really have worker
24 specific air monitoring data. We have BZ and
25 GA air sampling data without necessarily

1 identifying specific worker groups. We may
2 have some job locations and plant locations
3 but not really individual-specific data. So
4 this is really not a coworker model.

5 **DR. MAURO (by Telephone):** Maybe I used the
6 wrong term. I guess I was thinking in terms
7 of you've got a group of workers, and you're
8 going to try to characterize the distribution
9 of the exposure in that group of workers.

10 Whether it's bioassay data, air sampling data,
11 breathing zone data, external dosimetry
12 measurements, film badge readings, all I'm
13 really saying is that when you try to
14 understand the exposures that any given group
15 of people have been exposed to, the idea of
16 pooling the data is, you want to avoid that.

17 You want to try to create a dataset,
18 in this case air sampling data, at a level of
19 resolution that you feel confident that the
20 distribution you create captures the range for
21 a particular group and is not pooled to such
22 an extent that it's diluted to the extent that
23 you really don't know whether you've captured
24 the high end or not. And I can almost see
25 that being done early in the process, you

1 know, not after you've gathered the data but
2 while you're actually characterizing the
3 operations and preparing the site profile,
4 that particular chapter two is prepared with
5 that in mind.

6 I think right now there's a lot of
7 information of that type, but I don't think
8 that chapter is prepared with that issue in
9 mind. Because in the end that's how you use
10 chapter two. It should lead you to how much
11 granularity do you need in order to understand
12 the differing population groups and activities
13 that took place that will need to be
14 characterized whether it's a coworker model or
15 whether, as in this case, we're talking air
16 sampling data that's going to be used from
17 which you'll pick off a distribution.

18 Anyway, forgive me. It was sort of in
19 my head, and I wanted to get that out.

20 **MR. CLAWSON:** I understand. So, John, let
21 me just try to capture what you just told us.
22 You're talking about when they're developing
23 the site profile, correct?

24 **DR. MAURO (by Telephone):** I think that's
25 the right time to do this because you're not

1 already immersed in the data. In other words
2 you're basically, it's almost like a clean way
3 to do it. In a perfect world given the site
4 we would like to have data at a level of
5 resolution, certainly all the individual data
6 that's your perfect world, but you never have
7 that.

8 And you may have to resort to what
9 we're doing right now, drawing upon air
10 sampling data. But then again if you're going
11 to do that, right up from the beginning you
12 need to appreciate how much resolution do you
13 need in characterizing the workforce? Where
14 they were. When they were. What they were
15 doing.

16 And that should be done before you're
17 looking at the data so that later when you do
18 collect your data, you could actually evaluate
19 that data from the perspective of will it
20 serve our purposes to characterize the
21 exposures that workers experienced given the
22 granularity that we defined in chapter two.

23 **DR. ZIEMER:** It sounds to me like this is a
24 suggestion for NIOSH, maybe two years too late
25 or something.

1 **MR. ELLIOTT:** This is Larry Elliott. I
2 appreciate hearing your thoughts, John, and it
3 certainly needs to be considered in the
4 context of how we have approached our work.
5 As Dr. Ziemer points out I think that our
6 strategy has been to look at sites where we
7 have a large number of claims and datasets to
8 apply to those claims and move a technical
9 approach into play, into dose reconstruction
10 practice as soon as we could so that we could
11 use that to the best advantage of a majority
12 of the claims. In some cases we would not be
13 able to complete a given claim because we
14 didn't have all the information assembled. So
15 you could say maybe we put our cart before the
16 horse here, but that's why we're going through
17 this today I think.

18 **DR. MAURO (by Telephone):** Yeah, I think so,
19 too.

20 **MR. ELLIOTT:** We're going through this now,
21 and we're saying, okay, how do we fill these
22 holes? How do we fill these gaps? What are
23 the questions that our overall strategic,
24 general approach didn't really address for
25 each individual claim? The majority of the

1 claims we feel we're working with a document
2 or set of documents that give us the correct
3 answer for compensation.

4 **MR. CLAWSON:** And we appreciate that, John.
5 I'm sure NIOSH will take that into
6 consideration.

7 We'd also like to welcome Larry
8 Elliott here. He just arrived.

9 So I'm going to turn this back over to
10 Hans, and he can proceed on.

11 **FINDING 4.3-7**

12 **DR. BEHLING:** The next one, 4.3-7 on page 86
13 of the report again makes reference to perhaps
14 a fairly significant program that involved
15 redrumming of thorium.

16 **MR. GRIFFON (by Telephone):** Hey, Hans,
17 before you move on to 4.3-7, on 4.3-6 I just
18 wanted to clarify in the previous action we
19 had said NIOSH would post thorium in vivo
20 data, and I underlined here, and associated
21 model.

22 I'm pretty sure, Mark, that you've
23 posted the data, but is there any coworker
24 model associated with that for people that
25 wouldn't have their own individual data during

1 that time period?

2 **MR. ROLFES:** I don't believe the final
3 version has been put out there. The data has
4 been --

5 **MR. GRIFFON (by Telephone):** Okay, I just
6 don't want to lose that because your response
7 says done, but I think the second part of that
8 action isn't necessarily completed. Is that
9 correct?

10 **MR. ROLFES:** The descriptive information I
11 believe is probably still being finalized.
12 But the white paper that we had completed for
13 the in vivo, the assignment of thorium intakes
14 based on in vivo data, we've put together some
15 documentation of the intakes and everything.
16 There was a descriptive report I believe for
17 that.

18 **MR. MORRIS:** Yeah.

19 **MR. ROLFES:** I do not believe I have put
20 that back on or I do not believe that it is on
21 the X drive or O drive at this time, but I
22 will make sure it is available.

23 **MR. GRIFFON (by Telephone):** Okay.

24 **MR. MORRIS:** And probably as a result of
25 this meeting and the comments that we've heard

1 you say today that you'd like us to
2 specifically consider, we'll make one more rev
3 on it before we give it away.

4 **MR. ROLFES:** Probably a good idea.

5 **DR. MAKHIJANI:** This is the coworker model
6 you're talking about, for thorium?

7 **MR. ROLFES:** For thorium, correct.

8 **DR. MAKHIJANI:** In this 4.3-6?

9 **MR. ROLFES:** Yes, and were we going to
10 separate that out from the, are we going to
11 put one general white paper for thorium out or
12 are we going to divide it into the early time
13 period and the more recent time period? Are
14 we going to have two separate white papers,
15 one for the early time period and one for the
16 more recent time --

17 **MR. MORRIS:** We've got a coworker model for,
18 based on in vivo chest counts starting with
19 '68 that goes through '88. And we've got an
20 air sample-based intake model that uses the
21 Battelle TBD-6000 documentation, the equation
22 that's in Battelle's 6000 which is, I think,
23 has been reviewed by SC&A in a Procedures
24 working group. So I think the only issues
25 that could be left is who would be applied to

1 the operator category versus the laborer
2 category versus the --

3 **MR. GRIFFON (by Telephone):** I think that
4 TIB-6000 is still kind of under review. I
5 mean it's in the resolution phase in the work
6 group, Procedures work group.

7 **MR. MORRIS:** Possibly, I know SC&A has
8 provided a draft.

9 **DR. MAURO (by Telephone):** Mark, but bear in
10 mind that it looks like what's more applicable
11 here is 6001, which is the process. We did
12 review 6000 which is metalworking, and that
13 certainly is, we completed our draft. It has
14 not entered into the issue resolution process,
15 but I think that we did not review 6001 which
16 has to do with processing with the thorium
17 issues come in.

18 **MR. MORRIS:** Well, essentially the model is
19 repeated in 6001, John.

20 **DR. MAURO (by Telephone):** Oh, okay, okay,
21 then in that regard many of the comments in
22 6000 may very well apply to 6001.

23 **MR. GRIFFON (by Telephone):** And as far as
24 one white paper or two separate, it sounds
25 like you already kind of have two separate --

1 **MR. MORRIS:** We have two separate --

2 **MR. GRIFFON (by Telephone):** -- that's fine.

3 **MS. BALDRIDGE:** I have a question. How do
4 you plan to approach the Plant 6 three and a
5 half years where we didn't know that they were
6 processing the thorium because you didn't have
7 access to the records? So obviously the
8 worker records didn't show any, there wouldn't
9 be any worker records specific to thorium in
10 that timeframe so you would have to rely on
11 air sampling. But how do you develop a model
12 where a group of people that you really don't
13 know what they were dealing with since they
14 were handling raffinates?

15 **MR. ROLFES:** Well, these individuals were
16 not handling raffinates. They were handling
17 materials that had been through the Plant 9
18 process in the 1950s. These were leftover
19 scraps, thorium contaminated material such as
20 thorium oxide, incomplete fires, incomplete,
21 so there was a lot of high volume of
22 contaminated scrap.

23 It was contaminated with thorium, and
24 the idea was to reduce the volume of the
25 materials that were contaminated for storage.

1 And so what they did is converted the Plant 6
2 sludge furnace over to handle thorium, and
3 they essentially reduced the volume of the
4 thorium contaminated waste from the earlier
5 production time period. And so we're going to
6 use the air sampling data for that time period
7 for that operation to assign intakes.

8 **DR. BEHLING:** Let me just briefly introduce
9 Finding 4.3-7 and that, as I started to say,
10 was an issue that surrounds the redrumming of
11 thorium and there were large, large numbers of
12 drums that on a repeated basis were decaying
13 and corroding, had to be repackaged.

14 And one of the things that, or at
15 least we were not able to find any BZ air dust
16 data or air sampling data on behalf of that
17 operation, and we know very well that that is
18 likely to be a fairly high airborne
19 environment in this whole process. And the
20 question is to what extent will that also,
21 that particular evolution, be considered as
22 part of your white paper in assessing air
23 concentration intakes.

24 **MR. ROLFES:** The redrumming operation was
25 typically done on every couple of year basis.

1 We do have BZ air sampling data for the three
2 individuals that were involved in redrumming
3 during one of the redrumming operations. That
4 information has been provided to the Advisory
5 Board.

6 **DR. BEHLING:** And that was three
7 individuals?

8 **MR. ROLFES:** Correct.

9 **DR. BEHLING:** And do you have any idea as to
10 how many individuals -- I would assume much of
11 that effort was done by people who were
12 declared as labor pool members of the labor
13 pool. Do we have any understanding as to how
14 many people we might be looking at who were
15 exposed to airborne environments during this
16 redrumming?

17 I mean, that's an awful lot of drums
18 when I consider, for instance, the issue of
19 the 13,000 drums and the number of years it
20 took for the transfer of that material into
21 silos one and two. When we're talking about
22 periodic redrumming, I'm sure we're talking
23 about a significant number of people. Do we
24 have any idea who they were?

25 **MR. ROLFES:** The 13,000 drums of material

1 were the raffinate wastes that were shipped
2 from Mallinckrodt and from Lake Ontario --

3 **DR. BEHLING:** I realize that. I'm just
4 giving that as --

5 **MR. ROLFES:** -- separate operation --

6 **DR. BEHLING:** I realize that.

7 **MR. ROLFES:** If you take a look at the
8 quantities of thorium that were handled on the
9 site, the typical production from the early
10 time period was about a metric ton per day.
11 So it was a very low quantity of material --

12 **MR. RICH:** Less than.

13 **MR. ROLFES:** -- less than a metric ton per
14 day. So I do have some inventory data for
15 some thorium here, and I'd have to take a look
16 at it. But it was typically handled by a
17 small number of people and we do have some
18 breathing zone air sampling results associated
19 with those individuals completing the
20 redrumming operations. So that is something
21 that we will elaborate on in our white paper
22 as well.

23 **MR. CLAWSON:** So, Mark, let me make sure
24 that I'm clear on this. When you're talking
25 about the redrumming process in the white

1 paper coming out, you're going to kind of
2 cover how and what people are covered by that?

3 **MR. ROLFES:** I would suspect if an
4 individual was, in fact, involved in a job
5 where he was exposed to thorium, I believe he
6 would have been one of the individuals that
7 would have been counted by the in vivo lab at
8 Fernald. In the earlier time periods we're
9 going to have to rely on air sampling data to
10 reconstruct exposures from this pathway.

11 **MR. CLAWSON:** Well, the reason why I'm just
12 trying to get my hands around what people were
13 involved in this because I do agree, that's an
14 awful lot of drums to be able to... And I'm
15 just, I'm trying to just figure out how we can
16 (inaudible).

17 **DR. ZIEMER:** How many drums are we talking
18 about?

19 **MR. CLAWSON:** I see here in the
20 (unintelligible) materials have been
21 redrummed, there's approximately 2,000 drums
22 of material. This is just another report.

23 **DR. MAKHIJANI:** There were a lot of thorium
24 drums onsite that involved stored materials
25 because Fernald became a storage site, and a

1 lot of the thorium was not processed there,
2 but it had to be redrummed because the drums
3 corroded.

4 **MR. ROLFES:** That's true.

5 **MR. BEATTY:** Just from the campaign record
6 of 2,000. Silo three was also full of
7 thorium.

8 **MR. CLAWSON:** And I guess I'm looking at
9 this a little bit different, Mark, and I
10 apologize for my ignorance. But a lot of our
11 processes -- we run an awful lot of people
12 through, and I'm just wondering how we can get
13 our hands around what people were going to be
14 covered by this.

15 **MR. ROLFES:** Well, the time period that
16 we're referring to with the Building 64, 65,
17 the thorium storage buildings at Fernald.
18 Thorium was sent from across the entire DOE
19 complex to Fernald beginning in about I think
20 it was 1972. And this is the time period that
21 the mobile in vivo lab was monitoring people.

22 So for an individual that was
23 potentially exposed to airborne thorium, had
24 intakes of thorium, these individuals were
25 likely counted by the mobile in vivo radiation

1 monitoring lab at the site. So there would be
2 information in that individual's file that
3 would allow us to reconstruct in a claimant
4 favorable manner his thorium exposures
5 associated with redrumming.

6 But the mobile in vivo results would
7 be independent of the actual process because
8 we have measurements indicating how much
9 thorium is in the body. But really, you know,
10 how it got there, we can make assumptions
11 about inhalation, ingestion that result in a
12 claimant favorable dose estimate. So the fact
13 is that the data are in the dosimetry files
14 for the individual.

15 **DR. MAKHIJANI:** The thorium in vivo stopped
16 in '78, right?

17 **MR. ROLFES:** No.

18 **MR. MORRIS:** 'Eighty-eight, mobile in vivo
19 monitoring laboratory went through '88.

20 **DR. MAKHIJANI:** Yeah, but for thorium I
21 thought your in vivo only went --

22 **MR. MORRIS:** No --

23 **MR. ROLFES:** That's not the way it was
24 reported.

25 **DR. BEHLING:** The next issue I think is

1 something that perhaps Arjun is more qualified
2 to --

3 **FINDING 4.3-8**

4 **DR. MAKHIJANI:** The fugitive emissions.
5 This came up last time I did cite the memo
6 which is quoted in review and maybe also, in
7 the TBD review and maybe also in the
8 evaluation report. There were quite large
9 fugitive emissions, at least from the
10 qualitative description in the memo. I read
11 it out last time where trays were left in a
12 doorway to dry and then there's a lot of
13 loose, suspended, or suspended thorium in the
14 air both inside and outside the plant. And
15 the atmosphere is described as very dusty.

16 And so not only production workers but
17 others would also have been exposed to
18 thorium. I wondered whether and how you were
19 including them in the model. This doesn't
20 involve just inside the plant. It involves
21 also workers who would have been there
22 outside. I believe the memorandum is in the
23 TBD review. I can try to bring it up. Yeah,
24 it's on page 41 of the TBD review. And it is
25 in relation to thorium metal production

1 housekeeping, and it's from 1970.

2 So this is a period where the actual
3 production air monitoring data, well, the ones
4 that I've seen, were not as high as in the
5 earlier period. But the processing operations
6 were leading a huge -- well, the words
7 indicate large fugitive emissions. There were
8 no numbers that I'm aware of.

9 **MR. ROLFES:** In what form are they? Arjun,
10 are they referring to air dust or are they
11 referring to --

12 **DR. MAKHIJANI:** No, no, air dust. One is
13 probably the worst housekeeping problem in the
14 facility, the (unintelligible) mill equipment
15 leaks at practically every joint. All
16 horizontal surfaces have a thick covering of
17 dust, ventilation is inadequate and so on. So
18 this --

19 **MR. ROLFES:** Is that not referring to
20 uranium though?

21 **DR. MAKHIJANI:** No, it is thorium metal
22 production housekeeping, Ross 1970. And then
23 the same memorandum explicitly talks about
24 thorium tetrafluoride. During operation of
25 removing calcine thorium tetrachloride and

1 calcium fluoride from the retorts. A stack of
2 trays was left standing on a skid near the
3 south annex door. The door is left open to
4 aid in cooling the trays. The wind coming
5 through the doors blows the loose powder from
6 the trays and spreads it generously through
7 the annex, and so on. So I don't know which
8 door this refers to. I'm assuming it's a door
9 between the building and the outside, but it's
10 not explicit here.

11 **MR. MORRIS:** So it spreads it through the
12 annex. That's not out backwards through the
13 door.

14 **DR. MAKHIJANI:** But if the door is to the
15 outside, if it's a door between the inside and
16 out, it's an access door, then it would also,
17 it will be on the outside and non-thorium
18 workers on the inside would also be at some
19 risk.

20 **MR. MORRIS:** There's no doubt about that.

21 **DR. MAKHIJANI:** So this is the problem of
22 fugitive emissions in a period where you're
23 relying on in vivo data, but you may have a
24 lot of workers who were exposed to thorium who
25 don't have any in vivo data because they were

1 not considered to be at risk.

2 **MR. ROLFES:** It's always very possible that
3 an individual was exposed to thorium; however,
4 because we do have mobile in vivo radiation
5 monitoring results for the individuals, we can
6 simply assign a missed intake. Because if an
7 individual was exposed to thorium, and we have
8 indication that he was in a thorium area, we
9 could assign a missed intake of thorium based
10 on his non-positive or positive mobile in vivo
11 results.

12 **DR. MAKHIJANI:** Now these thorium areas are
13 the same plants as the uranium areas. You're
14 talking about a lot of workers, but you
15 indicated that the thorium workers were
16 actually very few. Well, we have to look at
17 your in vivo database to see how many workers
18 are involved in it, and whether workers who
19 were in a particular building were all
20 monitored in the in vivo or not.

21 But it's a question as to how workers
22 who were not designated as thorium workers
23 would be subject to this kind of emission.
24 And how are you going to assign the, how are
25 you going to know to assign a thorium dose to

1 them? Or are you going to assign a thorium
2 dose to everybody?

3 **MR. ROLFES:** We would, based on an
4 individual's mobile in vivo results --

5 **DR. BEHLING:** But he wasn't, that's the
6 point, he was not monitored.

7 **DR. MAKHIJANI:** This gets to another
8 question. Fugitive emissions means workers
9 who were not designated thorium workers were
10 at risk of thorium exposure. If they're not
11 being monitored for thorium because they're
12 not at risk of thorium exposure but are still
13 at some risk of considerable thorium exposure,
14 how would you know they're thorium workers,
15 and how would you know to assign them a
16 thorium dose?

17 **MR. ROLFES:** Everyone that had a mobile in
18 vivo radiation monitoring lab result was
19 monitored for both uranium and thorium.

20 **DR. BEHLING:** But, Mark, that's the point
21 Arjun's trying to make, that not everyone was
22 monitored by the in vivo system, meaning that
23 there will be people who for whom there is no
24 record that they were given chest counts for
25 either thorium or uranium.

1 It may have been a secretary who was
2 obviously considered not at risk who was
3 obviously subject to fugitive emissions but
4 has no record of ever being monitored. How
5 would you know to assign her missed thorium
6 dose based on fugitive emissions? That's
7 Arjun's question.

8 **MR. ROLFES:** That will be documented in the
9 thorium coworker model.

10 **DR. MAKHIJANI:** Who are you going to apply
11 the coworker model to? Are you going to apply
12 it to secretaries? That's the question.

13 **MR. ROLFES:** A secretary certainly does not
14 have the same exposure potential for a
15 chemical operator directly involved with the
16 thorium processing.

17 **DR. MAKHIJANI:** That's not the question.
18 How are you going to determine who was subject
19 to fugitive emissions, and therefore should be
20 assigned a thorium dose? I guess we're not
21 talking to each other.

22 **MR. ELLIOTT:** No, you're not, you're not.
23 You're coming at it, Mark, from what
24 environmental dose is going to be assigned.
25 That's the way we would view it, an

1 environmental dose. And first I'd have to
2 understand to even enter into this what is
3 considered a considerable thorium fugitive
4 emission and whether or not there are enough
5 of those that merits risk.

6 **MR. RICH:** That's the sticking point.

7 **DR. MAKHIJANI:** Well, I agree that that's
8 the key point. I mean we just have, I mean,
9 there may be other documentation. I happen to
10 know of this one. It's from 1970, and it
11 describes a routine operation. This is not an
12 incident. This is a piece of equipment that's
13 leaking and a procedure, there's two things.
14 A piece of equipment is leaking and spraying
15 dust. And an operation that was routine that
16 was used to dry thorium tetrafluoride.

17 So we're talking about operations that
18 were done there as part of their method of
19 dealing with thorium. And so I don't know how
20 long these things were done. I don't know how
21 long this equipment was leaking. That's part
22 of the problem is that we don't have any
23 numbers, but obviously it was a pretty big
24 concern because the surfaces had a thick
25 covering of dust of thorium, that means you're

1 leaking a lot of thorium.

2 **DR. BEHLING:** And also it parallels the
3 issue that identifies those four individuals
4 who had an unexpected high uranium intake.
5 Had, for instance, on behalf of those
6 individuals you're fortunate enough to give
7 annual physicals that included a urinalysis
8 that also looked for uranium in the urine.

9 In which case I believe those four
10 individuals, and we can go back to that
11 particular issue, were obviously identified
12 and identified as unexpected. The point here
13 is that we haven't monitored for thorium; and
14 therefore, we're questioning whether or not
15 they were people who on a parallel level were
16 exposed to thorium. But in this case you have
17 no chance of capturing them as you did in the
18 case of the uranium.

19 **DR. MAKHIJANI:** That's right.

20 **MR. CLAWSON:** Was somebody trying to speak
21 on the phone? We were getting a lot of static
22 there.

23 (no response)

24 **MR. ROLFES:** For the early time period the
25 Battelle model does allow us to assign a

1 fraction of the intake or a fraction of the
2 air monitoring results to a person based on
3 their job category. And if you fold in the
4 Battelle model for individuals that were
5 potentially exposed to non-processing areas,
6 you know, to general background areas or
7 occasional entrants into the plant such as a
8 secretary or something, we default to one
9 percent of the intakes based on air monitoring
10 data for the earlier time period. So the
11 information for the later time period, the
12 more recent time period, can be documented or
13 will be documented in our white paper.

14 **MS. BALDRIDGE:** I have a question. In one
15 of the documents included in the petition it
16 states concerning thorium that there are
17 improperly coded items that at times have
18 exploded and burned. There were large losses
19 into the storm sewer, and that 240,000 pounds
20 of residue was sent to Plant 6 for oxidation.
21 How are you going to determine who would have
22 been exposed during an explosion or a fire
23 concerning thorium? Not only the people
24 assigned to the area but observers, the fire
25 department that may have come to assist in

1 getting this under control. Are these people
2 identified?

3 **MR. ROLFES:** Yes, they are. For example, in
4 1954 when the thorium processes were starting
5 up, there was a very bad incident, an
6 explosion, there was a partial reduction of
7 the thorium in process. Some calcium metal
8 that was used to reduce the thorium was being
9 blended, and there was a little bit of
10 moisture I believe in the materials being
11 blended. The calcium reacted with the
12 moisture and caused a large fire and explosion
13 involving about -- off the top of my head --
14 around 100 pounds of thorium I believe it was.

15 The individuals involved with that
16 incident, two of them died because of the
17 incident because of burns. There were other
18 individuals that came to the first aid of, to
19 give first aid to the individuals that had
20 been burned. There is a very detailed
21 incident report and investigation of this
22 occurrence in Plant 9.

23 There are other documented incidents
24 where there is indication that some thorium
25 sludge or materials contaminated with thorium

1 were burned. And it is documented in
2 documents that we have available to us in the
3 site research database, both the numbers and
4 the names of the individuals that were
5 involved.

6 **MS. BALDRIDGE:** Now my point, there have
7 been other incidents concerning uranium, other
8 locations, where in excess of 20 people have
9 been involved in the incident but only five
10 people had it accounted for in their records
11 because only five people were examined for the
12 uranium excretion levels. Now if they didn't
13 have a practice of even recording all the
14 individuals involved in an incident, how can
15 you be sure that the ones who were recorded
16 are the only ones who had been involved?

17 **MR. ROLFES:** Individuals that were involved
18 in an incident were required to report to the
19 medical office for giving a urine sample.
20 That was part of the procedures that were
21 documented at the site.

22 **MS. BALDRIDGE:** But they weren't always all
23 tested.

24 **MR. ROLFES:** That's not true.

25 **MS. BALDRIDGE:** Well, there's documentation

1 to support my opinion.

2 **MR. ROLFES:** There is, for example, there
3 was a large uranium hexafluoride release in
4 1966 I believe it was. There is a report
5 documenting what happened, what led up to the
6 event of the release, the number of urine
7 samples collected, the number of urine samples
8 tested, et cetera. I believe there were more
9 than 1,200 urine samples taken as a result of
10 this event from I believe in excess of 200
11 people.

12 They did slightly change their
13 procedure because they did not have the
14 capabilities to do as many counts as they
15 typically did. They normally count each urine
16 sample with the barometer in triplicate.
17 However, because of this incident and given
18 the large volume of incident urinalyses, they
19 reduced it to only duplicate counting of the
20 sample.

21 So there was a documented change.
22 However, it appears that all of the urinalysis
23 results were, in fact, counted. All of them
24 that were collected were counted. Now there
25 could have been some laboratory errors

1 associated with that, just like any other
2 operation. There could have been samples that
3 were lost, contaminated samples. Those are
4 all possibilities.

5 **MS. BALDRIDGE:** I just want to make the
6 point that everybody involved in an incident
7 isn't always accounted for.

8 **MR. ROLFES:** It's very unlikely, but there
9 may be an unusual case. However, I haven't
10 seen a case where, now it usually follows that
11 if there's an incident, that an individual had
12 to report to Medical and provide a urine
13 sample. And also --

14 **MR. ELLIOTT:** Was it within the discretion
15 of Medical to say you don't need to give us a
16 urine sample?

17 **MR. ROLFES:** I've never seen such a
18 statement being made or documented.

19 **MR. RICH:** Could I just make a statement?
20 Based on a lot of years of experience at a
21 number of different plants, when you have an
22 incident, that is the time when you actually
23 look at the most likely exposed people, those
24 that are in the immediate vicinity of what
25 happened. You sample those people

1 extensively, and that is (unintelligible).
2 Those are the highest exposed people. There
3 may be people in the building or in adjacent
4 laboratories and if you don't get significant
5 exposures in the initial responders or those
6 that were involved in the initial, you don't
7 sample everybody. It's not necessary.

8 **MS. BALDRIDGE:** I realize that.

9 **MR. RICH:** And so you could have people that
10 said I was there. I was in the building, but
11 I was not sampled, and there's a reason why
12 they weren't sampled because the maximum
13 exposures were bounded by the sampling that
14 was done as a result.

15 **MS. BALDRIDGE:** My point is it's not, when
16 dose reconstructions were done, the
17 information that I received even from the
18 evaluation that SC&A did on the initial way
19 that NIOSH was handling things was that they
20 did not attribute that type of dosage
21 associated with an incident except to the
22 people whose file indicated that they were
23 involved in the incident.

24 In the case where five people were
25 captured and in excess of 20 were involved,

1 only five people's dose reconstructions
2 hypothetically would have included a dose
3 attributed to an incident. The other 15, 16,
4 whatever, would not have been given that dose
5 consideration.

6 **MR. ROLFES:** I think what you may be
7 referring to is our approach that we use for
8 dose reconstructions based on our Technical
9 Information Bulletin 0002. And this is a
10 large intake that we assign to an individual
11 on the first day of his employment as a
12 demonstration of a large and very unlikely
13 exposure to that individual. And this is a
14 gross overestimate of the potential radiation
15 exposures that an individual received, but it
16 is done to provide a timely and quick response
17 for the claim.

18 So typically when we go back and
19 revisit those types of dose reconstructions,
20 the actual dose that the person could have
21 received was typically much lower than what we
22 assigned in our efficiency process. And I
23 believe that may be what you're referring to.

24 **DR. BEHLING:** I think I understand very well
25 what Sandra is taking about, and I fully

1 understand what Bryce was talking about. If
2 you have an incident, and you realize given
3 the circumstances investigative people would
4 look and say among the 20 people who are the
5 five most likely to receive the highest dose.
6 You assess them, and that's fine.

7 And let's assume that for the five
8 highest exposed people they each get assigned
9 100 MAC hours. But you realize there were 15
10 others, and for those five people you will
11 have in their personal files an assignment of
12 100 MAC hours for that particular incidence.
13 But you also realize that there were people
14 who were in the periphery whose exposure may
15 have been half of that. We know reasonably
16 well that their exposure was less than a
17 hundred, but for whom you have no data.

18 And they're not going to be covered by
19 your TIB-0002 because that's strictly used for
20 the estimation of a person's exposure who you
21 know you're not going to compensate. So
22 that's not going to cover that particular
23 issue that we mentioned with Sandra. TIB-0002
24 does not address the issue that Sandra raised
25 here.

1 And that is among the 20 people, the
2 hypothetical case of 20 people involved in the
3 incident, five were assessed. Five people
4 have in their personal records information
5 that would allow a dose reconstructor to take
6 into consideration that radiological incident.
7 But the other 15 whose exposures were less
8 than those five for whom data is available
9 have no data, and therefore, will not have any
10 reference or no accounting for that particular
11 incident. I think that's an issue.

12 **MR. RICH:** Could I just add a comment to
13 what you said? And that is that typically in
14 an incident of this kind you sample people
15 until you get results approaching nothing
16 detected. In other words if you sample people
17 in the immediate vicinity and you get -- and
18 normally it's recorded in (unintelligible)
19 recording of CEDE, which is cumulative
20 millirem dose, if you get down into the levels
21 at which you cannot see them, then you don't
22 sample everybody else. If it's less than 100
23 millirem or something like that.

24 **DR. BEHLING:** I would buy into that, but in
25 the case I think that Sandra pointed out, it

1 may involve some things such as uranium
2 hexafluoride, a very soluble or relatively --
3 yeah, hexafluoride, a very soluble material.
4 And if when you sample the five maximally
5 exposed individuals that you assume were
6 maximally exposed, by the time you get the
7 data back, you may not have any chance to re-
8 sample the people who are at the periphery.
9 So that you can't do this on a concurrent
10 basis.

11 **MR. RICH:** But you know you can take that
12 maximum release of uranium hexafluoride
13 whether the visible cloud that went for long
14 periods of time, it is sampling (inaudible).
15 Everybody in the plant was potentially
16 exposed.

17 **DR. BEHLING:** Yes.

18 **MR. RICH:** And so they sampled to the point
19 where they were assured that no one else, at
20 least the exposures would be below permissible
21 or detectable levels.

22 **DR. BEHLING:** But what you're saying is the
23 fifth person that would have been sampled in
24 this hypothetical case of 20 individuals,
25 would represent a value between not

1 detectable.

2 **MR. RICH:** Yes.

3 **DR. BEHLING:** But you wouldn't know that
4 until you get the sample back, would it? All
5 five had very, very high exposures, and now
6 it's days later and you're looking at it and
7 saying, oh my god, those other 15 probably had
8 a high dose. It's kind of late in the day to
9 worry about this.

10 **MR. MORRIS:** There are other indicators,
11 too.

12 **MR. SHARFI:** From the dose perspective, if
13 they sample them later all you're going to end
14 up doing is increasing your minimum detectable
15 dose. So they did have a routine program so
16 even if they didn't do an instant
17 (unintelligible) sample, they do have a
18 routine program that if it was a, by extending
19 out the bioassay to anything longer, it just
20 ends up from our program's perspective
21 assigning larger doses.

22 So if their routine would have been
23 positive, which would likely be due to the
24 incident that is not in the record, you would
25 have to, you would do bits which would result

1 in very large doses. So the end people who
2 were associated with instant samples would be
3 easier to bound on a much smaller dose level
4 than the people who are much farther out, and
5 you're relying on their routine samples. So
6 this might go more towards your completeness
7 of data question of does everybody have
8 bioassay data. And if they do, if they
9 weren't captured under the incident main
10 (unintelligible), they still have monitoring
11 data that we can base the dose on.

12 **DR. BEHLING:** Well, I agree to a certain
13 extent that even a year later if you have a
14 monitored individual, and there's evidence of
15 an exposure, but then you have to make a
16 decision is this chronic exposure or was this
17 a year ago during the episodic event. And the
18 two are quite different.

19 **MR. ROLFES:** I'd like to read this into the
20 record. It's titled, "Bioassay Aspects of UF-
21 6 Fume Release". And it's NLCO-986. And this
22 is in regards to the incident that I was
23 referring to. There are some things that I
24 thought were worth mentioning.

25 There's indication that, let's see,

1 "all employees were instructed that if they
2 had noticed any peculiar odor or had any
3 reason to believe they may have inhaled some
4 of the material, they should report to the
5 dispensary. All involved in emergency actions
6 were also asked to report to the dispensary.
7 Urine samples were collected from all these
8 individuals within a few hours of the
9 incident. Follow-up urine samples were
10 collected at the beginning of the workday for
11 several days after the incident."

12 The activities in the bioassay
13 laboratory. "There was no need for evacuation
14 of the Health and Safety Building since it and
15 the site of the UF-6 release are on opposite
16 ends of the project. Most of the personnel at
17 the bioassay lab continued their routine
18 duties during the release. Urine samples
19 began arriving soon after the release was
20 stopped.

21 "During the week following the
22 incident, 280 employees and four visitors
23 submitted 1,024 urine samples which were
24 analyzed for uranium by fluorometric
25 technique. In the usual procedure samples are

1 analyzed in triplicate and only (sic) one
2 technician can analyze 60 to 80 samples per
3 eight-hour day. Because of the large sample
4 load and the need for rapid analysis, the
5 procedure was changed to duplicate analyses."

6 It goes on to say regarding the
7 results, "six employees voided urine samples
8 in which the uranium concentration exceeded
9 one milligram per liter. Their exposures and
10 results are briefly discussed below. No
11 albumin was found in any of the samples from
12 these employees. There was no clinical
13 evidence that any employee suffered damage as
14 a result of this uranium exposure.
15 Elimination of uranium was rapid. During the
16 first few hours after exposure the biological
17 half-life for most employees was four-to-six
18 hours. After 24 hours most employees were up
19 to their pre-incident level."

20 And it goes on to various case studies
21 of the highest exposed individuals associated
22 with this. So I thought it was important.

23 **DR. BEHLING:** It dramatizes the exact point
24 I'm making, and I'm not sure when that
25 particular incident took place. But the

1 situation that Sandra discussed may have
2 occurred many years earlier. When was that
3 particular incident?

4 **MR. ROLFES:** This was from, let's see, it
5 was 1966 is when it occurred. It was on, I
6 believe, Valentine's Day.

7 **DR. BEHLING:** There were certain incidents
8 involving a high exposures to uranium
9 hexafluoride in the '50s. And again, the
10 question is if you postponed monitoring people
11 that you retrospectively realize should have
12 been monitored based on your biological half-
13 time for excretion, you may miss the point in
14 time when you have a data point that is really
15 something that you want to look at.

16 And it addresses her issue saying that
17 you may have incidents in early years where
18 you only chose to monitor the maximally
19 exposed individual who then have records for
20 that incident, but not monitored people who
21 were more at the periphery but still were
22 significant exposures. For them you have no
23 data. And I think that's the central issue.

24 **MR. RICH:** However, Hans, the normal
25 sampling procedure was after a weekend off;

1 they normally sampled for long-term deposition
2 and excretion as opposed to the initial
3 (inaudible). So immediate sampling in
4 response to an incident they deliberately
5 looked for a maximum credible to have more
6 sensitive, but to delay a few days would not
7 hamper the total dose reconstruction.

8 **MR. CHEW:** I don't want to get into a long -
9 - your question really kind of poses really a
10 generic question if you really think about it.
11 And you've got to look at the practices. When
12 you have an incident where more than just
13 indicators (unintelligible) and we know that
14 from the practice of just looking at the
15 bioassay data. That the monitoring itself,
16 the air sampling itself, the contamination
17 levels, and so you know as an Operational
18 Health Physicist who the right people should
19 have been initially monitored. And if you
20 have a bioassay result come back or it's just
21 your indicators and you know the extent of the
22 incident itself tells you who you should
23 really be monitoring. And so there's a lot
24 more than the question, gee, I just monitored
25 five people who were closest.

1 **MR. RICH:** Even the area of contamination
2 gives you the boundary.

3 **MR. CHEW:** You have to give some credit to
4 the Safety people and the Operational people
5 who say, yes, we feel comfortable we have
6 adequately monitored all of the right people
7 that had potentially a significant exposure
8 due to this incident, okay, just a generic
9 question.

10 **MR. ROLFES:** There is discussion of the
11 urine sampling program that's well documented.
12 I don't know what site research database
13 document number this is, but it does describe
14 the sampling frequency and procedures for the
15 individuals for different work places.

16 **FINDING 4.3-9**

17 **DR. BEHLING:** The next finding is 4.3-9 on
18 page 92, and it just addresses the issue of
19 internal exposures that may have entered the
20 body by way of ingestion as opposed to the
21 more common pathway of inhalation. And we
22 bring this up mainly because of all of the
23 documentation that alludes to poor engineering
24 designs, poor ventilation systems, high
25 airborne concentrations, the lack of training

1 of personnel, the lack of anti-cees and other
2 measures that might have mitigated internal
3 exposures by way of careless handling. And so
4 this particular issue focuses on the ingestion
5 of thorium as a potential exposure pathway
6 that at this point we're uncertain as to how
7 that will be addressed.

8 **MR. ROLFES:** Ingestion intakes of thorium
9 will be based upon information documented in
10 the Battelle model.

11 **DR. MAURO (by Telephone):** Mark, this is
12 John Mauro. With regard to the Battelle
13 ingestion model, that's one of the areas that
14 we did have quite a bit to say. So I guess
15 regarding basically the Battelle model recent
16 TBD-6000 -- I assume 6001 is similar -- was
17 based on a methodology that pre-dated the
18 latest protocol that you folks have developed
19 and applied for Bethlehem Steel.

20 So one of our commentaries on 6000 is
21 that that method probably has certain
22 deficiencies. Whether or not this issue then
23 becomes something that we would transfer over
24 to the ingestion model, you know, because that
25 is a cross-cutting issue, and I believe what

1 was used in Battelle was the generic approach
2 that has been used across the board. But that
3 approach has, in fact, been significantly
4 modified with the method that was adopted for
5 Bethlehem Steel.

6 **MR. MORRIS:** This is Bob Morris. I think
7 that that's true, John. And if I recall your
8 comments, you actually analyzed the impact of
9 that change very closely, didn't you?

10 **DR. MAURO (by Telephone):** Yes, we did.

11 **MR. MORRIS:** And my recollection of that is
12 that depending on whether the new model
13 applies or the older model applies the answer
14 is still consistent within a factor of 50
15 percent. Is that --

16 **DR. MAURO (by Telephone):** I'd have to go
17 back and quantitatively, but I remember we did
18 have quite a bit of commentary on the Battelle
19 model and tested it against the, compared it
20 to the Bethlehem Steel. And there was some
21 differences, but I guess what I'm saying is
22 that we have engaged this issue extensively,
23 and it's really a generic issue that's cross-
24 cutting.

25 **MR. MORRIS:** That's right, and we have no

1 objection to following the lead that has
2 developed on this. My point here is that it
3 probably is just a parameter that's in the
4 equation. It's not the equation itself. And
5 also the ingestion pathway provides relatively
6 low dose compared to inhalation.

7 **DR. MAURO (by Telephone):** Oh, I agree with
8 that completely.

9 **MR. MORRIS:** Okay.

10 **DR. BEHLING:** The next issue of 4.3-10 --

11 **DR. ZIEMER:** Where are we leaving this one,
12 4.3.9?

13 **MR. CLAWSON:** Well, I was going to ask a
14 question. So have we reviewed this OTIB?

15 **DR. ZIEMER:** Is this covered by the
16 independent review of the Battelle model or --

17 **DR. BEHLING:** SC&A reviewed the 6000 OTIB.

18 **MR. MORRIS:** It's the Battelle Technical
19 Basis Document 6000.

20 **DR. BEHLING:** And if that's to be applied
21 we'll have to look at that again to be sure
22 that that's something that's --

23 **MR. MORRIS:** It's the subject of a
24 Procedures working group right now, and SC&A
25 has provided comments on it. And I think it's

1 in the process of being considered. So my
2 suggestion is to take it in that form where
3 it's already on the agenda.

4 **MR. GRIFFON (by Telephone):** The only thing
5 is this might be the more pressing --

6 **MR. HINNEFELD:** I would prefer -- this is
7 Stu Hinnefeld. I would propose that Brad talk
8 to Wanda, and they decide between them which
9 forum to solve it in because I don't know that
10 this work group wants to be held hostage to
11 the schedule of the Procedures working group.

12 **MR. ELLIOTT:** Or vice versa.

13 **DR. ZIEMER:** Or vice versa.

14 **MR. HINNEFELD:** I mean, this is a little
15 more, this specific for a site and it may be
16 better to resolve that one in this forum than
17 in a different --

18 **DR. ZIEMER:** Than in the Procedures group.

19 **MR. HINNEFELD:** Right.

20 **MR. CLAWSON:** I guess I'm still kind of at a
21 loss what to be able to do on an action on
22 this. I guess we need to be able to look at,
23 I guess I'd have to talk to SC&A about this.
24 How do we want to proceed on this one?
25 Because John's made a comment that this is

1 something that they were --

2 **DR. BEHLING:** I would say this. Since we
3 have no empirical data such as fecal analysis
4 which would give us some handle as to whether
5 or not the ingestion pathway was a significant
6 contribution to internal exposure, we're going
7 to have to rely on a generic model and the
8 Battelle-6000 may be your option for making a
9 default model that can be applied here. But
10 at this point we haven't looked at it to be
11 sure that that's the reasonable alternative
12 for dealing with the unknown of ingested
13 thorium.

14 **DR. ZIEMER:** Well, I'm trying to recall, and
15 maybe John will remember, John, does the
16 Procedures group have the SC&A comments on --

17 **DR. MAURO (by Telephone):** Yes, it does, but
18 it was transferred to the, in other words as
19 you recall in the Procedures group, whenever
20 we came across an ingestion pathway issue such
21 as we are doing right now for this case, for
22 this site, what we did in the Procedures group
23 was transfer it to a global issue. Namely,
24 right now the ingestion model is the subject
25 of a generic, complex-wide OTIB that's being

1 in preparation.

2 And so designate it as, okay, we're
3 not going to address it in the Procedures.
4 It's being transferred over as a global issue.
5 Now this brings up an interesting question.
6 That's certainly appropriate in the Procedures
7 group where we have the luxury to do that.

8 In this particular case here we have
9 an SEC and time is important. Perhaps the
10 appropriate thing to do at the next meeting is
11 to look at the comments -- well, I guess it's
12 a two-step process.

13 One is apparently the TBD-6001 has
14 adopted the same methodology in 6000. We'll
15 operate on the premise, TBD-6000. Two, it's
16 probably a good idea to make sure that, okay,
17 the comments that were made related to TBD-
18 6000 that SC&A made, is there anything about
19 this particular circumstance now at Fernald
20 that is, you know, the comment also applies
21 here and in the same way.

22 There may be something about the
23 circumstances of exposure at Fernald whereby
24 the methodology in 6000 may or may not be
25 applicable. But assuming it is, okay, now I'm

1 taking it now the third step would be, okay,
2 we all agree then that the comments on TBD-
3 6000 have applicability here. Then the
4 question becomes let's resolve that here
5 whereby we look at the comments, explore the
6 significance of the comments that SC&A made.

7 And then at that point, of course,
8 NIOSH could either say, yes, we agree with
9 those comments, and we will revise the
10 methodology in accordance with those comments
11 which by and large say we like Bethlehem
12 Steel, but we don't like TBD-6000. Now the
13 magnitude of that difference as pointed out
14 previously might be relatively small. I'm not
15 quite sure. But it seems to me that's a path
16 forward to resolve the issue here in a timely
17 fashion.

18 **DR. BEHLING:** John, I haven't looked at the
19 Battelle model but and just a quick question,
20 is that model linked to something such as air
21 concentration, surface concentration,
22 (unintelligible) ingestion?

23 **DR. MAURO (by Telephone):** Yeah, it's an
24 improvement over the old deposition velocity
25 approach and then the assumption that ten

1 percent -- I don't want to get into it.
2 There's a lot of structure to it. There
3 really were multiple developments of the
4 ingestion model. One was the original method
5 which we had some serious concerns about
6 because we didn't think it was scientifically
7 valid. Eventually all of those concerns were
8 resolved in the Bethlehem Steel site profile.

9 And now in this TBD there is another
10 method which I would say is some place in
11 between the method that originally was
12 developed and the method that was developed
13 for Bethlehem Steel. So it's an improvement
14 over the original one that we had some serious
15 concerns with, but it's still somewhat
16 different and less claimant favorable than the
17 Bethlehem Steel method.

18 And I believe that NIOSH right now is
19 in the process of perhaps formalizing the
20 Bethlehem Steel method as an OTIB that would
21 have cross-cutting operability everywhere.
22 And my sense would be when and if that occurs,
23 it would also be applied here to the TBD-6000,
24 -6001 documents.

25 But again as I mentioned I don't think

1 we have the luxury to wait for -- I don't
2 know. This is certainly your call -- to wait
3 for that or should we try to deal with that at
4 this time? That, of course, would be, the
5 only problem with that is that we'd be moving
6 ahead of the global investigations.

7 **MR. GRIFFON (by Telephone):** Well, my sense
8 is -- this is Mark. My sense is let's have an
9 action item that says SC&A to review TIB-6001
10 for application to Fernald workers. I can't -
11 - and we can coordinate with Wanda. I mean
12 I'm on the Procedures work group also so we
13 can coordinate with that group. But I don't
14 think we want to hold up an SEC work group for
15 a Procedures, you know.

16 **MR. ELLIOTT:** This is Larry Elliott. If I
17 can offer another suggestion. You have Mark's
18 suggestion, Mr. Chairman. It seems to me that
19 without Jim Neton here I'm at a disadvantage.
20 I don't know where he's at on this across the
21 complex ingestion model. But I do know that
22 we liked the Bethlehem Steel approach.

23 I'm a little bit concerned about where
24 TBD-6000 leads us and whether or not it's the
25 right one or not. And we need to think

1 through that. I think it needs to be NIOSH
2 that comes forward with what we're going to do
3 on Fernald and ingestion and which model we're
4 going for and then you can mac (ph) to that.
5 Does that take anything away from you, Mark?

6 **MR. GRIFFON (by Telephone):** No, no, no. I
7 thought the decision was made that you were
8 going with TIB-6001, so I was starting there.
9 But if you --

10 **MR. ELLIOTT:** I'm asking Mark Rolfes if it
11 helps him or not or it hurts him.

12 **MR. ROLFES:** We have documented right now
13 that in the matrix that our approach will be
14 to rely on the Battelle model. NIOSH does
15 have a separate technical information bulletin
16 on ingestion pathways as well. So we haven't
17 finalized the methodology, and our finalized
18 methodology will be in our thorium white
19 paper.

20 So we did not believe that this was an
21 SEC issue but rather a dose reconstruction
22 issue as to how much we are assuming a person
23 ingests rather than inhaled. So typically for
24 most organs for which we complete dose
25 reconstructions, the inhalation pathway

1 results in a higher dose.

2 **MR. GRIFFON (by Telephone):** And, Mark, I
3 was actually going to add on that it may be in
4 the course of SC&A reviewing your model, now I
5 guess I'll take back that action because maybe
6 it's SC&A reviews the approach described in
7 the white paper. I thought you were saying
8 TIB-6001 was one.

9 Anyway, it may be that this is a site
10 profile issue once they do that review, and we
11 don't have to close on TIB-6001 if that's the
12 model. We could just examine it enough to say
13 clearly the data's there. They have
14 sufficient data to bound, and we don't need to
15 know exactly the how's and particulars for the
16 SEC process. And the rest can go back to the
17 Procedures work group review, and it becomes a
18 site profile issue more than an SEC issue.

19 **DR. ZIEMER:** Well, then it would await the
20 white paper still so that you would tell us
21 what direction you're going and then --

22 **MR. ROLFES:** That probably would be the
23 best.

24 **DR. ZIEMER:** So it becomes a white paper
25 issue right at the moment.

1 **MR. ELLIOTT:** So it's back in our lap.

2 **MR. GRIFFON (by Telephone):** So it's back
3 with NIOSH with the white paper.

4 **MR. ELLIOTT:** Tell you which way we're
5 going. It bothers me that I don't know why we
6 would have a variety of ingestion models out
7 there unless they're circumstance driven and
8 so we need to look at that. And I don't know
9 if Mark and his folks have talked to Jim Neton
10 about this specifically, but I think we need
11 to make sure that Jim's included in this
12 discussion so that we can move forward. So
13 I'd ask that it be put back on NIOSH's
14 shoulders to deal with here.

15 **MR. CLAWSON:** Okay, and as soon as we know
16 then we can address it and go from there.

17 Hans.

18 **FINDING 4.3-10**

19 **DR. BEHLING:** Yeah, the next one is 4.3-10,
20 and I'm not sure with Dr. Wade's commitment,
21 are you, can you stay for a few more minutes
22 before we break for lunch?

23 **DR. WADE:** Sure.

24 **DR. BEHLING:** So let's maybe try to go
25 through 4.3-10, and then hopefully that will

1 bring us into our lunch hour, and we can take
2 a break.

3 But the issue of an unanswered
4 question regarding data integrity, there's two
5 elements to that. In this one, we didn't go
6 through it extensively, but we do have one
7 affidavit that was provided by a member of the
8 team of hygienists who was there to assess
9 obviously the work environments by air
10 sampling, and he had some disparaging comments
11 to make about some of the protocols and things
12 that he felt were inappropriate, and obviously
13 you may want to read that.

14 That's provided as an Attachment 4.3-
15 10. It's the sworn affidavit by a person, and
16 he goes through a whole series of things that
17 lead one to question to what extent was the
18 program that was designed to protect the
19 workers compromised by overzealous management
20 who was more concerned about maintaining
21 production quantities over worker health. And
22 you can draw your own conclusions.

23 In addition to this particular one
24 which clearly does affect the individual
25 workers, there were some other outstanding

1 issues that Arjun had identified in his TBD
2 that go beyond the working environment
3 necessarily to perhaps other indiscretions
4 that involved the use of not counting samples
5 that involved stack monitors and elsewhere.
6 And I'll let Arjun talk about those
7 separately.

8 **DR. MAKHIJANI:** Well, the stack monitor
9 samples that were not counted were I think in
10 the '69 to '81 period or '68 to '81 period.
11 We were talking about that at the break. This
12 problem is cited in the petition along with
13 some documentation if I remember right, Sandy.
14 And I believe the person involved who made
15 that decision to not count them regularly and
16 entered zeros even when they were not counted
17 actually has acknowledged that that was done.

18 So long as NIOSH is relying on -- this
19 is an issue that concerns directly
20 environmental dose. So long as NIOSH is
21 relying on the national lead environmental
22 dose data that was a problem. But I
23 understand NIOSH is now relying on the John
24 King environmental dose model.

25 **MR. ROLFES:** I'd like to clarify. The most

1 important piece of information is the
2 urinalysis data --

3 **DR. MAKHIJANI:** I understand that.

4 **MR. ROLFES:** -- in the person's file.

5 **DR. MAKHIJANI:** But environmental dose is
6 assigned to people who don't have urinalysis.

7 **MR. ROLFES:** For a small fraction, a very
8 small fraction of the workers at Fernald may
9 not have had urine sampling results. If we
10 have reason to believe that they were exposed
11 to airborne uranium of significant amounts we
12 are going to be using a coworker intake model
13 for those individuals.

14 **DR. MAKHIJANI:** Okay. The other question
15 that arises, I think maybe, Sandy, you raised
16 this so maybe you want to state the issue in
17 that regard.

18 **MS. BALDRIDGE:** Concerning the accuracy --

19 **DR. MAKHIJANI:** Well, reliance on data and
20 documents for use by a particular individual.

21 **MS. BALDRIDGE:** At the last meeting it was
22 brought up that the environmental portion of
23 the technical basis document was almost
24 finished. And my concern is whether they used
25 the same references that this individual in

1 question provided for the revised document as
2 was for the original, the one that the
3 individual acknowledged not looking at certain
4 data before they even wrote the report.
5 Without mentioning names, do you have any idea
6 what I'm talking about?

7 **MR. ROLFES:** I'm not exactly sure what
8 you're referring to.

9 **DR. WADE:** Is there a reference cited? I
10 think you can mention that.

11 **MS. BALDRIDGE:** There were several
12 references cited from Mr. Bobeck (ph) that
13 were used in the original environmental
14 portion of the technical basis document. The
15 deposition that he gave at the trial. Before
16 the trial he indicated that zeros had been put
17 into the data in lieu of actual measurements
18 which affects the credibility of the data used
19 in the environmental doses based on stack
20 releases.

21 I'm hoping that anything that would
22 have his name attached to it either directly
23 or other documents that might have used him as
24 a reference would be eliminated from
25 consideration for the revised environmental

1 portion of the new technical basis document.

2 **MR. ROLFES:** We will not be eliminating his
3 input because it has been very valuable to us.
4 We have spoken with him in great detail
5 actually in previous meetings to get a better
6 picture of workers' exposures, effluent of the
7 site. We do have documented interview notes.
8 I haven't made them available yet to the
9 Advisory Board members but documented probably
10 -- what, about maybe five hours speaking with
11 him? So we have about 30 pages of notes of
12 interviews with him. And we can --

13 **MS. BALDRIDGE:** Do you have notes of what he
14 did while he was there to know where he
15 actually applied data and where he didn't
16 apply data?

17 **MR. ROLFES:** I would have to ask Jim --

18 **MS. BALDRIDGE:** Or his recall from his
19 recollection?

20 **MR. ROLFES:** We can take a look and see what
21 it is exactly that's being referred to, and we
22 can consult with him to help in clarification.

23 **MS. BALDRIDGE:** Because Arjun had mentioned
24 like from 1968 through '81, well, that's, you
25 know, 12 years. I would just question unless

1 he actually had notes that he could rely on,
2 anybody's ability to remember, but why they
3 put a certain number down at any particular
4 time during a 13 year timeframe.

5 **MR. ELLIOTT:** Yeah, but your point is you're
6 questioning how we're going to handle the
7 testimony that Mr. Bobeck (ph) gave at the
8 trials in regard to the documentation that his
9 name is associated with elsewhere.

10 **MS. BALDRIDGE:** Right.

11 **MR. ELLIOTT:** That's what your point is,
12 okay. It's something we will look at.

13 **DR. BEHLING:** And let me go back in the
14 context with the discussion about this
15 individual. I think that the affidavit that I
16 included as Attachment 4.3-10, I think we
17 briefly touched on it the last time. And,
18 Larry, you mentioned that this individual you
19 hired yourself.

20 **MR. ELLIOTT:** I did not hire him.

21 **DR. BEHLING:** Or NIOSH hired him.

22 **MR. ELLIOTT:** I worked with him.

23 **DR. BEHLING:** But I think your comment if I
24 can recall was that he was a credible
25 individual.

1 **MR. ELLIOTT:** Yes.

2 **DR. BEHLING:** And his comments are very
3 strongly worded comments. And a person who
4 was there, he's not a bystander. He's not
5 looking at this from the viewpoint of a
6 distant observer. He's not a person that I
7 would define as a person with an axe to grind
8 who has malice on his mind.

9 I have to look at this and question,
10 therefore, to what extent was this whole
11 process more pervasive than we're willing to
12 admit, that it may have involved other
13 industrial hygienists who should perhaps be
14 looked at or contacted to see if they have
15 similar stories to talk about or present in a
16 sworn affidavit and let's go back.

17 After all, we are going to be using
18 air monitoring data exclusively for thorium
19 intakes prior to '65, '68. And for us to look
20 at that data and say it's credible requires us
21 to have some feeling or assurance that we're
22 not looking at data that has been manipulated
23 as he implies in his affidavit.

24 **MR. ROLFES:** Well, the affidavit was
25 referring to a uranium process area, Plant 5,

1 I believe, which our dose reconstruction
2 approach for reconstructing uranium exposures
3 would rely primarily on urinalysis data. So
4 it really wouldn't be an issue for a uranium
5 exposure. But for thorium it could be if this
6 was a pervasive and commonplace practice.

7 However, based on interviews with
8 industrial hygienists from Fernald this was
9 not a pervasive practice. Industrial
10 hygienists were told to sample the highest
11 areas where a person could potentially be
12 exposed. They were trying to collect samples
13 that were representative of the individual's
14 breathing zone. They were taught to resample
15 high areas. So when there was a high
16 exposure, that attracted much more attention.

17 There was nothing in the affidavit
18 that I saw that indicated that the high air
19 sample results were destroyed. It actually
20 appears that there were approximately six high
21 air samples followed by one low one that was
22 taken to satisfy the individual's supervisor.

23 **DR. BEHLING:** Which one is the sample of
24 record?

25 **MR. ROLFES:** All seven.

1 **DR. BEHLING:** Is that a fact?

2 **MR. ROLFES:** It appears to be. There was no
3 indication that the information had been
4 altered in any way.

5 **DR. BEHLING:** Well, you may log, or you may
6 identify six or seven air samples and then
7 decide, well, this one's the one that we're
8 going to put into the records as the one that
9 is credible, perhaps not worry about the other
10 six that we didn't agree on were reasonable
11 samples (inaudible) here.

12 **MR. ROLFES:** That's not accurate. If you
13 take a look, they're all air sampling
14 datasheets, industrial hygiene datasheets. It
15 has multiple results typically from the same
16 operation in various times as you had alluded
17 to before. And all those sample results were
18 in fact recorded. So all of them would have
19 become part of the record.

20 **DR. BEHLING:** It's hard for me to accept.
21 As I said, he doesn't go into any detail. He
22 does not talk about the destruction of sample
23 data, but the implication is that perhaps they
24 were not documented.

25 **MR. CLAWSON:** Well, the one statement right

1 here, "on several occasions during the term of
2 my employment I got air dust sample results
3 that were above the MAC. I was told by my
4 supervisors that the results were in error. I
5 was told to go back and resample."

6 **MR. ROLFES:** But it did attract additional
7 attention because they didn't expect the air
8 concentrations to be as high as what was
9 recorded. So time and time again the
10 individual was sent back into the work area to
11 resample because they did not believe the air
12 samples could have been that high. There's no
13 indication that the high air sample results
14 were deleted from the record or ignored. They
15 attracted additional attention so that they
16 could reduce the exposure in the workplace to
17 the people.

18 **DR. BEHLING:** When you have multiple high
19 values, you have to start to become a believer
20 and not keep sending the guy back. I have a
21 very different opinion that is not consistent
22 with your opinion. But I would certainly in
23 context with what was said previously about
24 the air emissions into the off-site or the
25 stack monitors, I would certainly want NIOSH

1 to perhaps contact this guy and clarify some
2 of these issues. What was done with these
3 high sample results? Were they discarded?

4 **MR. ROLFES:** No.

5 **MR. ELLIOTT:** He's no longer with us. He
6 passed away.

7 **DR. BEHLING:** Oh, he's passed away. I guess
8 we forfeit that option.

9 **MR. CLAWSON:** And for us to be able to say
10 what was done with these samples I think would
11 be questionable, too. Because there's only
12 one person that can tell us, and
13 unfortunately, he's not with us.

14 **DR. MAKHIJANI:** Brad or Mark or working
15 group, I mean, just in terms of what we are
16 doing. Do we await, is NIOSH addressing this
17 in the white papers and then we look at it or
18 we are supposed to -- I'm unclear as to
19 whether, who's doing what at this stage.

20 **MR. GRIFFON (by Telephone):** Yeah, I was
21 just going to ask for 43-10, I thought I heard
22 Larry offer a response to Sandy for an action
23 or follow up, and I might have missed
24 something. Do we have an action on this item,
25 4.3-10 for NIOSH to follow up on something?

1 **MR. ELLIOTT:** Well, I committed to Sandy
2 that we would consider her comments or
3 suggestion that this one individual's offering
4 and reference material may be compromised by
5 what he offered in testimony in a trial
6 situation. That's what I committed to.

7 On this particular point that we're
8 just discussing, however, I think what I'm
9 hearing Mark say is that we feel we have this
10 information for consideration in what we do.
11 We didn't lose any data here. We have it. We
12 had the testimony prior to it being included
13 as part of the documentation in a petition.
14 So we have, you're not the first ones to read
15 this information from this one individual. We
16 had it before the petition was presented to
17 us.

18 So, is that correct, Mark?

19 **MR. ROLFES:** Yes, correct.

20 **MR. ELLIOTT:** We feel we do have the data
21 that is mentioned in this affidavit that was
22 submitted by this one individual.

23 **MR. ROLFES:** He does not document exactly
24 what time period and what air sample numbers
25 these were that he was referring to. However,

1 we do have air sampling data associated with
2 this individual, this industrial hygienist.

3 But furthermore, I'd like to reiterate
4 that for the process where he was collecting
5 the uranium air samples, we would not be
6 relying on uranium air sampling data to
7 reconstruct an individual's dose. We would
8 rely on their bioassay data.

9 **MR. ELLIOTT:** And I would further that to
10 say that we have, I believe we've not run
11 across information that tells us that there
12 was a pervasive set of actions here that need
13 to be accounted for in how we go about doing
14 dose reconstruction. Yes, we have this one
15 source of concern that's provided, and we've
16 looked at that. But we don't see in a broad
17 sense of all the information that there's a
18 pervasive problem.

19 **MR. ROLFES:** Correct.

20 **DR. BEHLING:** I do have to, not to beat a
21 dead horse, but when I read the statement,
22 "when I got the air dust survey results that
23 were above the MAC, I was told by my
24 supervisor the results were in error." The
25 question is would you record a result that

1 your supervisor said was in error?

2 I mean, wouldn't you accept the fact
3 that your supervisor knows more than you do or
4 he has authority over you. And when he says
5 you did something wrong, would you necessarily
6 record something that your supervisor tells
7 you is in error? My gut feeling is you would
8 not.

9 And what he says is that when he
10 reversed himself, and his back was to the flow
11 of the air, he would get the much, much lower
12 air concentration readings on his air sample.
13 And that became the correct value.

14 Now I have a difficult time in
15 accepting the notion that in this case when he
16 said five or six times he had high dose and
17 then he gets the low dose that all the samples
18 for that particular assessment were, in fact,
19 documented and are part of the record. If
20 someone says to me you made an error here, I
21 would say, well, thank you very much. If I
22 believe him, I would probably discard those
23 data and probably rely on the one data that's
24 obviously acceptable to a supervisor. And
25 this is my opinion.

1 **MR. GRIFFON (by Telephone):** Yeah, my
2 opinion, Mark, is I agree with what you said
3 about the fact that you're not relying on the
4 air sampling for the uranium. I guess this
5 finding speaks more to the overall data
6 integrity question.

7 And I wondered if as a follow up, you
8 know, sometimes these Health and Safety
9 reports or Health Physics reports that we
10 talked about have summary stats including
11 number of samples greater than a MAC value or
12 number of, you know. I wonder if some of
13 these summary reports would, during that time
14 period or if they're available, would possibly
15 shed some light on this.

16 In other words if it shows a number of
17 values greater than the MAC consistent with
18 this guy's sampling, then actually that
19 supports your argument that not only did he go
20 in and measure all these high values, they
21 were translated into the quarterly report. I
22 guess that would corroborate the fact that,
23 yeah, it would support that those measurements
24 were not just discarded and the low one was
25 recorded.

1 I guess that's the question. It
2 speaks to the data integrity. We know that
3 you're going to rely on urinalysis, but this
4 speaks to data integrity and just trying to
5 think of a way to close it out. And one way
6 might be to examine the quarterly report
7 during that time period.

8 **DR. BEHLING:** And, Mark, I don't, I mean,
9 I've looked at enough data to realize that
10 there were plenty of air sampling for uranium
11 and for thorium where the air concentrations
12 were very high. And so you can look at those
13 and say, see, they recorded high air samples.

14 But there may be selective incidents,
15 and I suspect that in some instances these
16 measurements that we're talking about or that
17 this hygienist is referring to may have come
18 as a result of modification to the plant.
19 There were so many memoranda that I looked at
20 where there was a consistent effort to improve
21 the engineering controls regarding ventilation
22 systems.

23 And I'm sure that there have been
24 attempts where perhaps some effort was made at
25 some significant cost and perhaps slowing

1 production where there were changes made to
2 ventilation systems and other things and the
3 expectation was, oh my god, yeah, this is
4 really going to improve or reduce the air
5 concentrations, improve the working
6 environment, and it turns out it didn't quite
7 meet their expectation.

8 And perhaps this particular effort
9 here that we're talking about here was not so
10 much directed against cheating someone out of
11 an air dose or intake, but to somehow or other
12 to cover your butt with regard to having
13 invested a tremendous amount of money, stopped
14 work, introduced a lot of things involving
15 ventilation systems and changes in work
16 practices without no real significant benefit
17 after the fact. And I suspect that this might
18 be just one of those cases.

19 **MR. ELLIOTT:** Another possible scenario.
20 Another possible, I mean, I'm an industrial
21 hygienist, and when I'm told to go out and
22 take air sampling, I ask, well, what's the
23 purpose. Is this process point sampling or is
24 this sampling to determine what potential
25 exposure might be to an individual standing at

1 a work station?

2 So this particular individual may have
3 been sent out on a process point sampling
4 effort to try to see if he could sniff out
5 something that no one expected to be there.
6 And when he found it, he was met with
7 resistance.

8 **DR. BEHLING:** Yeah, it may have been a very
9 episodic issue, not a pervasive, systemic
10 problem, but one that involved the situation
11 where significant monies had been spent on
12 modifying the plant system engineering
13 controls that turned out to be of little use.
14 And the people didn't like it. Who's to say?
15 We don't know.

16 **MR. ELLIOTT:** Who knows? We could have an
17 employee-supervisor issue going.

18 **MS. BALDRIDGE:** I'd like to add something
19 here. I have a letter from 1985, Battelle's
20 letterhead, and it's addressed to the Health
21 and Safety Environmental Division at FMTC.
22 And it goes on they're requesting an open
23 house for employees and their families. It
24 says that the gentleman requesting the open
25 house is unaware of the extent of the

1 contamination problems at the site.

2 It goes on the last paragraph of the
3 letter it says, "There is, however, yet a more
4 compelling reason not to invite large numbers
5 of people, particularly children, into the
6 facility. As we have indicated, once friskers
7 are placed in the change room and become
8 readily available to workers, they will be
9 very likely to learn that they have frequently
10 been leaving the plant contaminated."

11 Now to me this shows a mindset that
12 they weren't willing to have an open house for
13 the purpose of the employees not finding out
14 how contaminated they were. It just looks
15 like as Hans said somebody's trying to cover
16 this up.

17 **MR. CLAWSON:** Where do we want to go with
18 4.3-10?

19 **DR. BEHLING:** 4.3-10. It's just an issue
20 that we have occasional an insight as to
21 perhaps the mentality of people who were,
22 whose charge was to protect the workers who at
23 least in this case that the person with 17
24 years experience talks about things that are
25 somewhat disturbing. And I just have to raise

1 the whole thing.

2 **MR. GRIFFON (by Telephone):** Well, can I
3 ask, you know, NIOSH indicated that they
4 interviewed many other industrial hygienists
5 and didn't, I mean, I think Larry is correct
6 in saying that really our focus should be was
7 this a systemic problem. Is this an isolated
8 incident? We really have to try to determine
9 whether there was some sort of systemic
10 problem here. And I don't know if SC&A has
11 looked at those interviews? I'm assuming
12 they're on -- I haven't looked at all of them.

13 **DR. MAKHIJANI:** I don't believe they're
14 posted. Are these interviews posted?

15 **MR. ROLFES:** Only, let's see, I've
16 documented, let me point to the end of the
17 matrix. I did identify a couple of interview
18 transcripts, site research database document
19 reference ID 26115 and 31023. There will be
20 at least two additional ones added.

21 **DR. MAKHIJANI:** They're on the site research
22 database you believe?

23 **MR. ROLFES:** Yeah, I have put a couple on,
24 maybe one or two onto the O drive for the
25 Advisory Board.

1 **MR. GRIFFON (by Telephone):** I'm just going
2 to capture that as an action, Mark, just as
3 reminder for all of us that NIOSH will post
4 industrial hygienist interviews on the O
5 drives for SC&A to review.

6 **MR. ROLFES:** Mark, we do have that on the
7 last page of the matrix. I'm sorry, I didn't
8 --

9 **MR. GRIFFON (by Telephone):** Oh, it is on
10 the last page, okay.

11 **MR. ELLIOTT:** Just the two that have been
12 posted out of perhaps three more coming or two
13 more coming?

14 **MR. ROLFES:** I don't recall. I know I have
15 two with me right now.

16 **MR. MORRIS:** Those two that I sent you in
17 the e-mail with reference numbers, then
18 there's two that we provided last week. And
19 then one --

20 **MR. ROLFES:** One that had been done awhile
21 back?

22 **MR. MORRIS:** Right.

23 **MR. ROLFES:** Okay, so there should be a
24 total of about five, and there may have been a
25 previous one. There's --

1 **MR. MORRIS:** But only one of those is an
2 industrial hygienist interview.

3 **MR. ROLFES:** Yes, correct.

4 **DR. BEHLING:** The reason I do have to
5 question whether or not the potential exists
6 for a systemic problem is the fact that if
7 this had been an individual who was fingered
8 by let's say somebody else who said we know
9 this guy doesn't like to go out there and
10 sample so he sticks a sample in there, ends
11 it. Then this would obviously be confined to
12 a single individual.

13 But in this case he's the individual
14 who's fingering his supervisors as he does on
15 bullet seven. And if this supervisor was in
16 charge of all of the industrial hygienists,
17 then perhaps his corruptive mentality would
18 impose certain feelings and directives to not
19 just this particular hygienist, but to all.
20 And so therefore, I have to question whether
21 or not this is an isolated event or if it
22 involves the entire group of hygienists whose
23 collective job was to protect the worker.

24 **MR. ROLFES:** That's a good point, and --

25 **MR. HINNEFELD:** It's Stu Hinnefeld, if I

1 could just make one comment because I knew
2 some of the people. I didn't know the person
3 who wrote the affidavit in the petition, but I
4 knew some of the people who worked out there.

5 Arjun a while ago when we were talking
6 about thorium and the fugitive emissions from
7 the pilot plant, there was a rather
8 condemnatory letter written about how terrible
9 the conditions were in the pilot plant that he
10 read from. That was written by an industrial
11 hygienist, wrote that.

12 **DR. MAKHIJANI:** Right.

13 **MR. HINNEFELD:** But before we paint the
14 entire department with a (unintelligible)
15 brush, I think you should look at the volume
16 of the things that were written. They're read
17 a lot more like Keith* read. I mean there are
18 plenty of stuff out there, I mean, like Arjun
19 read. There are a lot of those correspondence
20 like that out there before you want to make
21 some sort of judgment about some sort of
22 inherent supervisory-imposed brush on that.

23 **DR. MAKHIJANI:** I would support what Stu
24 said in terms of the volume of documentation
25 that shows high air sampling. Not that, it

1 doesn't negate what this person said, but I
2 think that there is a lot of documentation
3 with very high air samples, and some of it's
4 actually higher than anything recorded any
5 place that I know of.

6 But there's also this affidavit. I
7 mean, it would be useful to see these
8 interviews, but there's only one with an
9 industrial hygienist, and I guess is that the
10 person you were talking about it?

11 **MR. ROLFES:** Yes. We also have attempted to
12 contact the industrial hygienist of whom we
13 are speaking. We've attempted to contact his
14 supervisor, and we have not been able to
15 contact him to date.

16 **DR. ZIEMER:** Mark, how about other logbooks?
17 Have you done any spot checking? The reason I
18 raise the logbooks is I don't know what their
19 practice was at this facility, but my
20 experience at Oak Ridge was that the first
21 thing you did after you did a survey, it went
22 into a logbook long before a supervisor ever
23 saw the results. And those logbooks typically
24 had the results. You counted an air sample.
25 It was in the logbook right then.

1 And so someone telling you that you
2 got the wrong results isn't going to change
3 what's in the logbook unless somebody rips a
4 page out. They're there, and they're dated
5 and signed and numbered. Are there some log,
6 you talked about trying to recover some
7 logbooks. Do we have some that you could spot
8 check and say, yeah, here's the logbooks, and
9 here's where it's showing up on the survey
10 data?

11 **MR. ROLFES:** We had attempted, we contacted
12 DOE to see if we could recover logbooks from
13 industrial hygienists. They responded that
14 they did not have any logbooks. Based on the
15 query that we did it did not appear that there
16 were any logbooks at Fernald. However, we do
17 --

18 **DR. ZIEMER:** They didn't keep logbooks or
19 they just can't find them?

20 **MR. ROLFES:** I'm not sure.

21 Stu, do you know if the industrial
22 hygienists did in fact keep logbooks separate
23 from the industrial hygiene datasheets?

24 **MR. HINNEFELD:** From memory I can't say
25 definitively. My recollection is they carried

1 record books around like I do, but I don't
2 recall if they did.

3 **MR. SCHOFIELD:** Could they possibly have
4 used survey sheets? I know this was a common
5 practice at Los Alamos. Instead of being put
6 in logbooks they had survey sheets they did.

7 **MR. RICH:** Did we ever have access to survey
8 sheets?

9 **MR. ROLFES:** We do have the survey sheets.

10 **MR. SCHOFIELD:** Maybe that's what you're
11 looking for to find was the survey sheet where
12 they were logged the first thing.

13 **MR. ROLFES:** That's it. I'm still confused
14 about that myself. I do have, I wanted to
15 point out some, well, here's an example of an
16 air dust analytical sheet, and this says
17 National Lead Company of Ohio Analytical Data
18 Sheet. And this has the sample number, the
19 sample time, a description of the sample being
20 taken, air volume sample time, sampling and
21 the results as well.

22 And it's what I initially believed was
23 that this air sample result, this would have
24 been information that was recorded in a
25 logbook. This would have been the raw data

1 here. I'm not sure if that's true or not, but
2 we have requested logbooks to see if there are
3 logbooks that exist separate from the
4 analytical data sheets. Without going through
5 the records again I can't answer whether there
6 were separate logbooks from the analytical
7 data sheets.

8 **MR. CLAWSON:** You know, it basically comes
9 back to data integrity, and I think that's the
10 root of the whole issue here. And we've got
11 conflicting affidavit to what other stuff is.
12 I guess I'm at a loss of what we need to look
13 into on this, and what we're going to do with
14 this affidavit because --

15 **DR. BEHLING:** Well, it adds to the
16 collective uncertainty that started out with
17 the issue of how good is the air sampling.
18 How good is general air sampling relative to
19 BZ, and even we heard earlier from Mel that
20 you mount the BZ air samplers on the same
21 person and may have five different values.

22 So you add to the issue to the
23 uncertainty as to where a person worked, what
24 his job description was and then add to that
25 the issue of potential air sampling that

1 raises questions about these select samples,
2 and you have to come to the conclusion that
3 air sampling's not a very accurate measure of
4 what a person was exposed to and take that
5 into consideration when we use it for dose
6 reconstruction.

7 You cannot look at these data in a
8 definitive way and say this is precisely. You
9 have to recognize that the uncertainty
10 associated with air sampling data is very,
11 very large.

12 **MR. ROLFES:** Correct, that's a good point.
13 And all uncertainties go to the benefit of the
14 claimant.

15 **MR. CLAWSON:** Right, and so this basically
16 comes back to the person's personal file on
17 their bioassay or whatever and so forth.

18 **DR. MAKHIJANI:** Oh, no, Brad, actually the
19 thing that this throws into question is can we
20 trust the thorium air sampling data. If you
21 have high values recorded and somewhere, I
22 think we're not talking about the uranium
23 data. Mark Rolfes is right about that, but if
24 you're using coworker models and bioassay that
25 then the specific uranium air data are not in

1 question. I would suggest that maybe --

2 **MR. ELLIOTT:** But this affidavit speaks to
3 uranium air sampling, correct?

4 **DR. MAKHIJANI:** Yes, and it raises a
5 question whether it was a pervasive practice.
6 We do have what Stu said is high values were
7 clearly recorded so it was not happening all
8 the time. We know that. But accepting this
9 affidavit means it happened at least once.
10 And so where the actual matter is in regard to
11 a particular supervisor or particular employee
12 or particular period we don't know. And it
13 may be useful to do a couple of independent
14 interviews. Maybe the working group wants to
15 do it or the industrial hygienists from -- we
16 don't know the period from which this
17 happened.

18 **DR. BEHLING:** Yeah, it was a 17-year period.
19 Also, and he alleged --

20 **DR. MAKHIJANI:** And he alleged that it was a
21 routine thing in that period.

22 **MR. CLAWSON:** And whatever timeframe that we
23 had --

24 **DR. BEHLING:** And his second bullet here
25 identifies the employment period.

1 **DR. MAKHIJANI:** What was the period?

2 **DR. BEHLING:** It's blanked out actually.

3 It's just in the '50s --

4 **DR. MAKHIJANI:** But we have access to that.

5 **DR. BEHLING:** Yes. I have the original so I
6 know.

7 **MR. CLAWSON:** 'Fifty-three to '71. Well, I
8 guess for an action item I really don't know
9 which way we're going to go, but we will have
10 to look into this. I think at this time we're
11 going to have to break for lunch, and almost
12 quarter to one right now, ten to one. We'll
13 probably return at about two o'clock if that's
14 all right. And we'll go ahead and break the
15 phone line.

16 **MR. PRESLEY (by Telephone):** Hey, Brad, this
17 is Bob Presley. I'll see you at two.

18 **MR. CLAWSON:** Okay, thank you.

19 (Whereupon, the work group recessed for
20 lunch from 12:50 p.m. until 2:00 p.m.)

21 **DR. WADE:** We're back. We're prepared to be
22 back in session once the chairman lowers his
23 hand.

24 **MR. CLAWSON:** First of all Larry Elliott
25 would like to make a comment on the record,

1 asked for a moment here, and then we'll
2 proceed back in.

3 **MR. ELLIOTT:** Thank you, Brad. I just
4 wanted to react to at the last working group
5 meeting for Fernald, Dr. Makhijani asserted
6 that NIOSH selectively relies on worker input.
7 The implication was that NIOSH listens to
8 workers when their input supports positions
9 that is taken by NIOSH but ignores workers
10 when their input contradicts with NIOSH
11 positions.

12 And in his assertion Dr. Makhijani
13 offered an example that related to the thorium
14 strikes that occurred in Rocky Flats and the
15 potential for an intake during those thorium
16 strikes. Specifically, he said that we relied
17 wholesalely (sic) on one individual, a health
18 physicist who was involved in that particular
19 work, without listening to others.

20 It is not clear why Dr. Makhijani
21 again raised the issue of these thorium
22 strikes and this issue since the Advisory
23 Board has already opined upon the subject with
24 regard to Rocky Flats. However, in a more
25 general context I want to speak specifically

1 to what NIOSH does and how they value, how we
2 value worker input.

3 A review of the transcript on the June
4 12, 2007 Advisory Board meeting reveals this
5 question was explicitly raised by David Hiller
6 of Senator Salazar's office. You can find
7 that on page 143 of the transcript. And it
8 was also answered by Brant Ulsh of NIOSH on
9 page 143 to 147 of that same transcript.

10 As explained at that time NIOSH
11 examined the redacted pages from a classified
12 document that mentioned in passing that the
13 thorium strikes occurred in Building 771
14 rather than Building 881. The subject of this
15 investigative report was a later contamination
16 incident involving Uranium-233 rather than the
17 thorium strikes themselves.

18 Furthermore, the report was written by
19 an independent committee convened to
20 investigate the Uranium-233 contamination
21 incident. One of the criteria for selecting
22 committee members was that they were not
23 directly involved in the project which helped
24 assure their independence. Balanced against
25 this report we had the explicit and detailed

1 account of the thorium strike operation as
2 provided by the health physicist in charge of
3 the project.

4 He clarified that the Uranium-233
5 solution had been received in Building 771
6 from offsite and transferred out of the
7 shipment container in that building. The
8 Uranium-233 was then transferred to Building
9 881 for the thorium strike and subsequent
10 Uranium-233 metallurgical and machining
11 operations.

12 The health physicist had direct hands-
13 on involvement with the thorium strikes,
14 provided a list of employees involved in the
15 project from memory which was confirmed later
16 by the health physics logbook covering the
17 project, and provided a detailed sketch of the
18 room where the thorium strike occurred. That
19 would have been Room 266 in Building 881, from
20 memory.

21 And we further confirmed that by
22 examining that drawing, the sketch, against
23 building blueprints. He also provided the
24 approximate dates of the operation from memory
25 which was later confirmed by his own logbook

1 and the logbook of his supervisor.

2 On balance we considered the detailed
3 recollection most of which was independently
4 confirmed of the health physicist with direct
5 involvement in the project to be more reliable
6 than an incidental mention in an investigative
7 report dealing with a different subject and
8 authored by individuals with no involvement in
9 the thorium strikes.

10 It is noteworthy that this question
11 was raised in the larger context of evaluating
12 the potential for thorium strikes at Rocky
13 Flats. Over the course of this investigation
14 NIOSH interviewed 12 workers including one
15 site expert currently retained by SC&A and to
16 an individual they stated their belief that
17 there was no potential for thorium intakes at
18 Rocky Flats.

19 SC&A was apparently unconvinced by
20 this unanimous opinion from the workers and
21 repeatedly has asserted that there were
22 potential intakes even though they could
23 provide no monitoring data, worker statements,
24 incident reports or any other documentation
25 supporting their contention that such intakes

1 could have occurred during thorium strikes or
2 any other thorium operation at Rocky Flats.

3 In conclusion, NIOSH stands by its
4 position that there were no thorium intakes
5 during the thorium strikes or any other
6 thorium operation at Rocky Flats for that
7 matter. This position is supported not only
8 by the information provided by the health
9 physicist directly involved in the project but
10 also by the testimony from numerous other
11 workers, logbooks covering the operation and
12 other written documentation.

13 So we in essence take full account of
14 all of the information that is presented to us
15 on a topic, and we take from that a balanced
16 opinion as to where we need to go forward and
17 what approach we would use specifically in
18 that set of circumstances. So I just wanted
19 to get that on the record since it came up in
20 this working group.

21 I know it's Fernald, and we talk about
22 Rocky Flats here in this example, but I do see
23 a lot of consternation in the claimant
24 community right now about how much value NIOSH
25 puts into worker input, worker interviews,

1 worker comments. And I just want it to be
2 known that we value a worker's input as much
3 as we do, we consider them to be site experts.

4 So we're reaching out, and we're
5 trying to improve our interactions and the
6 ways that we interact with workers. So I just
7 wanted to make this comment for your record.

8 **MR. CLAWSON:** Appreciate that.

9 **DR. MAKHIJANI:** Might I have a chance to
10 clarify. I don't want to get into Rocky Flats
11 stuff, but I brought this up not in a Fernald
12 meeting but in a Nevada Test Site.

13 **MR. ELLIOTT:** I missed the meeting.

14 **DR. MAKHIJANI:** Yes.

15 **MR. ELLIOTT:** Thanks for correcting me. I'm
16 sorry.

17 **DR. MAKHIJANI:** I believe that you were
18 there.

19 **MR. ELLIOTT:** I was there.

20 **DR. MAKHIJANI:** It was at the last Nevada
21 Test Site working group meeting. I brought it
22 up because I felt that there was not a clear
23 and full acceptance of the statement that the
24 fellow, retired health physicist, made, kind
25 of regarding badge practices. I did not bring

1 it up to revise any Rocky Flats issues. I
2 realize that the Board has voted on that and
3 made a decision on that.

4 I did not bring this up in any context
5 that involved thorium exposures at Rocky
6 Flats. I believe Dr. Ziemer was there. I
7 believe the Board actually took some action on
8 that, and I have to revisit my notes from the
9 Nevada Test Site. Jim Neton was there, and it
10 was agreed that some investigation in regard
11 to the badges not being worn in the forward
12 areas needed to be done.

13 And that was as a result of the
14 intervention that I made because I thought
15 that not only a particular health physicist's
16 statement was at least as much of a site
17 expert as any other site expert at least that
18 I'd interviewed or any evidence that I've seen
19 brought forth from any site expert because he
20 witnessed more than 900 nuclear weapon tests.
21 And that was the context in which I brought it
22 up.

23 I believe the record of the reports
24 that we showed in which I played a significant
25 part in preparing SC&A's, some of SC&A's Rocky

1 Flats report will not show that we had stated
2 that there were significant thorium exposures
3 during thorium strikes. But we had repeatedly
4 questioned whether NIOSH has properly created
5 a bounding dose or not. And we repeatedly
6 rejected the use of NUREG-1400 as the approach
7 for bounding dose and asked for evidence from
8 the site regarding bounding doses.

9 It is simply not correct and a
10 misrepresentation of things that I said last
11 time and a misrepresentation of things that
12 are there in the report to have read into the
13 record the kinds of things that you have just
14 done, and I do object to it.

15 **MR. ELLIOTT:** Well, I apologize for getting
16 the wrong working group, but the issue was --

17 **DR. MAKHIJANI:** But a considerable portion
18 of the other record is also not properly
19 stated in that e-mail, and I do object to it.
20 I have not fought an exercise about anything
21 in three years, but this misrepresentation of
22 what's in our written reports, it's a matter
23 of record what's in our written reports.

24 We did reject NIOSH's repeated
25 statements that NUREG-1400 was bounding dose

1 as improper. And that was done by the whole
2 team. It wasn't done by me. For your
3 information every report that I have submitted
4 has been reviewed so far as I can recall, has
5 been reviewed by John Mauro and signed off by
6 John Mauro including, and specially I asked
7 him to go over every word in sensitive reports
8 to make sure that he knows every detail of
9 what's in them. And if he's on the line --

10 John, are you on the line?

11 **DR. MAURO (by Telephone):** Yes, I am, and I
12 agree with what --

13 **DR. MAKHIJANI:** -- or deny or --

14 **DR. MAURO (by Telephone):** -- especially
15 NUREG-1400.

16 **DR. MAKHIJANI:** Sorry?

17 **DR. MAURO (by Telephone):** Especially the
18 NUREG-1400 work. In fact, that was my
19 concern. I mean, just to hearken back I am
20 familiar with that particular subject and
21 being very much involved in that part of the
22 review.

23 **DR. MAKHIJANI:** Thank you.

24 **MR. ELLIOTT:** I was not --

25 **DR. MAKHIJANI:** When you make ad hominem

1 characterizations, I would request you to make
2 correct ad hominem characterizations. I do
3 try to avoid them here, and I am exercised
4 that your team has chosen to make incorrect
5 characterizations on the record in a way that
6 I find objectionable.

7 **MR. ELLIOTT:** Well, I think that's the pot
8 calling the kettle black because I'm sorry, it
9 was the NTS --

10 **DR. MAKHIJANI:** And there you go again.

11 **MR. ELLIOTT:** -- working group meeting that
12 you brought this up. And you brought it up in
13 the context that NIOSH does not listen to
14 worker input. And I have so many --

15 **DR. MAKHIJANI:** You might ask a whole bunch
16 of workers about that. We've had this
17 complaint from workers repeatedly.

18 **DR. WADE:** We need to go back now to the
19 business of this work group.

20 **MR. CLAWSON:** We appreciate the input, and
21 we'll proceed on with this, Hans.

22 **DR. BEHLING:** The next section deals with
23 the in vivo monitoring of workers for uranium
24 and thorium that started with the introduction
25 in 1965 in mobile in vivo radiation laboratory

1 monitoring unit that was brought onsite, a
2 discrete timing of people were assessed for
3 lung burdens involving uranium and thorium
4 exposures.

5 And starting on page 103 of the report
6 I talk about some generic aspects, and I
7 preface my statement on that page by saying
8 not considered a finding by SC&A. A critical
9 component of the MIVR lung counting system,
10 however, was the radiation detection system
11 was perhaps not the one that should have been
12 used.

13 And I stand not alone in that
14 particular criticism because recently I
15 reviewed the Portsmouth TBD and some of the
16 supporting documents that surround the
17 Portsmouth TBD, one of which was a DOE
18 document that had some very, very critical
19 comments to say about the Y-12 mobile in vivo
20 laboratory system. And principally the
21 consideration here is the level of sensitivity
22 that comes with the very, very large crystals
23 that were used, the four-inch thick crystals.

24 As we know if you're looking for lower
25 energy photons, you tend to go with the thin

1 crystals in order to avoid the (inaudible)
2 background against which you have to discern
3 your signal. And if you read that particular
4 report from the DOE that relates to the
5 Portsmouth, you will see similar statements
6 that I make here. Again, they're not
7 findings. It's just the level of sensitivity
8 that says the system was not intended to be
9 used for lower energy photons.

10 And in the case of uranium you're
11 really looking at U-235, the 186 keV photon,
12 and if you look at the conventional gamma
13 spectroscopy issue involving the backscatter
14 photon, then that particular 186 keV for
15 uranium coincides with, if you look at, for
16 instance, the 183 backscatter photons for
17 cesium or for cobalt, they all lie somewhere
18 between 180 to 210 to 120 keV.

19 So you have a real problem here when
20 you're potentially dealing with other
21 radionuclides. And I realize cesium was not
22 one of the major radionuclides, but we all
23 have, especially in the early days, cesium
24 from atmospheric fallout. And so I just
25 brought that up as an issue that the four-inch

1 thick crystal compares very poorly in terms of
2 discerning low energy photons for chest
3 counting when you compare it to the crystals
4 that are conventionally used at other DOE
5 facilities that involve four millimeters
6 instead of four inches. And so I just brought
7 that up.

8 **DR. ZIEMER:** Well, it still is possible to
9 use them with proper calibration.

10 **DR. BEHLING:** Of course.

11 **DR. ZIEMER:** And, in fact, and I wouldn't
12 know in this case, but it's interesting to
13 note that sometimes the higher background is
14 not an issue. Your sort of coefficient of
15 performance goes to sample squared to
16 background. So if your sample count gets high
17 enough, you can put up a terrific background.

18 That's why Los Alamos for many years
19 was able to use those large whole-body liquid
20 simulation counters with terrific backgrounds
21 because the sample count was so high, the
22 sample squared background ratios were good.
23 And I don't know what they would be in this
24 case. My guess it's very inefficient to use a
25 thick crystal because the particles only

1 penetrate in the outer surface. So you
2 probably don't have good samples squared to
3 background here. And so it's not optimum.

4 And I agree with your point. I think
5 it's not optimum, but it's usable.

6 **COURT REPORTER:** 4.4-1?

7 **DR. BEHLING:** Yes. We haven't really gotten
8 to 4.4-1 because I'm only talking about a
9 generic statement.

10 **DR. ZIEMER:** Right, right.

11 **DR. BEHLING:** And I meant to bring with me -
12 -

13 **DR. ZIEMER:** That wasn't a finding but an
14 observation.

15 **DR. BEHLING:** No, no, that wasn't a finding,
16 just an observation.

17 **DR. ZIEMER:** Yeah, that's the best way to do
18 it.

19 **DR. BEHLING:** Be careful about how much
20 accuracy you assign to these measurements and
21 realize that perhaps by design this particular
22 counting system was not optimal.

23 **DR. ZIEMER:** It's not optimum, yes.

24 **DR. BEHLING:** And was clearly not the one of
25 choice that, because other DOE facilities used

1 it for millimeter inch thick crystals for
2 counting these lower energy photons. But
3 having said that --

4 **MR. MORRIS:** I don't think you should say be
5 careful of the accuracy. You should say be
6 careful of the detection limits.

7 **DR. BEHLING:** Detection limits.

8 **DR. ZIEMER:** Yeah. We can be very accurate,
9 but the detection limit is much higher.

10 **MR. ROLFES:** Right, and the net result from
11 that I think is important to clarify that a
12 higher detection limit will result in a higher
13 dose estimate for a claimant. So once again
14 this is another example of the uncertainties
15 associated with a measurement being credited
16 to the claimants in a dose reconstruction.

17 **FINDINGS 4.4-1, 4.4-2**

18 **DR. BEHLING:** There are a number of other
19 findings. In part they were due, and I will
20 ask you to look at page 110 of the report
21 which is a reproduction of one of the tables
22 that were identified in the original TBD. And
23 I will say that because initially that is what
24 I was working on in making some of my comments
25 that relate to finding number 4.4-1. Actually

1 not so much that but the other ones, finding
2 4.4-2.

3 And if you look at page 110, you will
4 see a table that talks about the different
5 measurements that were taken on a yearly basis
6 as you see on that page for the year 1965.
7 They were two Uranium-235 counts, two uranium
8 total, and zero thorium although it says there
9 were two Lead-212 and two Actinium-228 which
10 by default I assume are there for thorium.
11 And as you go down the list over the years, it
12 isn't until you get to the time period of 1978
13 or really 1979 that you see a large number of
14 citations that reflect Lead-212 and Actinium-
15 228.

16 And prior to 1978 you see an awful lot
17 of data that involves thorium. And having
18 looked at that I was very much confused. And
19 I make all these statements in preface to what
20 you're about to tell me is that this is how
21 the data was reported. And I think we can go
22 through some discussion and come to terms with
23 what the data really represents. But at the
24 time when I looked at this, this was the table
25 I was making reference to.

1 And quite frankly I could not make
2 heads or tails with the notion that up to 1978
3 all of the thorium was reported in terms
4 milligrams and for Lead-212 and Actinium-229,
5 which are your two indicator radionuclides.
6 There was no data there. And I think since
7 that first discussion you informed me that
8 this was an issue of reporting the method by
9 which the mobile in vivo data was reported.

10 And that brings us to a couple of
11 other issues, but having said that, we can
12 discard perhaps a couple of the first findings
13 here, 4.4-2. At this point I have looked at
14 some of the data, and it is clear that the
15 thorium data reported in milligrams between
16 '68 where you have 310 all the way to '78
17 where you have 161 are reflections of data
18 that involve Thorium-232.

19 One of my concerns was what thorium
20 are you really referring to, but it's clear
21 these data do reflect Thorium-232 and Thorium-
22 228. So I have at this point accepted the
23 notion that these data do, in fact, involve
24 Thorium-232 as opposed to Thorium-230 or
25 something else.

1 But having said that we can now go and
2 look at a couple of the other issues that I
3 guess I would like some clarification on
4 because when you don't have any data that
5 involves a definitive assessment for Lead-210
6 -- and I guess for those who may still be
7 somewhat unsure as to what these mean, I
8 enclosed for the benefit of the reader,
9 Exhibit 4.4-2 on page 106.

10 And there you have a citation of the
11 radionuclides that start with Thorium-232 and
12 the intermediate products between 232 and
13 Thorium-228 and the two indicator
14 radionuclides defined by Actinium-228 and
15 Lead-212. And you realize, and I explain here
16 briefly what assumptions are reasonable here.

17 Obviously, if you were to deal with
18 pure thorium material that is just harvested
19 for the first time, ore, you can reasonably
20 expect every one of these radionuclides --
21 let's put it this way. It's not unreasonable
22 not to expect them to be in exact equilibrium.
23 However, once you segregate the thorium
24 chemically again you may start out at time
25 zero with total equilibrium between 232 and

1 228, not equilibrium but equal quantities.

2 They won't be in equilibrium long
3 because what you've done is essentially
4 removed Radium-228 which has a half life of
5 6.7 years and in the process if you remove
6 Radium-228 you also remove actinium. And of
7 course, that's your indicator for Thorium-232.
8 At that point and moment in time when you
9 chemically segregate thorium and you isolate
10 Thorium-232 and 228, you start to, as a
11 function of time, lose Thorium-228 because you
12 have a half life of 1.9 years. So if you
13 segregate the thorium chemically at 1.9 years,
14 your Thorium-228 will be exactly half of the
15 Thorium-232.

16 And in fact, I think somewhere along
17 the line we do have a map that identifies how
18 these values coincide over time, and I can
19 pass it around here. And you see obviously
20 that this equilibrium that occurs with these
21 two radionuclides, and I guess the question
22 now I have is what happens when you deal with
23 data that you no longer have the individual
24 measurement.

25 Obviously, Actinium-228 is your

1 indicator for Thorium-232, and Lead-212 is
2 your indicator for Thorium-228. And now you
3 have to make a decision. What is it that I'm
4 looking at when it's reported in thorium
5 milligrams? What were the assumptions on the
6 basis of which the original data as you see in
7 that table on page 110 where you have thorium
8 reported in milligram quantities or microgram
9 quantities, how do you segregate the two
10 thoriums?

11 **MR. MORRIS:** It's a fair question, but it's
12 obviously a dose reconstruction issue, not an
13 SEC issue.

14 **DR. BEHLING:** Well, it's a dose
15 reconstruction because you can certainly --
16 let's assume you rely on Lead-212 and say,
17 well, they're in equilibrium. But you can
18 certainly have Lead-212 that after a period of
19 years has decayed off and it's going to be,
20 you will have an accurate assessment if you
21 rely on Lead-212. You have an accurate
22 assessment for Thorium-228, but you can also
23 realize that Thorium-232 has been grossly
24 underestimated if you assume that Lead-212
25 provides you with an indicator. Unless you

1 use both, and you have reasonable assumption -

2 -

3 **MR. RICH:** Again, you're using daughters of
4 both isotopes.

5 **DR. BEHLING:** Yes.

6 **MR. RICH:** And they also were very careful
7 to determine the age since separation of the
8 material that they were operating from.

9 **DR. BEHLING:** I would care less about the
10 age. If you have accurate measurements for
11 both Lead-212 --

12 **MR. RICH:** Well, it makes a difference,
13 Hans, in terms of the ratio that the activity
14 of the 232 to 228, depending on the age since
15 they've been separated.

16 **DR. BEHLING:** Of course, I know that. But
17 you could, if you had accurate measurement for
18 Lead-212 and Actinium-228, the 212, Lead-212,
19 tells you how much Thorium-228 you have. And
20 the 228 tells you how much Thorium-232 you
21 have.

22 **MR. RICH:** They made assumptions for both in
23 order to do the, to come to the conclusion of
24 how much Thorium-232.

25 **DR. BEHLING:** Because I have looked at data

1 in subsequent years following 1978. And we do
2 have data that tells you how much Lead-212 was
3 measured in the chest count and how much
4 Actinium-228. And they're clearly not,
5 frequently they're just a factor of two or
6 three higher different meaning that there is
7 disequilibrium between the two thoriums.

8 Now to what extent was that considered
9 or was a larger number or value used to
10 account for any uncertainty? I guess I would
11 like, I'll turn to you and tell me how it is
12 that you interpret data prior to 1978 when all
13 the data was only issued to you in units of
14 thorium mass as opposed to subsequent data
15 when you may have two values, one for Lead-
16 212, one for Actinium-228, and how do you
17 assess your lung burden based on these two
18 different sets of data, one lead involves just
19 thorium measurement, the other one for two
20 daughter products but they're not necessarily
21 in equilibrium?

22 **MR. RICH:** The data that's listed in the
23 claimant file prior to when they started to
24 simply record the two daughter products.
25 Those same two daughter products were used in

1 the analysis to come to the milligram
2 quantities prior, and it was just a matter of
3 change recording.

4 **DR. BEHLING:** I mean, do we have data that
5 says that for let's say in the years 1972 or
6 so prior to the change --

7 **MR. RICH:** Yeah, there are some transition
8 years where we have both the daughter activity
9 and the milligram.

10 **DR. BEHLING:** I've seen it. But are we
11 comfortable in understanding what it is that
12 they did to be sure that they didn't do things
13 that potentially are not claimant favorable?

14 **MR. RICH:** I'm comfortable, yes.

15 **DR. BEHLING:** Are you?

16 **MR. ROLFES:** We've also pointed the Advisory
17 Board members to a couple of documents that
18 discuss the assumptions that went into
19 measuring Thorium-232 in the body. And
20 there's a record of, let's see, one report is
21 the evaluation of health physics problems from
22 thorium and its daughters in a thorium
23 purification and fabrication process. This is
24 in the Health Physics Journal, Volume 8, pages
25 279 through 297 for 1962. And also we have

1 radioactivity of thorium and the feasibility
2 of in vivo thorium measurements from the Oak
3 Ridge Y-12 plant, Report Y-1280, 1959.

4 **DR. BEHLING:** Again, I just want to be very
5 careful about interpreting some of the data.
6 As we know and we're fully aware because I'm
7 preaching to the choir here, that
8 disequilibrium is an issue here that you can't
9 avoid. And on page 107 I give an extreme
10 case. If you had something that is at this
11 point thorium ore that has been just
12 separated, what you don't have at that point
13 is Radium-228 or Actinium-228. Meaning that
14 you have no indication as to the fact that
15 Thorium-232 is there potentially in large
16 amounts, but you have no way of verifying that
17 because your indicator, Actinium-228, simply
18 isn't there.

19 **MR. RICH:** That was well understood by those
20 people who were doing the work.

21 **DR. BEHLING:** I mean I just want to be sure
22 that we're not caught off guard here by people
23 who don't understand the mechanics and the
24 biokinetics of all these radionuclides and how
25 indicator radionuclides have some limitations

1 regarding the interpretation.

2 **DR. MAKHIJANI:** Bryce, is there a procedure
3 for the in vivo counter that shows that this
4 was well understood?

5 **MR. RICH:** Those documents that Mark just
6 referred to. The documents themselves were
7 explanatory.

8 **DR. MAKHIJANI:** I've looked at the in vivo
9 procedure, but I didn't see, I'll have to go
10 back and revisit it because I don't remember.

11 **MR. RICH:** There are a number of documents,
12 more than what we have here.

13 **DR. BEHLING:** If we go to, and if everyone's
14 comfortable. As I said there's no real
15 resolution other than to go back and assess
16 what were the methods used to interpret
17 thorium data prior to '78 when there
18 (unintelligible) not reported for two
19 indicators. And if we're comfortable with
20 that then I think we can --

21 **MR. RICH:** It was standard industry practice
22 and with the best minds that in vivo counting
23 for thorium (unintelligible).

24 **DR. BEHLING:** I was just somewhat taken back
25 because I did look at a couple memoranda that

1 talked about the early years when the mobile
2 unit was brought onsite and was operated by Y-
3 12 personnel. And I have to say on a relative
4 scale I would trust their ability to, since
5 they designed the system, understood its
6 limitations. And when they operated it, they
7 clearly understood what they needed to do to
8 compensate certain deficiency of the system
9 and how to interpret data.

10 What did cause me some concern, and I
11 quote one memoranda, is that the people after
12 the first two years at, Fernald took over and
13 it's a question of did they understand the
14 nuances? Did they understand what needed to
15 be done here? And there were a couple of
16 memoranda that I looked at that raised a
17 question about the qualifications of people
18 who ran the mobile in vivo lab.

19 And so again it's an issue that from
20 this point has a limited chance to be
21 resolved, but the qualifications of people who
22 were not necessarily trained on them to the
23 extent that the Y-12 people were, raises some
24 questions.

25 **FINDINGS 4.4-3, 4.4-4**

1 These next two issues relate to the
2 worker selection and the frequencies by which
3 the in vivo counts were conducted. And I know
4 I've read enough documents to suggest that on
5 average people at the high end of their
6 exposure potential were at least counted once
7 a year, but there were clearly indications
8 that some people were skipped and there may
9 have been two years. And, of course, the
10 question was there for let's say two years,
11 just after the unit left and the next time it
12 showed up obviously he would not have been
13 part of the monitoring program. And I assume
14 at this point if there's indication that he
15 was subjected to thorium, you're going to tell
16 me that there's going to be a coworker model,
17 is that correct?

18 **MR. MORRIS:** That is correct.

19 **MR. GRIFFON (by Telephone):** Are you on 44-
20 2, Hans?

21 **DR. BEHLING:** Yeah, 44-3 and 4.

22 **MR. GRIFFON (by Telephone):** And for 4.4-2
23 it says NIOSH will provide a coworker model,
24 and you indicate you've done that. Is that on
25 the O drive, that coworker model yet? Or is

1 that --

2 **MR. MORRIS:** No, it's not on the O drive
3 right now. It's in final review right now.

4 **MR. GRIFFON (by Telephone):** Okay, so it's
5 done, but it's not to us yet.

6 **MR. MORRIS:** Right.

7 **MR. GRIFFON (by Telephone):** Okay.

8 **MR. CLAWSON:** Pending.

9 **DR. BEHLING:** Again the issue of 4.4-4 on
10 page 109, again, raises some questions again
11 based on the memorandum that talks about
12 worker selection. You know, you use good
13 judgments and you rely on your process
14 knowledge, your work environment and select
15 workers. Again there are certain suggestions
16 here in one of the memoranda that are
17 (unintelligible). Air monitoring data for
18 certain locations within the plant did not
19 coincide with the highest empirical exposure
20 data as evidenced by the mobile in vivo lab
21 data.

22 And so the question comes to mind is,
23 are there people there that should have been
24 monitored (unintelligible) as opposed to
25 people who may not have been at the high end

1 but who were monitored. And are we
2 potentially finding ourselves in a situation
3 where people with potential high exposures
4 were simply ignored? And I can't answer that.

5 **MR. ROLFES:** That's the opposite of the
6 truth. In 1959, I have a letter here dated
7 October 21st, 1959, in regards to thorium
8 bioassay. It goes on to say "our interest in
9 the subject concerning," excuse me. "Our
10 interest in the subject stems from the thorium
11 operations we had at the plant a few years
12 ago. Although this operation has been shut
13 down, many of the thorium workers are still
14 employed at this plant, and we are still
15 interested in performing tests to determine if
16 retention of thorium from exposure to airborne
17 material was appreciable. Recent efforts
18 along this line have included the analysis of
19 urine samples for radium daughter" -- and it
20 also, this was one of the precursor letters to
21 the individuals being sent outside to the
22 University of Rochester.

23 So to me this indicates to me that for
24 individuals that were potentially exposed to
25 thorium, they were interested in determining

1 historical thorium exposures. But --

2 **DR. BEHLING:** And that may be fine, but I'm
3 also looking at on page 108, and I'll read it
4 for those who may not have access to this
5 report. And it's a direct quote from one of
6 the memorandum that I selected and it's
7 phrased as follows: "Recent in vivo
8 monitoring (unintelligible) employs utilizing
9 the IVRML indicated (unintelligible) of
10 currently sustained 70 percent to 100 percent
11 of a permissible lung burden of uranium." And
12 then it continues. "A serious question has
13 been raised regarding the validity of the job
14 (unintelligible) and air dust sampling
15 approach used by NLO since that data would not
16 suggest lung exposure (unintelligible) at the
17 in vivo indicated level." And again, --

18 **DR. MAKHIJANI:** Which page are you one?

19 **DR. BEHLING:** This is on page 108 of the
20 report.

21 And it goes back to the similar issue
22 we observed for uranium. We had people that
23 just simply didn't expect to have had a high
24 urinary excretion rate of uranium. Here you
25 have people who show high test burdens, lung

1 burdens, who were at 70 to 80 percent of the
2 permissible lung burden who were not expected
3 based on weighted air dust sampling data to
4 have been exposed.

5 And then the question is since you
6 selected these people on that premise, to what
7 extent are there people for whom the in vivo
8 data simply doesn't exist? Now again if there
9 is a coworker model that elects to use a
10 fairly conservative upper-end value, we can
11 accommodate. But the question is what would
12 we do for people for whom perhaps data is not
13 there or is very, very sparse.

14 **MR. MORRIS:** There is the coworker model in
15 final review.

16 **MR. ROLFES:** That's it. We do have a
17 coworker model that will be made available to
18 the Advisory Board working group members.

19 **DR. BEHLING:** And the next finding, 4.4-4,
20 is something that perhaps you can clarify
21 here. I think at one of the meetings that we
22 had -- I'm really referring to you, Mark. You
23 had mentioned that there was going to be some
24 correlation between lung count data with
25 thorium air sampling data. And is that still

1 a process that you're going to look at in
2 trying to establish some correlation between
3 air monitoring data and in vivo chest
4 counting?

5 **MR. ROLFES:** It's a potential approach, but
6 I don't believe we would be doing that at this
7 time.

8 **MR. RICH:** We wouldn't be applying the ratio
9 back to the early times.

10 **DR. BEHLING:** Yeah, my concern was that
11 obviously post-'79 we're not dealing with
12 processing of thorium any more; and therefore,
13 air monitoring data that correlates during
14 that timeframe may be poorly correlated. So I
15 just was looking to make sure that we
16 understand what the limitations of the intakes
17 exist when you compare two time periods that
18 may or may not necessarily apply to earlier
19 years when thorium was processed.

20 **MR. RICH:** However, we have taken a look at
21 the relationship between internal uptake in
22 the '68 period of time when they brought in
23 vivo and air samplings. We find the in vivo
24 results always significant.

25 **DR. BEHLING:** Now I would hope that if such

1 correlation exists, that we would exclude
2 post-'79 data because at that time air
3 monitoring data may have very limited value to
4 relating to body burdens.

5 **MR. RICH:** And because of the differences in
6 operational and circumstances in the very
7 early times where you're not going to tie that
8 ratio back to the early time. That'll be done
9 with pure air sampling results.

10 **DR. ZIEMER:** Yeah, you'd have no guarantee
11 that that ratio which is sort of a modern day
12 ratio held for the earlier days. It may, but
13 there's no guarantee.

14 **MR. MORRIS:** They were totally different
15 plants and different processes.

16 **DR. ZIEMER:** The net result is that earlier
17 days are going to look like higher exposures.

18 **MR. RICH:** Well, they do have --

19 **DR. ZIEMER:** They may or may not be. You
20 don't know, but you have to assume they were.

21 **MR. RICH:** Well, we have some assurance
22 because of the experience in the period of
23 time when both sets of data are there that the
24 air sampling data will give us a very
25 conservative result in the earlier time.

1 **DR. ZIEMER:** It tends to overestimate.

2 **MR. RICH:** Yeah, it tends to overestimate
3 for a variety of reasons which are
4 (unintelligible).

5 **FINDING 4.4-5**

6 **DR. BEHLING:** The last finding on that issue
7 is Finding 4.4-5 on page 110, and we've raised
8 it before. Perhaps we need a clarification.
9 Based on one of the (unintelligible) on page
10 111, at a previous meeting I believe Mark had
11 identified certain statistics regarding the
12 number of cases that had been completed or
13 adjudicated to date at Fernald.

14 And I know that in many of these cases
15 for efficiency's sake, ORAU/OTIB-0002, had
16 been used to essentially say what kind of
17 exposure did you receive from the 12 or 28
18 radionuclides defined in TIB-0002 at the first
19 day of employment. And would that result in
20 if you're not going to be compensated on that
21 premise. Chances are that you're not going to
22 be compensated using your data.

23 I have yet to see, for instance, a
24 comparison between OTIB-0002 and compare that
25 to perhaps someone who had perhaps as many as

1 30 years experience at working at Fernald and
2 apprise certain data, some of which you may
3 have for uranium exposure from urine bioassay.
4 And now that you have perhaps coworker data
5 for thorium and others, and I'd like to see a
6 comparison to see if that statement is, in
7 fact, a true statement.

8 I mean, it's clear that if you had a
9 person who worked for one year, but to assume
10 that that is, that particular model transcends
11 all other options for saying we're going to
12 clear the slate by assuming that we can run
13 your dose model using (inaudible) and thereby
14 determine whether or not you're going to reach
15 the 50 percent mark is something that I
16 haven't convinced myself truly holds.

17 **MR. ROLFES:** This is not an SEC issue. It
18 is how NIOSH does dose reconstruction. That
19 is the issue. The TIB-0002 methodology we can
20 show you a comparison of TIB-0002 intakes
21 versus actual data.

22 **DR. BEHLING:** I would like to see, now that
23 we're in the process of revising the TBD we're
24 developing white papers. We're developing
25 coworker models. I'd like to see someone for

1 whom that TIB-0002 was used to say, okay,
2 you're finished. We're done with you.

3 I'd like to be sure that under the
4 most extreme case a long-term employee, a
5 worker who is at the forefront of some of the
6 exposures and determine whether or not the
7 current assumptions as you're proposing here
8 would still hold up in the sense where the
9 TIB-0002 data would transcend all other
10 exposures that you just pointed to by two
11 workers.

12 **MR. ROLFES:** Has SC&A seen, have you looked
13 at the data and seen any results where an
14 individual's actual dosimetry records would
15 have exceeded TIB-0002 intakes?

16 **DR. BEHLING:** Well, we've already concluded
17 that dosimeter data for external is one
18 parameter, that uranium bioassay, there are
19 certain loopholes there. We don't know what
20 thorium data to apply and other things that at
21 this point are still part of your ongoing
22 revision.

23 And so we're hard pressed to say once
24 all of the dust settles, and you tell us that
25 you were finished with providing this

1 particular approach and this model, that's the
2 time when we would want to look at and take a
3 limiting case, a worker who worked from the
4 early '50s through the end of his employment
5 career, maybe 30, 40 years later and determine
6 whether or not the application of TIB-0002 is,
7 in fact, a limiting exposure scenario.

8 **DR. MAKHIJANI:** I haven't checked the
9 Fernald situation, and I agree with Hans that
10 we have to await your formulation of these
11 models. But I did do some back of the
12 envelope work in relation to Mallinckrodt, and
13 I believe SC&A raised questions about TIB-0002
14 in the context of Mallinckrodt not with
15 uranium but with the other radionuclides, with
16 Actinium-231, the thorium.

17 And I wasn't convinced that the TIB-
18 0002 -- at the time I think you've since
19 revised it somewhat, and I'm not aware
20 whether, how many and what numbers have
21 changed or how its application has changed.
22 But in the context of Mallinckrodt certainly
23 there seemed to be situations where TIB-0002
24 would not be bounding or would not be a --

25 **MR. ROLFES:** For monitored workers? Is that

1 what you're referring to?

2 **DR. MAKHIJANI:** Well, we --

3 **MR. SHARFI:** OTIB-0002 was not allowed to be
4 used on every case. It does have limitations
5 inside the TIB. It does point out that there
6 are cases where you can run into a situation
7 that you may see larger doses by assessing
8 bioassay than you would have OTIB-0002. So
9 you do have to consider before the monitoring
10 data whether or not OTIB-0002 would
11 (unintelligible).

12 **DR. MAKHIJANI:** Right.

13 **MR. SHARFI:** I don't want to believe that we
14 always say OTIB-0002 is an overestimate, but
15 usually we do some analysis and make sure for
16 that particular claim the OTIB-0002 would
17 result in larger doses than would be if we
18 assessed the individual data.

19 **DR. MAKHIJANI:** I was speaking in the
20 context where you didn't have bioassay data
21 for those radionuclides, and that's why there
22 was sort of an extended discussion about the
23 SEC at Mallinckrodt. And here also we're
24 talking about thorium where you don't have
25 bioassay data for the first 16 years.

1 **MR. SHARFI:** And that might (unintelligible)
2 for OTIB-0002 when we go back and --

3 **DR. MAKHIJANI:** And in that context NIOSH
4 had applied OTIB-0002 in Mallinckrodt and also
5 noted that NIOSH has frequently applied OTIB-
6 0002 in Fernald when, in fact, there are no
7 thorium bioassay data. And so the fact
8 remains to be demonstrated, and in a few cases
9 that I, I did review some cases at Fernald
10 when I drafted the site profile review for our
11 team, and I did not find, you know, I didn't
12 look at every scrap of paper in your dose
13 reconstruction files, but I did not find an
14 attempt to calculate whether the thorium doses
15 are based on air concentration data. Of
16 course, the air concentration models you were
17 using, were they correct?

18 **MR. SHARFI:** Yeah, you've compared that they
19 were concerned to the thorium at the 110 MAC.
20 There was 1,050 MAC which is different than
21 the new proposed. So it may be in the
22 revision of the site profile that now it may
23 not be applicable, and we may have to then go
24 back and redo it, which we'd have to redo
25 those cases. (Unintelligible).

1 **DR. MAKHIJANI:** I agree.

2 **MR. SHARFI:** So there's a lot of potential
3 where a lot of these cases they might be
4 reworked. The thorium they may still be
5 bounding.

6 **MR. ROLFES:** That's correct. We'll go back
7 and look at previously done claims in a formal
8 program evaluation report for Fernald based on
9 document changes to the site profile.

10 **DR. MAKHIJANI:** Right, I agree. The Fernald
11 question is still on the table. I just wanted
12 to point out that this issue had been raised
13 earlier in the context of radionuclides that
14 were not monitored --

15 **MR. SHARFI:** That was never dose per unit.

16 **DR. MAKHIJANI:** Yeah, that was never brought
17 to a conclusion because it was rendered moot
18 by the decision of the Board.

19 **FINDING 4.5-1**

20 **DR. BEHLING:** If there are no other
21 comments, I guess we can go to the next topic
22 starting on page 112, Section 4.5 and we're
23 still with external exposure monitoring at
24 Fernald. Finding 4.5-1 states the absence of
25 performance standards quality assurance for

1 personal dosimeters, and you see in the write
2 up that there were a number of issues here
3 that deal with the training of the people who
4 processed the film, the certain practices
5 involving film dosimeters that were left in
6 cars were experiencing heat damage and other
7 things.

8 And apparently there was very little
9 in the way of controlling how these badges
10 were used by the individual person to whom the
11 dosimeter was assigned to as well as perhaps
12 some of the qualifications for the people who
13 ran the program in terms of their training
14 qualifications in using calibration standards
15 appropriate for the energies to which workers
16 were exposed and a number of other things.

17 And I found very little that would
18 give us a warm feeling about the quality
19 controls and the QA program that was in place
20 especially in the very early years. And
21 again, I refer to a couple of attachments that
22 make reference to that. Among the other
23 things that was missing was obviously
24 extremity exposures that were not monitored
25 properly.

1 **MR. ROLFES:** NIOSH has located inter-
2 comparison studies from Herb Parker, dated in
3 1945. It was inter-comparisons of the
4 (unintelligible) lab, the Oak Ridge Clinton
5 lab and Hanford Works. The three badges were
6 inter-compared. The Oak Ridge dosimeter was
7 the one that was used at Fernald during start
8 up, and we've provided that on the site
9 research database, reference ID 439.

10 **DR. MAKHIJANI:** And the relevance of a 1945
11 study at Fernald?

12 **MR. ROLFES:** It was the same dosimeter.

13 **DR. MAKHIJANI:** The same three badges that
14 were compared?

15 **MR. ROLFES:** The inter-comparison study was
16 done by Herb Parker in 1945. It was an inter-
17 comparison of the Oak Ridge dosimeter, the
18 Argonne National Laboratory dosimeter and the
19 Hanford dosimeters.

20 **DR. MAKHIJANI:** (Unintelligible) dosimeters?

21 **MR. ROLFES:** It was the Oak Ridge dosimeter
22 that was used at Fernald.

23 **DR. BEHLING:** I don't question the validity,
24 obviously the key component in the integrity
25 of a dosimeter is the people who manufactured

1 the film and how does it respond and how is it
2 processed. And when you obviously go through
3 the exercise you will find that there's a fair
4 degree of consistency when you have such a
5 test as you mention.

6 But the question is when these
7 dosimeters were, in fact, processed by in-
8 house people who were perhaps not properly
9 trained, who did not or may not have
10 understood the need for calibrating these
11 dosimeters to energies, photon energies, that
12 were applicable to the facility, then these
13 are issues that you can't really assess by
14 this inter-comparison that you mention.

15 So I still have questions about the
16 quality of the program because there's regular
17 documentation that would give you this feeling
18 that there was a high degree of emphasis
19 placed on the processing of these dosimeters
20 and an assurance program that said these
21 things are always done by procedure. I didn't
22 see such, especially for the early years.

23 **MR. ROLFES:** The calibration curves for the
24 dosimetry that was used at Fernald is in fact
25 on the site research database. There are

1 several calibration curves reported. As far
2 as procedures I would have to take a look back
3 to see what we do have.

4 **MR. GRIFFON (by Telephone):** Hey, Mark,
5 these reports, these Health and Safety
6 Radiation Safety reports, whatever these are,
7 these monthly or quarterly reports, do they
8 have any section on quality, assurance quality
9 control? Because this issue came up related
10 to the bioassay I think related to the
11 urinalysis results, too. And you had
12 mentioned that you were going to look for QA
13 reports but were unable at that point to
14 locate any.

15 **MR. ROLFES:** I'm looking through a stack of
16 papers on the table in front of me here,
17 and...

18 **DR. BEHLING:** The ones I've seen are
19 obviously later years and clearly again when
20 you talk about later years, the question is to
21 what extent were similar procedures applicable
22 to earlier years. And that's always an
23 unanswered question. Obviously, as we all
24 know in the health physics field things were
25 fairly questionable early on in the '50s.

1 They obviously significantly steadily improved
2 over time. And so when you look at something
3 that was the health physics people put out in
4 the '80s, you have to obviously be very
5 mindful of the fact that what existed in the
6 '80s may not have existed in the '70s, '60s
7 and '50s.

8 **MR. ROLFES:** Let's see, I believe we had
9 spoken with a couple of employees from
10 Fernald. We did receive indication that there
11 were procedures for some badge calibrations.
12 We haven't located those procedures to this
13 date I believe. We're still looking for
14 additional procedures and if Leo Faust is on
15 the line I wondered if he could please
16 elaborate on what I've just stated.

17 Leo, are you on the line with us?

18 **MR. FAUST (by Telephone):** Yes, I am. You
19 have to remember, Mark, that the first year
20 and a half of operation at Fernald, the
21 dosimeters were actually read out by HASL.
22 And they didn't start their own read out until
23 I would say 1953, about 18 months after start
24 up. As far as calibration is concerned they
25 used uranium and uranium slab of which the

1 surface dose rate is well known, and they used
2 radium as their photon source which everybody
3 else did, too.

4 That badge, the Oak Ridge badge, or as
5 it's referred to in the Parker study as the
6 Clinton Laboratory, that badge was used for a
7 long time and any changes that were made at
8 Oak Ridge were incorporated in the same
9 dosimeter that was employed at Fernald until
10 Fernald decided to go with a TLD system which
11 was in the '80s.

12 So we also found some procedures that
13 were employed. I did not find any that
14 related to the actual calibration itself other
15 than the calibration curves and the timing
16 that was used to establish a certain number of
17 doses to calibration film.

18 They also handled their film just like
19 everyone else did. They had controls and they
20 had backgrounds. And they stored their new
21 film in refrigerators which was the standard
22 practice.

23 **DR. BEHLING:** Well, I'm going back to page
24 112 of our report, and I made a number of
25 statements which actually are quotations from

1 the 1981 response to dosimetry assessment fact
2 sheet that follows, that's included in the
3 report. And the statement says test
4 dosimeters, i.e., control badges, are not
5 routinely processed. And these are again
6 things that a good quality assurance program
7 would do obviously on a routine basis.

8 You would obviously zero in your
9 densitometer and make sure your densitometer
10 is working. You would have various protocols
11 that says on measuring things that I can
12 reliably assign to an individual as an
13 exposure. And there seems to be questionable
14 data that would support that this was in fact
15 done.

16 **MR. FAUST (by Telephone):** What time period
17 was that?

18 **DR. BEHLING:** Well, I don't know if you have
19 access to --

20 **MR. FAUST (by Telephone):** No, I do not.

21 **DR. BEHLING:** Okay, then I'm sorry, but in
22 my report as Attachment 4.5-1 on page 113 is a
23 response to dosimetry assessment fact sheet.
24 Apparently the National Lead Company of Ohio
25 was asked to perhaps support a reconstruction

1 program. And they went back to historical
2 records.

3 And so you get some assessment of what
4 they felt in 1981 were limitations that would
5 allow them to do so. And in that report they
6 make certain statements that lead you to
7 believe that they didn't really have a lot of
8 faith in some of that historical dosimetry
9 data.

10 **MR. FAUST (by Telephone):** Yeah, I'm
11 familiar with that report. I don't have it
12 with me. I'm sitting in Branson, Missouri, as
13 a matter of fact. But the person that, well,
14 we're intimately familiar with that particular
15 report, but from our interviews with at least
16 three different individuals, they all claim
17 that there are not exact responses to the
18 questions that were asked in that particular
19 survey. And that's about all I can say to it
20 at this stage.

21 We also recognize that during the
22 changeover from the film to the TLD that there
23 were some discrepancies in the algorithm that
24 was used. And those discrepancies were in
25 fact taken care of and changes were

1 incorporated into the algorithm. However, we
2 haven't found anything that would discredit
3 the film dosimetry program at the site.
4 Everything that we have found supported a good
5 dosimetry program. And that's been verified
6 by interviews with people that were
7 responsible for the program including an
8 individual that actually operated it.

9 **DR. BEHLING:** Well, apparently there was,
10 but the single individual, I will read to you
11 from one of the pages in paragraph G that
12 states in this particular report, "There were
13 no specific training requirements for the film
14 badge technicians when this program began in
15 1951. The technicians received on-the-job
16 training. The technician now performing all
17 film badge processing began this work" -- and
18 then it's been blanked out for Privacy Act
19 reasons -- and has been the only technician
20 doing this work since whatever.

21 So we have but one individual who
22 apparently was responsible for the issue of
23 assessing personal dosimeters, the film badge
24 dosimeters. And apparently, he was not
25 necessarily trained, formally trained, in this

1 area.

2 **MR. MORRIS:** I have a question for you. Bob
3 Morris. Excuse me, Leo.

4 On page 112 your finding, quotes,
5 "test dosimeters," and I assume that's your
6 parenthetical addition, i.e., control badges?

7 **DR. BEHLING:** Yes, yes.

8 **MR. MORRIS:** Are not routinely processed. I
9 don't think that was control badges that
10 they're talking about there. If you go into
11 the actual text you quote that from, I think
12 you're out of context.

13 **DR. BEHLING:** I'm not sure, where did you --

14 **MR. MORRIS:** Just go down one more page,
15 right below there, and you'll see where you
16 quoted that. And it doesn't say control
17 badges. That was your interpretation of it.
18 And I think that's in response to a specific
19 question, do you use test badges. And I don't
20 think that was in their vocabulary, but he
21 does, whoever replies, goes on to say "test
22 dosimeters are not routinely processed;
23 however, five or ten gamma and six or seven
24 beta and gamma calibration films are
25 processed." So I think that you're out of

1 context on that.

2 **DR. ZIEMER:** There's two kinds of
3 possibilities here I think. One is where
4 you're giving known doses and you're
5 confirming your calibration. Another would be
6 a blind test. Some groups do that where
7 somebody gives a dose, but the reader doesn't
8 know which it is which is different from a
9 calibration.

10 **MR. MORRIS:** A round robin perhaps.

11 **DR. ZIEMER:** Yeah, it's something like an
12 inner-calibration study where the person
13 reading it out does not know the dose that's
14 been given to a, quote, test badge. As I say
15 that's different than a control badge where
16 you give it a known dose and confirm that you
17 get some density reading on the film. So
18 those two --

19 Hans, I'm wondering if those two
20 issues got intertwined here.

21 **DR. BEHLING:** You know, in fact I'm kind of
22 trying to search where that statement was
23 extracted from.

24 **MR. MORRIS:** Okay, let me get it for you
25 exactly.

1 **DR. BEHLING:** Give me the number.

2 **MR. MORRIS:** In your attachment there's a
3 little page number two at the bottom of it,
4 and it's item D, page 114 at the bottom.

5 **DR. BEHLING:** D, okay, now I see.

6 **MR. CLAWSON:** This is Brad. We used a
7 control badge, and I believe they use that for
8 general background.

9 **MR. MORRIS:** That's right.

10 **DR. ZIEMER:** Yeah, a control badge that
11 gives you a background reading.

12 **MR. FAUST (by Telephone):** Correct.

13 **DR. ZIEMER:** Badges which are given known
14 doses to establish your calibration curve.
15 And then the third thing is many places used a
16 blind test badge where somebody has given that
17 badge some dose and the reader doesn't know
18 what it is in advance.

19 **MR. RICH:** You express those in your
20 sequence so that periodically it just
21 validates --

22 **DR. ZIEMER:** It looks like another user
23 badge and whoever's reading it out doesn't
24 know that it's --

25 **MR. CLAWSON:** Checked before that it was --

1 **DR. ZIEMER:** I'm wondering if they didn't do
2 that.

3 **DR. BEHLING:** Well, I guess I don't really
4 understand what a test dosimeter represents.

5 **MR. MORRIS:** Well, I think he, we don't know
6 what the --

7 **DR. ZIEMER:** Sort of like a blind review for
8 dose reconstruction.

9 **DR. BEHLING:** On the next page, item E
10 again, "test dosimeters were not routinely
11 evaluated." I don't have --

12 **MR. MORRIS:** Well, first of all they didn't
13 process them, and then they didn't evaluate
14 them.

15 **MR. FAUST (by Telephone):** That's correct.
16 They were not processed unless there was some
17 mix-up or a question regarding a particular
18 result of a particular dosimeter. Then a
19 control may have been processed just to answer
20 that particular.

21 **MR. MORRIS:** The way I interpret this is,
22 are you involved in a round robin where you're
23 trading dosimeters with other groups.

24 **MR. FAUST (by Telephone):** That we would
25 terminate, we would call that a test program,

1 and they would be readily identified as a
2 separate test from the ordinary day-to-day
3 operation of the dosimetry program.

4 **MR. MORRIS:** But I think the important part
5 of this quote is where the responder says test
6 dosimeters weren't done, but we did do five of
7 these and six of those.

8 **MR. FAUST (by Telephone):** That's correct.
9 They did a whole bunch. I mean if I remember
10 correctly it's some 15. They also used a so-
11 called fast dosimeters for the calibration of
12 their densitometers.

13 **DR. BEHLING:** We can strike number three
14 then. As I said I was not, and I'm still not
15 certain I understand what test dosimeters are,
16 but I will accept the notion that a certain
17 number of badges were processed with this
18 badge to establish the fact that a system was
19 properly functioning, at least the
20 densitometer.

21 **DR. MAKHIJANI:** Number three.

22 **DR. BEHLING:** Three on page --

23 **DR. ZIEMER:** In the report.

24 **DR. MAKHIJANI:** Not in the matrix.

25 **DR. ZIEMER:** No.

1 **DR. ZIEMER:** Could I ask here? I'm not sure
2 anybody was using sort of you mention the
3 quality factors here. Somewhere I thought I
4 saw that. Virtually everyone in the early
5 '50s was using a, well, I'm not sure anybody
6 was using the rem even.

7 **DR. BEHLING:** No, they were interchangeable.

8 **DR. ZIEMER:** Well, I think in the early '50s
9 I'm not sure the rem was even --

10 **MR. RICH:** Invented yet.

11 **DR. ZIEMER:** Well, probably invented, but I
12 think almost all badges were in Roentgen units
13 in those early days. Even the rad probably
14 wasn't, in fact, they were using reps and --

15 **MR. FAUST (by Telephone):** And we recognize
16 that, and we take the easy route out, and we
17 equate them all.

18 **DR. ZIEMER:** Well, I think within the
19 accuracy of a film badge, a rep, rad, rem,
20 it's probably the same thing.

21 **MR. FAUST (by Telephone):** It didn't matter
22 all that much.

23 **MR. RICH:** For gammas.

24 **DR. ZIEMER:** For gammas I'm talking.

25 **MR. FAUST (by Telephone):** Yeah, for gammas.

1 A rep was like 94 erds* per gram and a
2 Roentgen is give or take a little bit about
3 88.

4 **DR. ZIEMER:** Eighty-seven point six.

5 **MR. FAUST (by Telephone):** Yeah, right. So
6 for all practical purposes it doesn't really
7 matter whether, you can interchange them
8 without worrying too much about it. And they
9 finally, everybody did. But as far as I can
10 tell the rem didn't come into play until
11 probably early '50s, somewhere around '55 I
12 would guess.

13 **DR. ZIEMER:** Well, I don't think it was that
14 early. I'd say '59 or '60.

15 **MR. FAUST (by Telephone):** Well, I was
16 thinking of ICRP-2 they were using the rem.

17 **DR. BEHLING:** Well, that wasn't published
18 until '59.

19 **DR. ZIEMER:** Roughly, yeah.

20 **MR. FAUST (by Telephone):** That wouldn't
21 matter here anyway.

22 **DR. BEHLING:** In fact, if you look at
23 (unintelligible) 20 in the late '80s before
24 they converted or revised the NCR
25 (unintelligible) standards, the statements say

1 that Roentgen is the rem for gamma and beta.
2 That's the statement. I don't know what to
3 say other than to again mention the fact that
4 I didn't come across any kind of QA of
5 procedures or anything that for the early
6 years would let you know that there was a
7 quality program here that had certain
8 procedures that had to be adhered to in
9 processing and read out of dosimeters.

10 I obviously identified that as a
11 finding, but at this point you're going to
12 find anything that would support your
13 statement that there was some very, very well
14 defined procedures and protocols in place. I
15 didn't see any. And the 1981 document reports
16 that statement that there is very little data
17 so we really (unintelligible) which film
18 dosimeters were used.

19 Finding 4.5-2, unaccounted doses to --

20 **MR. GRIFFON (by Telephone):** Hans, back to
21 4.5-1, I just wanted to say I have one action
22 down there which is just that, and this has
23 been a kind of ongoing thing, that NIOSH will
24 also attempt to identify procedures in their
25 QA reports from the early time period related

1 to that topic. So it's just sort of a follow
2 up. If we can find any procedures or QA
3 reports from that '53 to '85 time period that
4 might help close this out.

5 The only other thing I wanted to note
6 in that in your report page 115 interested me.
7 As we were looking through those other areas I
8 looked at page 115 on the bottom, and this
9 part, I don't know who added the emphasis with
10 the underlining, but it might have been you,
11 Hans.

12 Under number one there at the bottom
13 of the page it says employees have always worn
14 badges; however, exposures were not always
15 determined for all employees. I think we
16 might want to keep this in mind as we look at
17 the data completeness question when we look at
18 these individual files. I don't know if it's
19 going to even, are we going to be able to pick
20 that up though because I'm not sure what years
21 we might have annual summary data as opposed
22 to cycle data.

23 Can NIOSH respond to this? I mean,
24 you're probably aware of this issue or this
25 statement, but does this result in gaps in the

1 external monitoring data or have you examined
2 this at all?

3 **MR. ROLFES:** NIOSH is aware that not
4 everyone was monitored.

5 **MR. GRIFFON (by Telephone):** This says even
6 the people who were wearing their badges, not
7 all of them, exposures weren't determined for
8 all of them.

9 **DR. ZIEMER:** This is Ziemer. I'm not sure
10 you should interpret that word badges as film
11 badges.

12 **MR. GRIFFON (by Telephone):** Security
13 badges, I know, yeah.

14 **DR. ZIEMER:** I mean many facilities
15 everybody wore badges, but not everybody wore
16 film badges. The ones that did those were
17 built into the security badges.

18 **MR. GRIFFON (by Telephone):** Since badges
19 were always a combination security/dosimeter
20 badge is the first line in that paragraph,
21 that's what I was going on.

22 **DR. ZIEMER:** Yes, but if you weren't
23 required to wear a film badge, it wasn't
24 loaded as it were.

25 **MR. GRIFFON (by Telephone):** Right, right,

1 right, so, yeah, I understand. And also, if
2 they were in a, they could have made an
3 educated determination to not measure, like I
4 think at Rocky Flats we found that they made a
5 decision; it was in memos, that these people
6 that were on quarterlies we weren't going to
7 read the badges in these years because they
8 were likely to have very limited exposure
9 anyway. And so they made a determination that
10 certain people even though they had the badge
11 in there, they weren't going to bother reading
12 it.

13 **DR. ZIEMER:** Well, you wouldn't read it
14 unless there was some kind of an incident?

15 **MR. GRIFFON (by Telephone):** Yeah, if
16 something came up, then they might, you know,
17 so they only, but I just wondered whether
18 this, you know, I'm not sure exactly how to, I
19 just noticed this statement as I was reading
20 through.

21 **MR. FAUST (by Telephone):** This is Leo
22 Faust. We have to remember that the dosimeter
23 in the security credential weren't necessarily
24 incorporated into a single unit until later
25 on. I can't tell you what Fernald did, but a

1 lot of other sites the security credential and
2 the dosimeter were two separate things. And
3 finally they were incorporated probably in the
4 mid-'50s for the most part.

5 **MR. GRIFFON (by Telephone):** Yeah, that's
6 what I, we've certainly seen that at other
7 sites. And this statement in the survey,
8 maybe I'm misinterpreting it or it might be
9 slightly inaccurate. Who knows? But I just
10 think we might want to, but I think this
11 question can be further examined in our review
12 of the data completeness question really. I
13 don't know that --

14 **DR. ZIEMER:** Another piece of that is it
15 looks like they had criticality dosimeters
16 incorporated into those. So that might be a
17 reason why everyone would wear it.

18 **MR. GRIFFON (by Telephone):** Right, right.

19 **DR. ZIEMER:** But you wouldn't look at any of
20 those unless you had a criticality accident.

21 **MR. HINNEFELD:** This is Stu Hinnefeld from
22 NIOSH. I'm just reading this note off Brad's
23 screen here, and it sounds to me like they
24 describe the people who were not, whose badges
25 were not read and were women through two

1 periods of time. And I was told anecdotally
2 while I was there that there was a period of
3 time when women weren't allowed to go to the
4 process areas so they didn't wear a dosimeter.

5 **MR. GRIFFON (by Telephone):** Yeah, maybe it
6 is just a female.

7 **MR. HINNEFELD:** I believe the people who
8 were -- wore a badge who were not monitored
9 are depicted right there in the following four
10 lines. It's the two periods when women
11 weren't.

12 **MR. FAUST (by Telephone):** Well, yeah, there
13 was two periods in time when females were not,
14 did not wear a dosimeter.

15 **MR. HINNEFELD:** I believe that's the entire
16 interpretation of that statement that not
17 everybody who wore a badge was monitored.

18 **MR. FAUST (by Telephone):** That could very
19 well be, Stu.

20 **MR. GRIFFON (by Telephone):** It could be,
21 Stu. You could be right, yeah, yeah.

22 **MR. SMITH (by Telephone):** This is Billy
23 Smith. I was the health physicist in charge
24 of dosimetry at the Nevada Test Site for
25 years, and I processed thousands of film

1 dosimeters. The terminology that I've been
2 listening to relative to the quality control
3 process that may have been in place, at NTS we
4 processed film in batches of 100 badges each.

5 And in each batch we had two controls
6 which were dosimeters, film badges, that had
7 no dose on them that we used to determine what
8 the background was going to be that we were
9 going to subtract from any readings from any
10 film that we read.

11 Also in that batch we had five
12 standards. The five standards were film that
13 had been exposed to 30 millirem, 100 millirem,
14 500 millirem, 1,000 millirem and 2,000
15 millirem. Those were processed prior to
16 reading any dosimeters for dose purposes from
17 people to determine that the densitometers
18 were working properly, and then the individual
19 film dosimeters were read.

20 Now if the same process that Oak Ridge
21 had previously established that Fernald was
22 following, then they would process controls
23 and what I call standards at the same time.
24 And that to me indicates a quality control
25 process that's going on in the reading

1 process.

2 **MR. FAUST (by Telephone):** I think they
3 looked at it that way, Billy, because that was
4 pretty much the standard practice throughout
5 the industry. And there's no reason to
6 believe that Fernald was any different than
7 anybody else in my opinion anyway.

8 **MR. CLAWSON:** Well, we can all project our
9 opinions into what they mean, but bottom line
10 is we're trying to get to the bottom of a
11 determination if we could find this is
12 evidence of this, then it brings this to a
13 head. And as Mark stated into this that he's
14 tried to check for a procedure or so forth
15 that was being followed to be able to say that
16 this is how it was done.

17 **MR. FAUST (by Telephone):** And we're
18 continuing trying to find those procedures.
19 We found a lot of different procedures, but we
20 haven't found one for that yet. But that
21 doesn't say it doesn't exist.

22 **MR. CLAWSON:** That's true.

23 **DR. ZIEMER:** So they're continuing to look
24 for that then. Well, who read about the five
25 and four? Was that from there? Was that a

1 procedure?

2 **DR. BEHLING:** Yes.

3 **MR. MORRIS:** Well, right here on page -- you
4 got your file open?

5 **DR. ZIEMER:** Oh, yeah.

6 **MR. MORRIS:** The SC&A report page 114 at the
7 bottom of that page, item D.

8 **DR. ZIEMER:** Now is that a quote from --

9 **DR. BEHLING:** You know, the response, from
10 the 1981 response report.

11 **DR. ZIEMER:** Okay.

12 **MR. GRIFFON (by Telephone):** And that sort
13 of, I mean, Paul, I think that says they're
14 doing calibration films but whether it was
15 each batch just like we heard happened in
16 Nevada. But if we can get a --

17 **DR. ZIEMER:** Well, a formal procedure would
18 help.

19 **MR. GRIFFON (by Telephone):** But I think
20 that's as far as we can take it really is to
21 try to identify that.

22 **DR. ZIEMER:** They're doing that which would,
23 if they're doing what would be considered good
24 practice at the time, that's important.

25 **MR. GRIFFON (by Telephone):** Right, but I

1 think this survey, to me anyway, it says they
2 were doing calibration runs along but not
3 necessarily what people are calling tests or
4 round robin tests or whatever.

5 **MR. FAUST (by Telephone):** By the way that
6 was recommended in that Parker report that
7 continued inter-comparisons between the sites
8 was recommended by Herb. Whether or not it
9 was practiced I can't say for certain, but I
10 do know that at the Hanford site we did
11 exchange dosimeters with various other
12 organizations on a cooperative kind of a
13 basis. There was nothing required to do that,
14 but we just did it as a good practice.

15 **DR. ZIEMER:** Do we know whether later on
16 after they got into TLDs and so on, did they
17 get involved, would they have been eligible
18 for DOELAP?

19 **MR. HINNEFELD:** They were certified by
20 DOELAP.

21 **MR. FAUST (by Telephone):** They were the
22 very first organization to be DOELAP
23 accredited.

24 **DR. ZIEMER:** Okay, well, that's important to
25 know.

1 **MR. FAUST (by Telephone):** And they've kept
2 it up or they've kept it up through their
3 operating time.

4 **DR. ZIEMER:** Well, that doesn't come out of
5 the blue either. There had to be some --

6 **MR. CLAWSON:** Other reason.

7 **DR. ZIEMER:** -- well, some basis for
8 achieving that.

9 **MR. MORRIS:** This is Morris. One of the
10 things, Hans, that you had mentioned in your
11 preliminary remarks was matching the energy
12 spectrum of the radionuclides to the challenge
13 spectrum that is used for calibration. And
14 radium and uranium combination is quite a
15 reasonable approach to matching that spectra I
16 would think.

17 **MR. FAUST (by Telephone):** Well, they
18 couldn't get any better quite frankly. And
19 later on it was DOELAP. DOELAP dictated what
20 calibration energies they had to perform by.
21 So that kind of took it out of the individual
22 site's hands so to speak.

23 **MR. CLAWSON:** Well, this is a rousing
24 conversation. I do think we're going to take
25 probably a ten-to-15 minute break. We're just

1 going to mute the phone, but we're going to
2 have a quick comfort break, and then we'll
3 come back.

4 (Whereupon, the working group took a break
5 from 3:30 p.m. until 3:40 p.m.)

6 **DR. WADE:** We're back in session, the last
7 leg of a journey.

8 **FINDING 4.5-2**

9 **DR. BEHLING:** I guess we're down to the item
10 finding 4.5-2 on page 119 and that is the
11 exposures to extremities. And I guess there
12 were certain studies done, and I quote them in
13 the first quotation there on page 119 that
14 talked about fairly high ratios.

15 And I can only gather that the ratios
16 that are defined therein in 1963 where they
17 identified 22.9 rem that represents beta and
18 gamma versus 4.4 rem penetrating only in
19 providing a fairly high ratio was based on a
20 whole body dose in the one on the chest. And
21 at that point they compared it to earlier data
22 in the 1960s when that same ratio was 20.7 to
23 1.

24 And so it's clear that there were
25 significant skin exposures, and I believe

1 those measurements represent a film badge worn
2 at the chest. Now the question that comes to
3 mind is what would have been the potential
4 exposures to extremities that were not
5 monitored.

6 And it's clear that obviously that
7 ratio for a whole body dosimeter may have
8 significantly underestimated skin exposures
9 experienced by your extremities based on
10 strictly the geometry and/or distance to
11 source term especially when you deal with
12 uranium and its radioactive daughters,
13 Protactinium-234. So I raised some questions
14 about the potential for extremity exposures
15 that may not have been properly monitored or
16 not monitored at all.

17 Because in the next paragraph down
18 there we talk about, and I quote, "The results
19 of the study showed projected annual forearm
20 exposures from about 14,000 to 46,000
21 millirems." And there was a subsequent time
22 period during which wrist exposures were used,
23 and again, they may or may not necessarily
24 reflect hand exposures which were estimated to
25 be two-to-three times the wrist exposure.

1 So this whole issue deals with
2 extremity exposures to the skin and in
3 particular hand exposures that even during the
4 time of wrist monitors may not have been
5 properly assessed. So I guess I'll ask Mark
6 to, give your opinion as to what you intend to
7 do to deal with skin exposures and
8 specifically skin exposures involving the
9 extremities.

10 **MR. ROLFES:** We at NIOSH typically don't
11 receive many claims for a skin cancer of the
12 extremities. I can think of one. We do have
13 extremity monitoring for many individuals that
14 may not be complete in certain years.

15 What we have done typically is used
16 recorded results to the time, day, the ratio
17 for -- to interpolate between years where the
18 individual didn't have an extremity monitor.
19 We can use a ratio of the dose received by the
20 whole body badge to assign a ratio to the
21 extremities, or assign a dose to the
22 extremities, excuse me.

23 We don't consider this to be an SEC
24 issue but rather an issue that is how we go
25 about doing dose reconstructions. What

1 assumption we make regarding the dose that's
2 being assigned. And once again this is for a
3 very, very low number of individuals whose
4 dose is being reconstructed.

5 **DR. BEHLING:** I accept the notion that skin
6 cancer of the extremities are probably not a
7 very common occurrence, and you may not even
8 have one. But if you did have one, you would
9 have a difficult time in reconstructing
10 exposures during a timeframe when skin
11 exposures to the extremities was not the
12 issue. And so if it's a contractor would you
13 say I'll reconsider that the potential issue
14 that involves (inaudible) because you really
15 have no way of properly addressing that
16 particular exposure.

17 **DR. MAKHIJANI:** I have a question.

18 **MR. ROLFES:** The approach that we use in
19 that case it would be done on a case-by-case
20 basis. We would have to take a look at the
21 extremity dosimetry results for the employee.
22 And if there was a year or two years that the
23 individual was not monitored for extremity
24 doses to the skin, on skin we could use a
25 previously documented ratio of the recorded

1 wrist dosimeter to the whole body badge and
2 assign that ratio for the unmonitored periods.
3 There are other methodologies that could be
4 used.

5 **DR. MAKHIJANI:** Mark, just a question of I
6 thought wrist dosimetry started in 1970. Was
7 there wrist dosimetry before 1970 at Fernald?

8 **MR. ROLFES:** I don't believe a routine
9 program prior to that.

10 **DR. BEHLING:** No, and, Arjun, what I've
11 mentioned was the earlier ratios that were
12 developed were based on the shallow dose to
13 deep dose worn at the chest so we don't really
14 have an understanding other than certain
15 measurements that were done, I guess, on an
16 experimental level later on that would suggest
17 a fairly large ratio.

18 **DR. MAKHIJANI:** Yeah, so that's right. I
19 mean, it's not a question of a year or two gap
20 where somebody was monitored, and then they
21 were not monitored so you can interpolate
22 something, the whole first 19-year period I
23 think. There may have been some experimental
24 badging, but I don't believe there was
25 extremity badging until 1970.

1 **MS. BALDRIDGE:** Mark, I have a question.
2 Have you addressed exposure to private
3 contractors who came in? Because the petition
4 was filed for employees and subcontractors. I
5 personally met a gentleman who had skin cancer
6 on his arm who was a private contractor. He
7 wouldn't have monitoring. He was allowed to
8 work in his street clothes.

9 **MR. ROLFES:** Was he in a radiation area?

10 **MS. BALDRIDGE:** He was cleaning and
11 painting. He's had two types of skin cancer.

12 **MR. ROLFES:** Was he in the process area or
13 was he outside of the area?

14 **MS. BALDRIDGE:** I don't know where he was,
15 but the point is subcontractors who didn't
16 have files, they're not considered employees
17 to be monitored the same way someone on
18 National Lead's payroll would be. What type
19 of provision is there for them in the
20 evaluation of their extremity exposures?

21 **MR. ROLFES:** What time period was the
22 individual on site?

23 **MS. BALDRIDGE:** Probably late '80s, '90s.

24 **MR. ROLFES:** Well, if it's the '90s, we
25 haven't specifically looked outside of the SEC

1 time period. During the '90s I haven't looked
2 in detail at the procedures involved for
3 individuals that were brought into the site.

4 **MS. BALDRIDGE:** I believe his father was a
5 sheet metal worker, and he's been dead for
6 years. So there wouldn't have been a claim
7 filed for him unless he filed for his father
8 in addition to himself.

9 **MR. ROLFES:** I would have to take a look at
10 the information that we have and separate from
11 dose to the extremities for a painter or for
12 someone who would have brought in casually
13 into the area. It's very unlikely that those
14 individuals would have spent a significant
15 amount of time in a position where they were
16 directly handling uranium metals.

17 **MS. BALDRIDGE:** Except that they would have
18 had to be cleaning and prepping areas that
19 would have been contaminated.

20 **MR. ROLFES:** Sure, they may have --

21 **MS. BALDRIDGE:** Releasing that as a dust
22 factor. If they're sweaty, then you have an
23 adhesive factor there where the perspiration
24 just causes the dust to cling to the skin.

25 **MR. ROLFES:** We actually did a little

1 research experiment to bound this scenario. I
2 can have Billy if he's on the line and
3 available to discuss what we did, or Bob?

4 **MR. MORRIS:** I don't have my memory right
5 now.

6 **MR. ROLFES:** Okay, Billy, are you available
7 to discuss what we did with the experiment
8 that was conducted to bound skin
9 contamination?

10 **MR. SMITH (by Telephone):** Yes, I'm on the
11 line. I conducted an experiment at ULD using
12 Whatman filter paper, both wet and dry filter
13 paper, and to see how much contamination could
14 actually be deposited, retained on the filter
15 paper.

16 I used chalk dust, that is the
17 construction material that's used to mark
18 chalk lines, and sprinkled it on square pieces
19 of paper that were about three centimeters
20 square. And then shook it off of the dry and
21 the wet and then weighed the individual pieces
22 of paper. And there were 20 pieces of paper
23 in each category.

24 And then after the weighing took
25 place, I converted that math to what the

1 uranium, I assumed that that mass was uranium
2 and converted it to a uranium number and came
3 up with what kind of contamination would be
4 retained on a person's skin. It's interesting
5 to note that it takes a very, very large
6 amount of contamination to be seen on a
7 person's skin, on his contamination clothing.

8 And right now I'm in the process of
9 finishing up a white paper of this experiment
10 that will be provided to NIOSH so they'll be
11 able to put it out on the O drive so you can
12 get a feel for what the exposures would be.
13 But the exposures came up to be very, very low
14 from the amount of contamination showing up on
15 these particular experimental papers.

16 **MR. FAUST (by Telephone):** This is Leo. In
17 addition to that there were some actual
18 measurements of contaminated gloves at
19 Mallinckrodt. And the maximum dose rate was
20 measured, if my memory serves me correctly,
21 was 45 mRads per hour. And the smallest or
22 the minimum dose rate, and these are now
23 contaminated gloves, was like 23 mRads per
24 hour. So the people that we interviewed were
25 adamant in their insistence on clothing

1 changes at least twice a day and glove changes
2 as often as once an hour. So in our
3 estimation and in the records if you look at
4 the exposure records, there is no one that
5 exceeded the administrative levels for skin
6 contamination.

7 **MR. MORRIS:** Skin dose.

8 **MR. FAUST (by Telephone):** It's highly
9 improbable that a painter, particularly late
10 in the '80s or early '90s, would have had
11 anywhere near that kind of an exposure.

12 **MR. ROLFES:** In addition to what Leo has
13 said we also do have some surveys that were
14 taken of personnel clothing, coveralls. There
15 were several measurements made in various
16 areas of several different employees'
17 coveralls and shoe covers. There are results
18 --

19 **MR. FAUST (by Telephone):** It's item 41-36.

20 **MR. ROLFES:** Approximately 15 measurements
21 of the chest area on coveralls, the stomach
22 area on coveralls, the thigh area and the leg
23 area of coveralls, and then also additionally
24 there are radiation survey results of the shoe
25 covers. The results range from, the highest

1 result that I see here is one and a half
2 millirep per hour.

3 **MR. FAUST (by Telephone):** There was also
4 the Fernald used the wrist dosimeter prior to
5 the advent of reasonable TLDs, and they used a
6 wrist-to-extremity ratio. And the ratio that
7 was employed was three. So whatever the wrist
8 dosimeter results were, the extremities were
9 given three times that. And in about 19 -- I
10 believe it was, well, I don't know, '87 I'm
11 going to say, a study was made by an
12 independent person.

13 And she concluded from the results of
14 her study that the ratio, wrist-to-extremity,
15 should have been somewhere around 2.1. I
16 think it's actually 2.09 is what she came up
17 with. But they accepted that, but they did
18 not change any of their doses of records to
19 account for the fact that they were very, very
20 claimant favorable.

21 **MR. GRIFFON (by Telephone):** But I guess I'm
22 having a little trouble following on the phone
23 here. I think we just went back to Finding
24 4.5-2. We delved into 4.5-3 for awhile there.
25 I think for 4.5-3, I don't know how much

1 further we want to discuss it, you have an
2 ongoing action. And it says that in the NIOSH
3 response.

4 But 4.5-2 I think, I mean in my mind
5 my question is similar to what Arjun had
6 raised which is this, you know, there's the
7 other question about this wrist ratio is that
8 prior to 19 -- I forget the date -- 70 or
9 whatever, you didn't have any wrist monitoring
10 at all. So you're proposing that that ratio
11 was consistent through all the early years,
12 too, I guess is what you're saying.

13 **MR. FAUST (by Telephone):** Yeah, and I'm not
14 certain I believe that they actually did use
15 wrist dosimeters pre-1970.

16 **MR. GRIFFON (by Telephone):** Okay.

17 **MR. FAUST (by Telephone):** They didn't use
18 extremity dosimeters, but they used a wrist
19 dosimeter and used that multiplier.

20 **DR. MAKHIJANI:** Well, is there documentation
21 on the site research database about wrist and
22 finger dosimetry? I think Stu might know.

23 **MR. HINNEFELD:** I don't know when the --

24 **DR. MAKHIJANI:** It's my recollection. I
25 might be wrong.

1 **MR. HINNEFELD:** I don't know when the wrist
2 dosimetry started. I believe it was in use
3 when I got there, but I don't know when it
4 started. The ratio, you know, I remember the
5 ratio, the wrist badge being applied to
6 generate the hand or the extremity dose. I
7 remember there was a ratio used for that.

8 **DR. MAKHIJANI:** I agree. I remember the
9 same thing.

10 **MR. HINNEFELD:** But I don't know what the
11 years when wrist monitoring was done. I
12 believe there's a presumption here that wrist
13 monitoring didn't start at the beginning, that
14 whatever ratios could be determined from the
15 monitoring occurred later on would be
16 applicable backward or there may be, you know,
17 I don't know if they're saying they're
18 universally applicable backward or applicable
19 backward with some caveat or some --

20 **MR. GRIFFON (by Telephone):** But if you
21 don't have wrist monitoring in the early years
22 you have nothing to apply the ratio to.

23 **MR. HINNEFELD:** So what I'm saying, no, I'm
24 saying in addition to the hand-to-wrist ratio
25 there's also theoretically a ratio to be

1 developed from a wrist to a whole body.

2 **MR. GRIFFON (by Telephone):** Yeah, right.

3 **MR. HINNEFELD:** So it would be combination
4 of those two ratios if, in fact, it was
5 extrapolateable, backwards.

6 **DR. MAKHIJANI:** Mark and Brad, one of the
7 things we could do since we're looking at
8 external completeness is to look at when the
9 wrist dosimetry started.

10 **MR. GRIFFON (by Telephone):** Yeah, okay,
11 that can be --

12 **DR. ZIEMER:** Well, there's an additional
13 issue. Did they have any operations at
14 Fernald where the body was actually shielded
15 such as you have in nuclear pharmacy where
16 there is reaching around a shield and a whole
17 body dosimeter will read essentially zero and
18 you can have high doses to the hand?

19 That's very different than working,
20 painting and so on where you're moving your
21 arms around and the actual extremity doses are
22 not very different from the whole body for a
23 person just working around in a general
24 radiation field. Their body moves around.
25 Their arms move around, and the integrated

1 doses are probably about the same.

2 The real times when extremity becomes
3 important is when the body itself is shielded
4 or if you have something like the fraction
5 units where you can stick your finger in a
6 beam and that's very different.

7 **MR. HINNEFELD:** I don't recall any, but it's
8 been awhile.

9 **DR. ZIEMER:** Because unless they're doing
10 something like that I don't see extremity
11 dosimetry as being important.

12 **MR. FAUST (by Telephone):** I don't either.
13 Well, to answer your question, Paul, they
14 didn't use a whole body shield as a
15 radiologist might use. They did use some face
16 shields though for eye protection.

17 **DR. ZIEMER:** That's for lens of the eye.

18 **MR. FAUST (by Telephone):** Yeah, right.
19 They did use some rubber matting to cover
20 finished product when it was located near a
21 place where, well, located near an occupied
22 area. They used rubber matting of some kind
23 or another to reduce the exposures that might
24 be obtained from that stockpile, if you will.
25 But other than that I don't believe they used

1 any protective clothing other than anti-cees.

2 **MR. GRIFFON (by Telephone):** But didn't
3 they, I mean, you've got to think about the
4 operation itself not necessarily the
5 protective gear but the operation itself.
6 Didn't they have furnace operations where they
7 would have been reaching into, you know, I'm
8 thinking about like cask cleanouts or cask
9 cleanout operations, those kind of things.
10 That would be the more, where I would expect
11 more and where you have --

12 **DR. ZIEMER:** That's similar to a shielding.

13 **MR. GRIFFON (by Telephone):** -- where you
14 also have the daughters separating, and you
15 have high concentrations of the radionuclides
16 of concern.

17 **MR. FAUST (by Telephone):** Well, they
18 encountered that. There was no doubt about
19 that.

20 **MR. GRIFFON (by Telephone):** Yeah, so that
21 would be more the issue.

22 **MR. FAUST (by Telephone):** The slag was the
23 concentrator of many of the daughter products.

24 **MR. GRIFFON (by Telephone):** Right.

25 **MR. FAUST (by Telephone):** And contaminants

1 of other kinds, too.

2 **MR. GRIFFON (by Telephone):** And that's
3 where I would be concerned about the whole
4 body ratio being representative of what your
5 arms, your forearms, would be getting. I
6 mean, that's why the document Hans has in his
7 report specifically talks about the forearms,
8 and I think that's probably why they're
9 looking at that.

10 **MR. FAUST (by Telephone):** But my point is
11 that the whole body dosimeter would be exposed
12 in those kinds of situations, too.

13 **DR. ZIEMER:** It's reaching in and cleaning
14 up something that was heavily beta in there
15 you might --

16 **MR. FAUST (by Telephone):** Yeah, if it was
17 inside of something, yeah.

18 **DR. ZIEMER:** But I think for dose
19 reconstruction if you looked at the individual
20 case and find out what the person, what kind
21 of things they did, you would end up having to
22 model that in some way I would think.

23 **MR. ROLFES:** You can certainly learn a lot
24 by looking at an individual's dosimetry
25 records, and you can identify those people who

1 would have been in a job where a potential
2 extremity dose could have been significant.
3 Typically, those individuals weren't monitored
4 especially in the more recent years.

5 There were surveys taken in the
6 earlier years prior to extremity monitoring.
7 That is typically something that is done on a
8 case-by-case basis based on the specifics of
9 the case. That's how it's previously been
10 handled. And it's been handled for a very,
11 it's been a low number of individuals who are
12 potentially affected by this issue.

13 **MS. BALDRIDGE:** I have a question. It's not
14 exactly an extremity, but how do you deal with
15 the set-up man, the set-up people that worked
16 with their heads inside the machinery?

17 **MR. ROLFES:** The head is considered an
18 extremity so it's not the same extremity that
19 we're referring as the hand or a foot, but it
20 is once again --

21 **MS. BALDRIDGE:** Special consideration for
22 that type of exposure?

23 **DR. ZIEMER:** There's a different dose limit
24 for the lens of the eye because that's a
25 critical organ for the head.

1 **DR. BEHLING:** In those early days they
2 didn't have a 300 milligram dose to worry
3 about.

4 **DR. ZIEMER:** They didn't worry about it, but
5 we would worry about it now for dose
6 reconstruction.

7 **DR. BEHLING:** Either shallow dose or 1,000
8 milligram dose.

9 **DR. MAURO (by Telephone):** This is John.
10 Are we talking about concern over skin cancer
11 of the extremities?

12 **DR. BEHLING:** Yeah, I guess we're talking
13 about skin cancer not only of the extremities
14 but in the next finding, 4.5-3, we talk about
15 shallow and deep dose resulting from skin and
16 clothing contamination that now extends to the
17 whole body skin that may have been
18 underestimated by use of a whole body film or
19 TLD that may or may not necessarily represent
20 the skin exposures received to the head or the
21 chest, the trunk or any place else.

22 So, yeah, we're talking about skin
23 cancers at large, and then in Section 4.5-2
24 we're talking about potential skin cancers as
25 they reflect the areas of the skin associated

1 with the extremities, the hands and the
2 forearms.

3 **DR. MAURO (by Telephone):** Now what about
4 the, we know what the upper limit is for a
5 contact dose with uranium. So in other words
6 I think it's 200 MR per hour in that order.

7 Does that have any play here or are we
8 basically saying all dose reconstructions, for
9 example, related to skin cancer would be based
10 on some type of film badge reading either
11 wrist or some kind of adjustment factors to a
12 ratio of, let's say, hand-to-wrist or does
13 somehow this affect the upper theoretical
14 limit, which would be the contact dose, have
15 any play here in dose reconstruction? Do you
16 believe that the person who was involved in
17 actually handling -- in this case I'm using
18 pure, natural uranium -- do any of your
19 procedures factor that in as opposed to
20 depending on the actual film badge reading?

21 **MR. ROLFES:** The first piece of information
22 for a dose reconstruction, for example, for a
23 skin cancer claim would be the individual's
24 dosimetry records. That was the most
25 significant type of exposure that could have

1 been received by an individual especially
2 chemical operator working in direct proximity
3 to uranium metal, especially aged metal.

4 We are aware that high skin dose
5 results were recorded for many of the chemical
6 operators. We would, in order to have an
7 issue with the dose reconstruction for skin
8 cancer, we would have to have a skin cancer
9 that was a non-compensable claim. At that
10 point we could take a look at the specifics of
11 the case and determine whether the individual
12 was in fact in an area where he was, could
13 have been exposed in any abnormal geometrical,
14 you know, we would take a look based on the
15 location of the individual's cancer to
16 determine if any additional correction factors
17 wouldn't be needed to correct the whole body
18 badge result to the area where the skin cancer
19 was located.

20 I can't give a more specific answer
21 than that because I would need more specific
22 information about the cancer location and the
23 job duties that the individual was working in
24 and also some information about the
25 individual's recorded dose. I'd be happy to

1 explain more details for a specific case
2 scenario.

3 I'd be happy to answer any questions
4 that there are about any specific scenario and
5 how we would handle dose reconstructions for
6 that specific scenario. So if there are in
7 fact a specific case such as --

8 **DR. BEHLING:** Let me point back to the
9 statement that I quoted on page 119 where we
10 had two timeframes, one 1961-1963. And during
11 that time the ratio between penetrating dose
12 and shallow dose as measured by, I assume, the
13 whole body dosimeter mainly worn at the chest,
14 and during that three-year time period it had
15 changed, the ratio had changed from
16 approximately five-to-one to 20-to-one ratio.
17 In other words in 1960 if you measured one rem
18 to the whole body for penetrating radiation,
19 you would have potentially experienced 20 rem
20 of shallow dose. That changed to only five-
21 to-one for 1963. So it was a dynamic process
22 and there was no single value, but it depended
23 obviously on the material that was handled and
24 the quantity of material handled. And so it
25 did change over time. And the absence of

1 monitoring really gives you some problem how
2 to accommodate these skin doses especially to
3 the extremities that were not monitored for
4 these select periods of time early on. And as
5 I said in the second statement, there was a
6 study that said the results of the study
7 showed projected annual forearm exposures of
8 14,000 to 46,000 millirem. You're talking
9 about a substantial dose to the skin involving
10 people who may have handled these materials.
11 And as Sandra pointed out we had a person here
12 with two skin cancers to the forearm, and this
13 person apparently was not monitored. Is that
14 correct?

15 **MS. BALDRIDGE:** (Unintelligible) monitored.

16 **MR. ROLFES:** Was that monitored at all or
17 monitored for his extremities? This sounds
18 more of a contamination issue than it does an
19 extremity monitoring issue. I think they're
20 two separate issues that we're discussing.

21 **FINDING 4.5-3**

22 **DR. BEHLING:** Well, that brings us to the
23 next statement, and that is unmonitored
24 shallow and deep dose resulting from skin-
25 clothing contamination. And we briefly

1 addressed it. I think Leo or somebody else
2 had mentioned the issue of having done
3 experimental studies with chalk and filter
4 paper.

5 But I did go through it and obviously
6 anti-contamination of clothing was not
7 provided for a good number of years during the
8 operation, and neither were people monitored
9 by using the friskers or portable monitors for
10 skin contamination. And, of course, in those
11 days early on one can reasonably conclude that
12 oftentimes people may have worn the same
13 clothing over and over.

14 And the assumption that skin
15 contamination is something that is confined to
16 at most a 24-hour period between showers may
17 or may not hold true. Certain skin
18 contamination is very persistent, and
19 therefore, in the absence of monitoring for
20 skin and clothing contamination, you may have
21 had a substantial skin dose that resulted from
22 persistence of repetitive skin contamination
23 that were clearly not monitored.

24 And early on Sandra had mentioned the
25 issue about families being invited onsite and

1 acknowledged the fact that they might in fact
2 be now informed of the issue that they've
3 carrying contamination home with them. And so
4 that particular issue is raised here under
5 Finding 4.5-3.

6 And I don't know when it was that you
7 finally introduced the issue of frisking out
8 people. Certainly it wasn't done for many
9 years early on. In fact, I think it's the
10 1985 site (unintelligible) that identified,
11 and I quote -- this is on page 124 -- "there
12 are no contamination survey instruments kept
13 at the work site for use in checking for skin
14 and clothing contamination. Neither are there
15 any hand and shoe counters available for use
16 either before or after showering."

17 So as late as 1985 you make very
18 little effort to assess people for skin and
19 clothing contamination that may persist for
20 days on end and repetitively expose people to
21 fairly high skin doses.

22 **MR. ROLFES:** Thank you, Hans. Well, I'll
23 reiterate what we do have from 1958 is the
24 results of a clothing survey. It appears that
25 the chest, stomach, thigh and leg area of 15

1 individuals' coveralls were in fact surveyed.
2 The highest contamination result was 1.5
3 millirep per hour. Shoe covers were also
4 surveyed.

5 The highest result there was 0.5
6 millirep per hour, an average of 0.24 millirep
7 per hour was documented. Individuals that
8 were working in the process areas were
9 required to shower before they left the area
10 for lunch and then again before they left for
11 the day. Employees were also encouraged that
12 if they had visible contamination on their
13 clothes, they were encouraged to shower during
14 the day, and they were allowed by management
15 to leave the process area to go take a shower
16 and change into new clothes.

17 Management also encouraged the routine
18 exchange of gloves by these individuals.
19 There is documentation of the numbers of
20 gloves that were sent offsite for laundering.
21 These were in the thousands for one month. So
22 it does indicate that the individuals were
23 changing their gloves very frequently. We
24 have documentation of individuals changing
25 their clothes and showering very frequently.

1 So it's very unlikely that a large
2 contamination, you know, a large unknown
3 contamination problem existed.

4 We feel that based on the results of
5 surveys that were conducted, information that
6 we have in a person's claim files and various
7 other sources, reports. We feel that we can
8 bound a skin contamination dose, and also we
9 do not feel that this is an SEC issue.

10 **DR. BEHLING:** Well, again, it's a subjective
11 issue whether it's something -- if you don't
12 monitor, you can't really assess the exposure.
13 Again here there was a, in Attachment 4.1-3-A
14 on page 123 is a memorandum issued by the
15 senior person who was responsible for the
16 Safety and Health or Hygiene program who in
17 1953 states that only those men involved in
18 the cleaning of the (unintelligible) would be
19 required to make a clothing change, again
20 indicating that the majority of people were
21 not given anti-cees and probably there was
22 minimal effort to assess potential skin and
23 clothing contamination during the early years
24 and possibly as late as the 1980s.

25 **MR. ROLFES:** I can show you pictures of the

1 individuals that worked in the workplace at
2 Fernald showing that they all had anti-cees.
3 They all wore coveralls.

4 **MR. MORRIS:** And it was hundreds of
5 thousands of gloves per month, not thousands.

6 **MR. ROLFES:** There was quite a high number.

7 **MR. RICH:** That's a lot of thousands.

8 **MS. BALDRIDGE:** We have to watch about
9 generalities because this petition covers 40
10 years.

11 **MR. ROLFES:** Correct.

12 **MS. BALDRIDGE:** When my father was working
13 there, he was never issued gloves. I have his
14 clothing issue and gloves was not on it, but
15 yet he was an inspector, and he was handling
16 the slugs for inspection. So when you say
17 there were gloves, there really needs to be a
18 timeline. When were there gloves? You know,
19 there are periods I know there were no gloves.

20 There were periods that people were
21 not required to have the monitoring badge.
22 There were, you know, there's so many
23 different issues that affect specific groups
24 within this petition, but they can't be
25 considered to be broad spectrum over the

1 entire 40 years. They may apply to one part
2 and not another part. When you do the
3 rationale on this you have to be able to
4 differentiate what timeframe, what group was
5 given what protection, what provision, and
6 what other groups were not.

7 **MR. ROLFES:** The report that we were
8 referring to was from 1959, so I haven't
9 completed an exhaustive search for the time
10 periods when gloves may or may not have been
11 worn and the numbers of gloves that were worn.

12 **MS. BALDRIDGE:** I mean gloves is just an
13 example.

14 **MR. ROLFES:** Sure, sure.

15 **MS. BALDRIDGE:** Throughout the discussion,
16 two meetings even before, there's just a lot
17 of factors that each group differs --

18 **MR. ROLFES:** That's very true.

19 **MS. BALDRIDGE:** And it has to be sorted out.

20 **MR. ROLFES:** That's very true. I agree
21 completely with that. There are very specific
22 issues that we're discussing today that
23 typically only affect a very, very small
24 population of the claimants that we have.

25 Many of the issues that we are not

1 discussing, well, excuse me, on a broad basis
2 we typically have 99 percent or greater than
3 99 percent of the information that we use for
4 an individual's dose reconstruction available
5 to us within that dosimetry file. The issues
6 that we're talking about today are typically
7 the less than one percent of the individual's
8 dose or a very small fraction of the
9 individual's work history that we're referring
10 to.

11 It requires a lot of digging, a lot of
12 investigation and these issues really, I don't
13 want to say they don't affect, but we're
14 getting into very specific small populations
15 of workers involved in some of these projects
16 and in some of these unique scenarios.

17 **DR. MAURO (by Telephone):** Mark, this is
18 John. On a related matter we spent close to
19 two or three hours last week talking about
20 OTIB-0017 which is the OTIB dealing with
21 reconstructing shallow doses. And I think a
22 lot of what we're talking about today as
23 applied to Fernald also is very much related
24 to the discussions we had the other day. I
25 think some of the members of this working

1 group are also sit (sic) on the other working
2 group.

3 And I just want to point out that the
4 area that was most contentious with regard to
5 OTIB-0017 was the dependence on your open
6 window film badge reading worn on the lapel
7 for shallow dose measurements and the fact
8 that those measurements -- and I know we're
9 talking about this though -- are really going
10 to decide contact doses which could occur.

11 There's also the matter of particulate
12 deposition. And I think that it sounds like
13 that there's a great reliance on some film
14 badge readings in a setting where there could
15 be, the film badge readings could, may be very
16 non-representative of the exposures to a
17 particular location on the body, especially
18 beta exposures localized to the skin.

19 And so we got into the discussion of
20 particle deposition on skin, the ability to
21 detect it when a person's leaving an area from
22 a scan or a portable monitor. We got into
23 discussions regarding VARSKIN and what type of
24 doses could be experienced as these small
25 particles are sitting, let's say pure uranium

1 metal oxide, on your skin for a day before
2 it's washed off.

3 Subjects that I guess we haven't, I
4 haven't heard discussed here with respect to
5 Fernald. To what extent do those kinds of
6 issues come into play in the dose
7 reconstructions, factoring in all these other
8 matters that I just mentioned?

9 **DR. BEHLING:** John, I would assume that hot
10 particles do not apply to Fernald.

11 **DR. MAURO (by Telephone):** So they don't
12 have any air particulates of uranium
13 depositing on people's skin.

14 **DR. BEHLING:** Well, you mentioned already
15 that they did calculations using enriched, up
16 to 20 percent or whatever, enrichment of
17 uranium and then determined basically on the
18 basis of skin contact what the dose would be.

19 **DR. MAURO (by Telephone):** Okay, I
20 apologize. I didn't catch that. So you do
21 use those techniques to place an upper bound
22 on what some localized dose might have been?

23 **DR. BEHLING:** Yes, and hot particles do not
24 apply to Fernald.

25 **DR. MAURO (by Telephone):** Okay, I'm sorry

1 for bringing it up.

2 **DR. ZIEMER:** Well, another issue, it's not
3 clear to me that the surface dose is really
4 the limiting factor here. Usually on
5 contamination you're really, the same amount
6 of activity, put it in nanocuries or whatever,
7 it's usually pretty low, maybe microcuries in
8 this case.

9 But you can deliver much more if you
10 ingest that than you will ever get to the skin
11 I would think. Isn't the internal dose still
12 going to be kind of the limiting or the driver
13 on these for personal contamination? Is skin
14 dose really the issue? I mean you can get
15 cancer.

16 **DR. BEHLING:** (Unintelligible).

17 **DR. ZIEMER:** Yeah, but it takes a lot of
18 dose to get an effect on the skin.

19 **MR. ROLFES:** Well, our first piece of
20 information if there was a systemic
21 contamination problem that typically skin
22 contamination is not a large source of dose to
23 the skin.

24 **DR. ZIEMER:** That's what I'm saying.

25 **MR. ROLFES:** Direct contact with uranium

1 metal is in large quantities. And that would
2 typically outweigh any potential exposure from
3 skin contamination by orders of magnitude.
4 That's the bottom line. We do have approaches
5 and methodologies that we can add what we're
6 essentially referring to as a very small
7 amount of skin dose based on skin
8 contamination in comparison to the large
9 amount of dose recorded by the person's
10 dosimeter. It's something that we have an
11 approach for, but it's not a very significant
12 source of skin dose so that's the bottom line.
13 And we can do simple VARSKIN calculations to
14 bound skin doses.

15 **MR. CLAWSON:** I just wanted a clarification.
16 This is Brad. You kept bringing up that you
17 sent off hundreds of thousands of gloves for
18 (unintelligible). Was this to be laundered?

19 **MR. ROLFES:** For laundry, correct.

20 **MR. CLAWSON:** Well, we're talking rubber
21 gloves and stuff like that.

22 **MR. ROLFES:** They were leather.

23 **MR. CLAWSON:** Cotton gloves?

24 **MR. CHEW:** Example, one had processed 29,000
25 pairs of gloves in one month in August in

1 1959, something like that.

2 **MR. CLAWSON:** They were surveyed when they
3 came back, too? Because I know that right now
4 we have a problem with our scrubs coming back
5 contaminated with europium and so forth like
6 that.

7 **MR. RICH:** (Unintelligible).

8 **MR. CLAWSON:** I was just sitting there
9 wondering if we had this much data on what was
10 going out, we're monitoring what these were
11 reading going out, coming back, it'd kind of
12 give a better idea of what we had for the kind
13 of contamination issues for that. I was just
14 wondering what kind of documentation we had of
15 that.

16 **MR. ELLIOTT:** I don't imagine they surveyed
17 the activity level on the gloves going to the
18 laundry. Do you think?

19 **MR. CLAWSON:** Ours does before it can leave
20 the building. They've got to have a --

21 **MR. ROLFES:** There are some documents of
22 surveys that contaminated gloves, but as far
23 as them coming back from the laundry I
24 wouldn't believe that.

25 **MR. ELLIOTT:** No.

1 **MR. RICH:** They would check and evaluate.

2 **MR. ROLFES:** They did, however, encourage
3 employees who were doing hands-on work with
4 uranium metal to change gloves, I believe,
5 hourly or as soon as visible contamination was
6 seen on the gloves. And I think that is
7 supported by the number of gloves that were
8 sent offsite in 1959 for laundering.

9 **DR. ZIEMER:** But I've seen overalls and so
10 on come back uncontaminated, but almost always
11 it's like a little spot somewhere. I don't
12 think I've ever seen one that was uniformly
13 contaminated come back from the laundry, and
14 maybe it would read a half an MR per hour, a
15 little spot or something. Well, how important
16 is that in, if you're working in a hot area
17 it's usually --

18 **MR. ROLFES:** Very trivial.

19 **MR. SCHOFIELD:** I've seen them come back
20 with chips of uranium in the pocket.

21 **MR. ROLFES:** Sure, it's very possible.

22 **MR. SCHOFIELD:** Or it's fairly significant
23 how it got out in the first place, shouldn't
24 have been able to get out to the laundry at
25 those levels.

1 **MR. CLAWSON:** I'm kind of at a loss where --
2 be able to do an action item on this.

3 **MR. POTTER (by Telephone):** Mark, this is
4 Gene Potter.

5 **MR. ROLFES:** Yes, Gene.

6 **MR. POTTER (by Telephone):** I just looked in
7 HIS-20 going back to a slightly earlier
8 subject, and there are extremity dosimeter
9 results in HIS-20 going all the way back to
10 1952, only just a few people. I'm only able
11 to look at annual totals for those years, but
12 right through the '50s there are some people
13 who are being monitored with an extremity
14 dosimeter it would appear up until the 1970s.
15 Then they appear to come into much more wider
16 use.

17 **MR. ROLFES:** Thank you, Gene. I did
18 misspeak. There were some individuals that
19 were monitored for extremity exposures earlier
20 on back in 1952 as Gene has indicated.

21 So thank you, Gene.

22 **MR. GRIFFON (by Telephone):** Well, Gene, is
23 it clear whether those were calculated values
24 or actual readings?

25 **MR. SHARFI:** They were actual readings

1 based, they have in HIS-20 a separate results
2 when they actually mark them, either
3 calculated or they give what hand it occurred
4 on.

5 **MR. GRIFFON (by Telephone):** Got you,
6 thanks.

7 **DR. BEHLING:** Can we get some kind of an
8 assessment as to what the ratio is for
9 individuals whose personal dosimetry data
10 include whole body exposure, deep dose,
11 shallow dose from a chest dosimeter as opposed
12 to dosimeter monitoring data from the
13 extremities. That would be extremely useful
14 for those instances where it might be needed
15 and establish a timeline for ratios that may
16 have to be applied in the event of a skin
17 cancer for whom we have no data.

18 **MR. SHARFI:** You have to be careful about
19 drawing too much conclusion. I'm not sure
20 that all these extremities that are listed for
21 the entire year, where their external badge
22 may cover them for the entire year, their
23 extremity may only be from jobs that needed
24 extremity dose monitoring.

25 **DR. BEHLING:** Well, so I'm sure that if

1 there are individual wear periods during which
2 that data's available you simply match those
3 data sets for that wear period and not make it
4 all inclusive for that year. But it would
5 give you some kind of an understanding so that
6 when you have a person who has no extremity
7 monitoring but you have data for someone else
8 for that time period that you can potentially
9 find something that has more transportability
10 than for subsequent years that may have no
11 relationship for the time period in question.

12 **MR. ROLFES:** So you're recommending that we
13 put some guidance into the site profile?

14 **DR. BEHLING:** Not necessarily, yeah, put
15 some guidance without going through that. You
16 may not have one single claim for which this
17 is necessary, and there's no sense in spending
18 energy for something that doesn't have to be
19 done until the time comes where you have
20 somehow feel compelled to do something that is
21 credible. But right now if you say there are
22 no claims for which this dose calculation
23 needs to be done, there's no point investing a
24 lot of effort and only realize it's not going
25 to be used. But --

1 **DR. ZIEMER:** It's data that could be used.

2 **DR. BEHLING:** Yeah, could be used, and just
3 put it in your back pocket and save it for
4 that day when you may have to resort to that.

5 **MR. RICH:** I'm just, to add to what Mutty
6 said. A number of different sites we through
7 the years did some studies of this very issue.
8 And if you look at the whole body through the
9 extremity dosimetry, you'll get a lower value
10 than what you can do experimentally.

11 If you look at a given job that may go
12 on for a month or so we could get ratios as
13 high as, depending on the job and the kind of
14 material you're working with, up to a factor
15 of seven higher including extremities but not
16 generally much higher than a factor of seven,
17 extremities to whole body. And again,
18 depending on how you're working. Glove box
19 operations are different than working with
20 uranium metal pieces and the like.

21 **DR. ZIEMER:** But if you have enough data you
22 can at least bound it then.

23 **MR. RICH:** Not to say that this review
24 should be fairly easy to do because it's on a
25 different database.

1 **MR. GRIFFON (by Telephone):** Well, that's an
2 interesting statement though, not much higher
3 than seven. You got some skin extremity doses
4 in HIS-20 that range up to 36,000 millirem.

5 **MR. RICH:** As I said, the ratio was whole
6 body to extremity. And that would be --

7 **DR. ZIEMER:** It would be about five rem
8 whole body.

9 **MR. GRIFFON (by Telephone):** It would be
10 about nine rem, right? Oh, five, five rem,
11 right at the limit.

12 **DR. ZIEMER:** Well, in those days the limit
13 was 15.

14 **MR. GRIFFON (by Telephone):** Right, right,
15 right.

16 **MR. RICH:** And then as (inaudible) the
17 reason that the permissible dose for
18 extremities higher (unintelligible).

19 **MR. GRIFFON (by Telephone):** Yeah.

20 **DR. BEHLING:** But I will bring you back to
21 the statement on page 119 where for the 1960
22 timeframe a study suggested that the ratio
23 again for the chest dosimeter was the deep-to-
24 shallow dose ratio was 20.7-to-1 so that's
25 greater than five.

1 **MR. RICH:** That's very conservative.

2 **DR. BEHLING:** Well, this is apparently just
3 quoting what was reported here in this study.

4 **DR. ZIEMER:** That might be enough for
5 bounding.

6 **MR. MORRIS:** And it could be a scenario that
7 Mutty just described which is that if one was,
8 that they may not have matched monitoring
9 periods.

10 **MR. SHARFI:** If you don't compare the data
11 well on the --

12 **DR. BEHLING:** Yeah, but to answer your
13 question if anything you would err on the
14 unconservative side. If you monitored whole
15 body but failed to monitor extremity, you're
16 going to end up with a dose ratio that is less
17 than what it should be, not the other way
18 around.

19 **MR. FAUST (by Telephone):** When was that
20 particular value, when did it occur?

21 **DR. ZIEMER:** Which one?

22 **DR. BEHLING:** Well, it was, I'll quote to
23 you, and if you have a report -- am I talking
24 to Leo here?

25 **MR. FAUST (by Telephone):** Yes.

1 **DR. BEHLING:** Leo, this was reported on page
2 119 of my report, and it identifies Attachment
3 4.5-2-A which is also part of the report on
4 120. And there it talks about the 1960
5 timeframe where they had a ratio of
6 approximately 20-to-1, more than 20-to-1 ratio
7 between deep dose and shallow dose.

8 **MR. SHARFI:** This is a ratio of deep-to-
9 shallow not extremity.

10 **DR. BEHLING:** But it could be higher yet
11 because obviously --

12 **MR. SHARFI:** I'm not disagreeing that you
13 could have, we've seen very sizeable deep-to-
14 shallow ratios. But it doesn't mean that the
15 extremity-to-whole body ratio (inaudible).
16 One's a material property, and one's a
17 geometry issue. Two separate ratios that
18 you're looking at.

19 **DR. BEHLING:** Well, I'm fully aware, but
20 would you expect an even greater ratio that
21 would have potentially separated the deep dose
22 measured by the chest dosimeter to a wrist or
23 femur dosimeter at the extremity? It's
24 possible that even that ratio of 20.7-to-1
25 could have been even three times higher. It

1 certainly couldn't be lower than --

2 **DR. ZIEMER:** Well, he was saying you might
3 have both together.

4 **MR. SHARFI:** Yes. I think we're combining
5 issues.

6 **DR. BEHLING:** But in this case you have at
7 least the assurance that the timeframes were
8 identical because the skin, the shallow dose
9 and deep dose measured by one common dosimeter
10 operate under the same timeframe. There's no
11 discrepancy. But what it doesn't do is to
12 account for the geometry difference which
13 could enhance a 20-to-1 ratio to 40-to-1.

14 **DR. ZIEMER:** Well, you may have to look at
15 the data to --

16 **MR. SHARFI:** Maybe I'm just not
17 understanding your point going from deep to
18 40-to-1. What we care about is what the
19 shallow level and whole body-to-shallow wrist
20 ratio is and whether deep to -- we're not
21 proposing to go from deep-to-shallow-to-wrist-
22 to-hand. We're talking about going from
23 shallow-to-wrist-to-hand.

24 **DR. BEHLING:** Well, as I said, there's
25 reason to believe that the deep and shallow

1 doses measured by the whole body dosimeter
2 worn at the chest provides you with a clue.
3 And it's likely and it's possible that the
4 ratio that is observed in this case to be 20-
5 to-1 could actually be significantly higher if
6 the source term that this badge was measuring
7 was right here and it's measuring here to
8 here, but my hands are here.

9 Which means that the skin dose to the
10 extremities is going to be considerably higher
11 than a skin dose monitored by my chest
12 dosimeter. And so what was already measured
13 as 20-to-1 ratio could easily be a factor of
14 two, two times higher. That's my point,
15 depending on the geometry. I mean, look at it
16 this way. If there's a uranium block, and I'm
17 wearing my TLD and that's measuring shallow
18 and deep dose, and it's giving me a 20-to-1
19 ratio, but here are my hands that are not
20 measured, they're going to be exposed to a
21 higher ratio yet.

22 **DR. ZIEMER:** I think Hans is saying it might
23 be the combination of both of these.

24 **DR. BEHLING:** Yes.

25 **DR. ZIEMER:** The deep-to-shallow ratio in

1 the badge may be different than the deep-to-
2 shallow ratio as well as the --

3 **DR. BEHLING:** The extremity dose is usually
4 defined by the seven milligram dose as a skin
5 dose.

6 **MR. HINNEFELD:** I think they're all saying
7 the same thing.

8 **DR. WADE:** It took us a long time to do it.

9 **DR. BEHLING:** You're the closer.

10 **MR. HINNEFELD:** No one else here seems to
11 be.

12 **DR. BEHLING:** Anyway, I think we've
13 exhausted that one. You say there are data
14 that may be used in the event that such dose
15 calculations would be done on the basis of
16 time, and I trust that you will do that.

17 **MR. CLAWSON:** Well, I guess I need to just
18 make sure that we're all on the right page on
19 this because I think we're still talking 4.5.3
20 of the unmonitored shallow and deep dose. Do
21 we have an action that we need to be able to
22 look into? I understand that we do have data
23 in the HIS-20.

24 **MR. GRIFFON (by Telephone):** Brad, I think
25 there's an outstanding action still there. I

1 mean --

2 **DR. WADE:** That study that was described.
3 We're waiting for the results.

4 **MR. CLAWSON:** Okay.

5 **DR. ZIEMER:** Well, that covers 4-5.2 and 3?

6 **DR. BEHLING:** Well, the two are different.

7 **DR. ZIEMER:** I know they are.

8 **DR. BEHLING:** One is, as you mentioned the
9 external beta component does not have to, is
10 likely to be much larger than a skin
11 contamination dose. Five point three really
12 deals with the issue of residual skin and
13 clothing contamination. And we said there are
14 some study data to suggest that it's marginal
15 at 1.5 reps per hour or something. On the
16 other hand if it's a persistent one over a
17 period of a year can still be a substantial
18 dose.

19 **MR. GRIFFON (by Telephone):** Well, I mean I
20 think for 4.5-2 if I'm understanding this
21 right, NIOSH is saying it's a very limited
22 number of people that would ever, you know,
23 they'd run across this for, and they'd do like
24 a case-by-case analysis if it came up as a
25 best estimate issue. And I guess I would just

1 maybe the action's in SC&A's court to say
2 reviewing HIS-20. Do they believe there's
3 enough information there to do case-by-case
4 all the way back to '52?

5 **DR. ZIEMER:** Do you mean to get those
6 ratios?

7 **MR. GRIFFON (by Telephone):** Well, to get an
8 extremity dose, yeah, assuming, you know, if
9 you only had whole body data as opposed to
10 some people in there clearly have extremity
11 data.

12 **DR. ZIEMER:** We have some ratios now, but
13 are you asking what do you do if you don't
14 have a person with extremity numbers in their
15 record?

16 **MR. GRIFFON (by Telephone):** Right.

17 **DR. ZIEMER:** I thought we were saying, Hans
18 was suggesting we establish the ratios as a
19 point during the time periods.

20 **DR. BEHLING:** The time from the data that
21 existed.

22 **DR. ZIEMER:** And then NIOSH could do that if
23 they got such a case, right?

24 **MR. ROLFES:** I think it's important once
25 again to reiterate that this is not an SEC

1 issue, but it's related to how we would do
2 dose reconstruction for a specific claim.

3 **MR. GRIFFON (by Telephone):** It's not an SEC
4 issue. I mean, if you have to have the
5 information to be able to do, reconstruct
6 doses for all members of the class, right? So
7 from that respect it is an SEC issue, isn't
8 it?

9 **MR. SHARFI:** (Inaudible) is not
10 (unintelligible).

11 **DR. ZIEMER:** You might say that louder,
12 Mutty.

13 **MR. GRIFFON (by Telephone):** Yeah, I
14 couldn't hear that.

15 **MR. SHARFI:** Mark, it's probably more of
16 agreeing that the ratio that we choose is, or
17 the approach we choose is conservative enough,
18 not that it isn't really doable. There is
19 data out there to say we can create one, it's
20 whether or not it's conservative enough.

21 **MR. GRIFFON (by Telephone):** Yeah, I don't
22 think there's any more action on NIOSH's
23 behalf here. I'm glancing at this HIS-20
24 stuff myself, and there's some very
25 interesting, I mean that one value I just saw

1 with the 36,000 millirem extremity exposure
2 has a deep dose for that year of 400 millirem.
3 That's a pretty high whole body-to-extremity
4 ratio or pretty low, whatever, vice-versa.
5 But I think SC&A should probably examine that
6 whether, is there sufficient information
7 there. If there is to do those ratios, then I
8 would agree it becomes not an SEC issue but a
9 DR issue.

10 **DR. MAKHIJANI:** Mark, earlier on we had
11 talked about when wrist monitoring began, and
12 I suggested maybe we'd look at that as one of
13 the criteria of periods in the completeness
14 investigation. You seemed to agree, but let
15 me, I just want to be clear about that so we
16 have a to-do list that's good.

17 **MS. BEHLING (by Telephone):** This is Kathy
18 Behling. Let me ask a question and maybe I
19 missed something along the way. Is there any
20 OTIBs or procedures or guidance available to
21 the dose reconstructor if they were to come
22 across a case like this to help to guide them
23 as to what to do? Or is this something that
24 is either in the Fernald site profile or will
25 be put into the Fernald site profile?

1 **MR. ROLFES:** If there's a case where this
2 information becomes necessary, we can add some
3 discussion of it in the site profile. But
4 typically --

5 **MS. BEHLING (by Telephone):** I guess what
6 I'm wondering from a dose reconstructor's
7 point of view if they come across a case like
8 this, how will they know how to proceed?
9 We're sitting here talking about these studies
10 that have been conducted and these ratios, but
11 is that something that the dose reconstructor
12 is going to have some guidance on or will he
13 be familiar with these types of studies that
14 have been done?

15 **MR. ROLFES:** I would say that the dose
16 reconstructor would typically be familiar with
17 such a situation.

18 **MS. BEHLING (by Telephone):** Okay.

19 **MR. SHARFI:** I mean, we do have like
20 principal external dosimetrists. We can bring
21 in additional help on a situation like this.
22 I do know of one site -- at Rocky Flats
23 actually did publish inside the technical
24 basis document whole body-to-wrist ratios.
25 No, they had hand-to-wrist ratios. So I mean,

1 there are, we have looked at this issue
2 before.

3 This isn't a, extremity doses are not
4 a new issue for us, but there's not, like
5 OTIB-0017 is we had talked about before that
6 covers skin cancers doesn't specifically cover
7 every extremity situation that you could run
8 into or otherwise it would become a 300 page
9 document. So I mean some of it is handled on
10 a more case-by-case basis.

11 **MS. BEHLING (by Telephone):** Okay, and I
12 understand that. I'm just thinking from a
13 dose reconstructor's point of view and
14 realizing that they have a lot of cases to
15 deal with and there are a lot of guidance
16 documents out there. And sometimes even if
17 there's just a generic guidance document that
18 points them in the right direction, and I
19 realize this might be sort of a unique
20 situation that they would come across. But I
21 just question whether that dose reconstructor
22 would know where to go from here.

23 **DR. MAURO (by Telephone):** Kathy, this is
24 John. During the OTIB, the Procedure close
25 out meeting last week, I guess a fundamental

1 concept was discussed and that is whether
2 we're talking about a particular OTIB or a
3 procedure or a site profile very often there
4 are unique circumstances that could arise.

5 And one of our commentaries, findings
6 for any particular document we happened to
7 look at -- it could have been OTIB-0017 -- is
8 that particular document only covers a certain
9 range of scenarios. And one could conceive of
10 numerous other scenarios that could be
11 presented to a dose reconstructor that he's
12 going to have to struggle with. And the
13 concern we expressed was that the guidance
14 regarding these other scenarios was not
15 explicitly provided in a given procedure.

16 But the position taken by NIOSH, and I
17 think was accepted by everyone present during
18 the Procedure review, is that you really have
19 to look at the collective set of procedures.
20 That is, for example, OTIB-0017 may not
21 address certain scenarios, but the site
22 profile and there are other guidance documents
23 that collectively are in place to allow that
24 that guidance does in fact exist.

25 And I guess I'm just passing this on.

1 This came out of the Procedures discussion
2 where it was agreed that we will not as a
3 review group expect every procedure to address
4 every scenario and that credit could be taken
5 for the fact that the knowledge base exists
6 collectively within the site profiles and the
7 suite of procedures that are available to the
8 dose reconstructor. And that the dose
9 reconstructor has access to that expertise
10 through training and through the other
11 resources available to him.

12 So I mean it was an important
13 precedent that said that, well, every
14 procedure does not have to address every
15 possible circumstance that might arise. The
16 degree to which that same philosophy is
17 embraced here is important, but I did want to
18 pass on that this did emerge during the
19 Procedure meeting, and that's how it was
20 resolved.

21 **MS. BEHLING (by Telephone):** And I do agree
22 that I understand that you can't account for
23 every circumstance that the dose reconstructor
24 might encounter. I guess I'm not familiar
25 personally with any extremity OTIBs or

1 procedures or really even how much it's ever
2 discussed in the site profiles. I'm just
3 personally not aware of any guidance document
4 whatsoever.

5 **DR. MAURO (by Telephone):** I would agree
6 that that is important because the philosophy
7 was that the scenarios that we were discussing
8 last week, you know, were tractable because
9 the know-how was either provided in the site
10 profile or in another procedure. And some of
11 these procedures were referenced actually
12 during the course of our conversations. But
13 if the reality is that the particular scenario
14 or issues that are being raised here, there
15 really is no guidance on it, I think that that
16 is an issue.

17 **DR. BEHLING:** On that issue let me also, I
18 looked at some of the example dose
19 reconstruction that was submitted on behalf of
20 the Fernald, and I'm looking at external dash
21 three. And I have to be a little cynical here
22 in saying does this really answer our question
23 with regard to skin contamination because in
24 example external three you have a situation
25 where you have a contamination report

1 indicating a worker's hand was contaminated
2 with uranium for one hour prior to
3 decontamination.

4 And you give a precise assessment as
5 to what the DPM per 100 square centimeters
6 was. And then you say that was there for
7 exactly one hour, and then using VARSKIN, and
8 it was 100 percent decontaminated and VARSKIN
9 calculates 1 millirem. Well, that's nice and
10 fine. It would make for a nice RADCON 101
11 quiz exam.

12 But in truth you don't have any data
13 where people were monitored, and certainly we
14 don't have a clean-cut situation where we know
15 precisely when that contamination took place,
16 100 percent successful decontamination
17 (unintelligible) VARSKIN. As we said before
18 we don't have any reason to assume that people
19 were ever monitored for skin contamination.
20 So in terms of this particular example has
21 very little value in terms of answering our
22 question.

23 **MR. ROLFES:** I've read into the record a
24 couple of times that individuals were in fact
25 monitored for clothing contamination. That

1 would be I think representative of potential
2 skin contamination. I don't want to read it
3 into the record, the results of the clothing
4 surveys that I just read twice, but it was in
5 fact monitored.

6 **MR. ELLIOTT:** I don't think this example
7 he's talking about was designed to answer this
8 particular issue we've been discussing.

9 **MR. SHARFI:** (Unintelligible) white paper on
10 dust loading on skin for dose we've already
11 talked about.

12 **DR. ZIEMER:** Yeah, we talked about it this
13 morning.

14 **MR. SHARFI:** That might be more to the level
15 of what Hans is referring to, long-term skin
16 contamination, dust associated with that and
17 he was doing a wet and dry filter paper. He
18 was going to write a white paper. I think
19 that will address more of what Hans is asking.

20 **MR. MORRIS:** Well, short term or long term
21 it's still a dozen hours or ten dozen hours,
22 it's still less than 100 millirem, you know.
23 It's not much.

24 **MR. GRIFFON (by Telephone):** Can I propose
25 an action for 4.5-2? I think we've discussed

1 these two items long enough actually. I was
2 going to say that what I have here is that
3 SC&A will review data in HIS-20 to consider
4 whether sufficient information is available to
5 estimate extremity doses for individuals who
6 did not have extremity data and who may have
7 had significant extremity exposures. And then
8 additionally, SC&A will consider whether this
9 should be considered in their review of data
10 completeness, in other words in that plan.
11 And the outline of their plan, should we be
12 looking at this issue? If those are okay we
13 can move on to the next set of items.

14 **FINDING 4.5-4**

15 **DR. BEHLING:** Well, the next item is 4.5-4,
16 and that's neutron dose.

17 **DR. ZIEMER:** Well, that was two that you
18 did. What about three?

19 **MR. GRIFFON (by Telephone):** Well, three
20 there's an outstanding item, action, Paul,
21 that this white paper that Mutty just referred
22 to I think, you know. So we'll just wait on
23 that.

24 **DR. BEHLING:** Okay, the next one involves
25 the issue of neutron doses. We do know that

1 people were not monitored for neutron doses.
2 The TBD identifies a neutron-photon ratio of
3 0.23. The last time we met we discussed the
4 issue, and I think we resolved it because we
5 did a calculation that came up with a higher
6 value. But we did, in fact, for deriving such
7 a higher value assume that you would have
8 multiple drums, three high, three deep and
9 three wide. And Stu brought our attention to
10 the fact that based on criticality
11 considerations that could never happen, and we
12 accept that as an explanation.

13 Am I correct, Stu?

14 **MR. ELLIOTT:** That's what he said.

15 **DR. MAURO (by Telephone):** I remember that
16 discussion also, and we agree.

17 **MR. GRIFFON (by Telephone):** I'm reading
18 from the matrix though, Hans. It indicates
19 here NIOSH will provide neutron survey data.

20 That was apparently posted, right,
21 Mark?

22 **MR. ROLFES:** That's correct. We provided
23 that prior to last meeting and discussed it in
24 quite a bit of detail.

25 **MR. CLAWSON:** That's also where Stu brought

1 up the configuration --

2 **MR. GRIFFON (by Telephone):** Right. So did
3 SC&A review that survey data or it was just in
4 this last meeting, this discussion?

5 **MR. ROLFES:** It was prior to the last
6 meeting we had provided the neutron survey
7 information.

8 **MR. GRIFFON (by Telephone):** I guess I'm
9 asking SC&A if they looked at the survey data.

10 **DR. BEHLING:** Mark, I did not look at this.
11 I haven't had time to look at that.

12 **DR. MAURO (by Telephone):** This is John.

13 **MR. GRIFFON (by Telephone):** I mean, it
14 sounds like we're okay. I just want to be
15 complete that we probably should look at that
16 survey data.

17 **DR. MAURO (by Telephone):** There were two
18 aspects of that that we looked at, the person
19 that did that is Bob Anigstein. He's not on
20 the line. One aspect was the data itself and
21 what it reported. And I recall that it did
22 support this ratio. But Bob had pointed out
23 also that, yes, you're correct. You're not
24 going to have enriched uranium stacked up that
25 way. But he did come up with higher ratios

1 than this for stacked up natural, you know,
2 unenriched uranium as being higher than that.

3 So the outcome of -- this is my
4 recollection. I certainly could confirm this
5 by checking with Bob -- was that, yes, the
6 data did, in fact, the actual measurements
7 taken, did, in fact, support the ratio
8 proposed here. However, there were scenarios
9 where you did have stored material that was
10 not enriched, but it was a large pile of
11 material where the neutron-to-photon ratio
12 could be greater than was here, but I don't
13 remember how much greater.

14 **MR. FAUST (by Telephone):** This is Leo.
15 That report does not support that conclusion.
16 It's just the opposite. It's much less than
17 what we originally used in the TBD. As a
18 matter of fact they used some 12,000, well,
19 the actual number is 12,773 containers located
20 in Building 4B with enrichments between,
21 somewhere between 0.711 and two percent. And
22 the maximum neutron dose rate measured was
23 0.089. And I'm trying to find the gamma dose
24 rate.

25 **MR. ROLFES:** The MP ratio, Leo, that you're

1 referring to. The MP ratio was less than 0.1-
2 to-1.

3 **MR. FAUST (by Telephone):** Right, and the
4 ratio used in the TBD was 0.23.

5 **MR. ROLFES:** Correct, so it is a bit higher.

6 **MR. FAUST (by Telephone):** It is higher. I
7 mean it's much more claimant favorable than
8 the actual measurements would conclude.

9 **MR. ROLFES:** Correct.

10 **MR. GRIFFON (by Telephone):** And I think
11 John was referencing something that SC&A team
12 did as far as --

13 **DR. MAURO (by Telephone):** Yeah, as I
14 mentioned we looked at the actual measured
15 values that you're making reference to. And
16 the empirical data certainly support the
17 conclusion that the 0.23 is, in fact, claimant
18 favorable. But I recall that we did just a
19 theoretical calculation. We ran I believe an
20 MCNP calculation to see, okay, if you had
21 stored uranium -- well, we did it for both
22 natural and also two percent, I believe,
23 enriched.

24 So we had two cases, and it was a
25 white paper that we submitted. It's in the

1 record somewhere. And it was pointed out at
2 the time we discussed this white paper where
3 SC&A did these calculations, we withdrew the
4 enriched one because the argument was made
5 that you would not have for criticality
6 reasons that kind of configuration. But I
7 believe our calculations for the unenriched
8 uranium in storage, and I think they were
9 working with uranium tetrafluoride.

10 **MR. FAUST (by Telephone):** That's what this
11 was, too.

12 **DR. MAURO (by Telephone):** Yeah, and the
13 calculations -- of course, I could confirm
14 this. It's on the record. I don't have it in
15 front of me, but I seem to recall that for
16 that scenario the ratio was somewhat higher
17 than 0.23. But I will need to go back and
18 check that.

19 Now the fact is though that's a
20 theoretical calculation. If you have
21 empirical data that you feel represents
22 reality that demonstrates that 0.23 is
23 claimant favorable, then you've got to give
24 the amount of importance you give to this
25 theoretical calculation. You know, that's

1 certainly --

2 **MR. GRIFFON (by Telephone):** Well, that's
3 what I'm suggesting, John. Why doesn't SC&A
4 just review the neutron survey data provided
5 by NIOSH along with revisiting your own white
6 paper and come back to us.

7 **DR. MAURO (by Telephone):** Fair enough, and
8 we probably could take care of that fairly
9 expeditiously because we have looked at.
10 Okay, we'll take that as an action item.

11 **DR. BEHLING:** John, just for your
12 information, you may be referring to a
13 calculation I asked Bob to do that looked at
14 for instance a pile of UF-4 salt just laying
15 there in a conical pile.

16 **DR. MAURO (by Telephone):** Yes, that's
17 correct. That's exactly what he did.

18 **DR. BEHLING:** So it's something that is
19 realistically something that you might have
20 encountered. And if I recall, and I don't
21 remember offhand the precise numbers, but
22 they're probably not significantly higher than
23 0.23.

24 **DR. MAURO (by Telephone):** And we can
25 certainly confirm that. Right now we're

1 speculating. It's in the record. We have the
2 information. We'll just have to get back to
3 you.

4 **MR. GRIFFON (by Telephone):** That's fine.
5 4.5-5, right?

6 **MR. CLAWSON:** Yes.

7 **FINDING 4.5-5**

8 **DR. BEHLING:** Let's see here. Oh, the only
9 other thing I want to go back and that is on
10 page 127 under the issue of neutron doses
11 there was one reference that I saw, and I
12 quoted this, that identified a neutron source.
13 And I didn't have a clue what to do with that.
14 Apparently a neutron generator or neutron
15 source that they talk about in this one, and
16 it's Attachment 4.5-4B that I'm quoting from.

17 And they talk about completion of the
18 detailed survey of the neutron generator is
19 needed for performing adequately Health and
20 Safety operational procedures. And I don't
21 know what that's a reference to, a neutron
22 generator. Because no one has made mention of
23 this before, and I don't have any clue as to
24 what that neutron generator involved, and what
25 potential exposures may have resulted in the

1 use of that neutron generator. I don't know
2 if there's any comment here from anyone here
3 that can shed light on that.

4 **DR. ZIEMER:** You also mention a Cockcroft-
5 Walton machine and you use that with a deep
6 (inaudible) reaction you get 14 meV neutrons.
7 I'm wondering if that's what they had.

8 **DR. BEHLING:** I don't know. I'm just, you
9 know, I came across a memo that identifies the
10 assistance of a neutron generator, and I saw
11 no other reference.

12 **DR. ZIEMER:** Were they doing activation
13 work?

14 **MR. ROLFES:** Yes, there was a Cockcroft-
15 Walton neutron generator at the site that was
16 part of the analytical laboratory. It was
17 used for the determination of mass quantities
18 of uranium.

19 **DR. BEHLING:** And there's also a reference
20 on the next page, 128, to a Californium-252
21 source as a potential source --

22 **DR. ZIEMER:** Apparently also for activation.

23 **MR. ROLFES:** I'm not aware of that source.
24 I'm not aware of the californium source, but I
25 am aware of the Cockcroft-Walton neutron

1 generator.

2 **MR. FAUST (by Telephone):** I never, in
3 anything that I've seen to date anyway, I
4 haven't seen any reference to a californium
5 source. That doesn't say it doesn't exist,
6 but I haven't found it.

7 **MR. CLAWSON:** Well, now this was for
8 checking for the -- I know we used to activate
9 and find out how much unused uranium we had.

10 **MR. ROLFES:** It could have been the
11 determination of mass, uranium mass.

12 **MR. CLAWSON:** Okay.

13 **DR. BEHLING:** Is there anything that needs
14 to be looked at with regards to the use of
15 these sources and --

16 **MR. GRIFFON (by Telephone):** I mean, I was
17 just going to, in your document, Hans, on page
18 133, it does describe the californium source,
19 153 micrograms.

20 **DR. BEHLING:** Yeah, yeah.

21 **MR. GRIFFON (by Telephone):** Okay.

22 **DR. BEHLING:** Obviously we have no data that
23 suggests people who used these facilities were
24 ever monitored for neutrons.

25 **MR. GRIFFON (by Telephone):** This neutron

1 activation facility, is there a building
2 number associated with that or is it within
3 one of the plants?

4 **MR. ROLFES:** I'd have to take a look back
5 into my notes, but it was part of the
6 analytical laboratory.

7 **DR. ZIEMER:** It does talk about a tritium
8 target so they must be using a DT reaction for
9 some neutrons. So it would be a little
10 surprising if they didn't have some kind of
11 neutron monitoring.

12 **MR. ROLFES:** Yeah, there are neutron
13 monitoring results in HIS-20. I haven't
14 looked to see if we have correlated that.
15 There is neutron monitoring there. It is
16 maybe one non-positive result in HIS-20. I
17 don't recall what time period it was.

18 **MR. FAUST (by Telephone):** It's 20 millirem.

19 **MR. ROLFES:** Twenty millirem, sure. But
20 there was an industrial hygiene and radiation
21 survey. Off the top of my head I don't recall
22 when it was, but there was a survey of the
23 area of the analytical laboratory where they
24 kept the check sources. And there wasn't very
25 much detail in there, but they didn't note any

1 problems associated with the storage of
2 sources or use of sources.

3 **MR. FAUST (by Telephone):** They also, Mark,
4 they also had a Snoopy monitoring instrument
5 because they used one in that neutron survey
6 study.

7 **MR. ROLFES:** Correct, that's true.

8 **DR. ZIEMER:** Well, Hans, were you asking
9 about whether they had neutron monitoring?

10 **DR. BEHLING:** Yes.

11 **DR. ZIEMER:** You're saying yes.

12 **MR. FAUST (by Telephone):** No, they did not.

13 As far as --

14 **DR. ZIEMER:** They did not?

15 **MR. FAUST (by Telephone):** -- personnel
16 monitoring is concerned they did not.

17 **DR. ZIEMER:** Well, Mark was saying --

18 I thought you said --

19 **MR. ROLFES:** I said we do have neutron
20 monitoring results in HIS-20.

21 **MR. FAUST (by Telephone):** We have zeros
22 with one positive.

23 **MR. ROLFES:** Well, that would be indicative

24 --

25 **MR. FAUST (by Telephone):** But that was late

1 in the game, guys.

2 **MR. ROLFES:** Okay, okay.

3 **MR. FAUST (by Telephone):** It was post-TLD
4 so it's 1977 or '78 forward.

5 **DR. BEHLING:** These were written, these
6 memos come from --

7 **MR. CHEW:** This is '68.

8 **DR. BEHLING:** Well, '64.

9 **MR. CHEW:** 'Sixty-four.

10 **DR. BEHLING:** Nineteen sixty-four was the
11 first report, and the second one is dated --

12 **MR. CHEW:** 'Seventy-two.

13 **DR. BEHLING:** -- dated '74.

14 **MR. FAUST (by Telephone):** It doesn't
15 matter. They did not use NTA film at Fernald.

16 **MR. CHEW:** (Inaudible) operational TLD?

17 **MR. FAUST (by Telephone):** The original, the
18 TLD system went into place either late '77 or
19 '78. And it was DOELAP-certified by --

20 **MR. CHEW:** Here's what I'm getting, is that
21 you may not have used NTA film, but you used a
22 combination of TLDs to monitor neutrons. Is
23 that what you're saying, Leo?

24 **MR. FAUST (by Telephone):** Yes, post-19 --

25 **MR. CHEW:** (Unintelligible) neutron

1 monitoring.

2 **MR. FAUST (by Telephone):** -- at the time
3 that they put it into place. All I'm saying
4 is that they had a Snoopy, which is a survey
5 instrument. I don't know when they got it, or
6 I don't know if they ever used it, but they
7 did use it during this documentation that was
8 or this document that were just referenced.
9 And that was done, and I think the actual
10 measurements were done in '98 to tell you the
11 truth about it. So they had that instrument
12 at that time anyway. When they got it, I
13 don't know.

14 **DR. ZIEMER:** Well, Snoopies weren't made
15 that late. Snoopies were made by Tracer Labs.

16 **MR. FAUST (by Telephone):** Yeah, we had one.

17 **DR. ZIEMER:** And Tracer Lab, they didn't
18 exist after what, 1980?

19 **MR. FAUST (by Telephone):** Yeah, so they
20 could have bought it prior to the time they
21 went --

22 **DR. ZIEMER:** Well, that's what I'm saying.
23 They wouldn't have bought it as late as '98
24 because --

25 **MR. FAUST (by Telephone):** Oh, no, no, huh-

1 uh.

2 **DR. ZIEMER:** Or they could buy it on E-bay I
3 guess.

4 **MR. FAUST (by Telephone):** Cheaper. No, I
5 don't know when they bought it, but I do know
6 they used it for this neutron study that they
7 did.

8 **DR. BEHLING:** But there was no personnel
9 monitoring. That's the issue.

10 **MR. FAUST (by Telephone):** They did not do
11 any for neutrons. They didn't have to, and
12 they didn't need to.

13 **MR. GRIFFON (by Telephone):** I guess, I
14 mean, I don't know if it's hanging out there.
15 Maybe as an action item we can just say NIOSH
16 will determine whether other neutron exposure
17 potentials existed. And, if so, whether the
18 current approach would be bounding. In other
19 words if these laboratory workers had a
20 potential, albeit small, potential neutron
21 exposure, does this 0.23 ratio, could that
22 still be used and be bounding?

23 **MR. ROLFES:** Well, this is a separate, sort
24 of a separate issue because we're talking
25 about rather than a continuous source of

1 potential neutrons, a very intermittent source
2 that would only be a source of neutron
3 exposure when electricity was applied to it.
4 It was not a continuous source of neutron
5 exposures.

6 **MR. MORRIS:** That's not true for the
7 californium.

8 **MR. ROLFES:** Well, true, but in speaking for
9 the Cockcroft-Walton neutron generator.

10 **MR. GRIFFON (by Telephone):** Right, right.

11 **DR. ZIEMER:** The californium source was only
12 there for a few months if this is correct
13 here. Well, that was limited. Well, we've
14 got to know, I guess, but that's what it says.
15 It was planned for four to five months.

16 **MR. CHEW:** You can read in there, I'm not
17 sure they actually even used it.

18 **MR. CLAWSON:** I guess that brings up a
19 question, you know, and this is where we need
20 to come to a closure on it, too, is what went
21 on with it and were the people monitored or
22 not.

23 **MR. MORRIS:** That's a fair question, and we
24 should interview the people that we --

25 **DR. ZIEMER:** Actually, there's probably a,

1 this would be a very small number of people
2 because Cockcroft-Walton, you're going to have
3 an operator, and that's probably it.

4 **MR. MORRIS:** Right, and we have contacts
5 with analytical laboratory people who could
6 make statements about this if we specifically
7 ask, I think.

8 **MR. CHEW:** I think we should do a follow up
9 on it.

10 **MR. ROLFES:** We'll take another look.

11 **MR. GRIFFON (by Telephone):** Yeah, that's
12 solved.

13 **MR. ROLFES:** We've asked around and, you
14 know, I've asked around casually with
15 individuals, not necessarily the same
16 individuals, but --

17 **DR. ZIEMER:** Now this is not part of the
18 matrix, right?

19 **MR. CLAWSON:** Now it is.

20 **MR. CHEW:** The neutron monitoring.

21 **MR. GRIFFON (by Telephone):** I'm just
22 putting it under 4.5-4.

23 **DR. BEHLING:** Yeah, the second bullet.

24 **MR. GRIFFON (by Telephone):** Just looking at
25 other neutron exposure potentials.

1 **DR. BEHLING:** No, it's probably not in the
2 matrix, Paul.

3 **MR. GRIFFON (by Telephone):** Yeah, it's not
4 really in the matrix, but it's in the report,
5 right?

6 **MR. CLAWSON:** Right.

7 **DR. BEHLING:** It's five o'clock, and we're
8 down to the last finding, 4.5-5, unmonitored
9 female workers. And the TBD fully
10 acknowledges two time periods during which
11 females were not monitored for external, but
12 then the question comes into play as to
13 whether or not 500 millirem may be a bounding
14 default value.

15 And that also comes into question
16 based on the fact that these women in the
17 laundry facility were subject to exposures
18 that come from dust collector bags and in
19 today's conversation we heard about thousands
20 of gloves that were subject to laundering
21 which were heavily contaminated in some
22 instances.

23 And I guess that the discussion that I
24 wanted to stimulate here is the external
25 exposure of 500 millirem a year, a bounding

1 value. And then does that also address issues
2 that may come to, or that may involve internal
3 exposures to whatever these dust collectors
4 and gloves may have contained in the way of
5 uranium, thorium and other radioactive
6 materials.

7 Here we see in one of the attachments
8 on page 135 I highlighted a statement here
9 that some of these bags that were subject to
10 laundering were reading up to five millirep
11 per hour after cleaning. The question is, oh,
12 yeah, 30 millirep before cleaning and five
13 millirem after cleaning. And to what extent
14 this would contribute a dose that might
15 significantly exceed the default value of 500.
16 Now I assume the millirep here is a contact
17 reading involving photon and beta dose. I'm
18 not sure.

19 **MR. CHEW:** Is that a question?

20 **DR. BEHLING:** Yeah, the question is is 500
21 millirem a year a default value that was a
22 bounding value for women who were not
23 monitored?

24 **MR. ROLFES:** I don't see the question how it
25 relates to the laundry studies of the dust

1 collector bags which were collecting uranium
2 materials and unmonitored women that didn't
3 enter the process area.

4 **DR. BEHLING:** Wait a minute. When you're in
5 receipt of huge quantities of dust collector
6 bags, they become your source of radiation
7 exposure as was suggested here by these
8 measurements. So they didn't enter a process
9 area, but they were certainly exposed to
10 external and potentially internal exposures.

11 **MR. ROLFES:** I'm still not clear where it's
12 saying that women received, unmonitored women
13 received dust collector bags.

14 **DR. BEHLING:** 4.5-5, laundry studies of dust
15 collectors. I mean, who else would have been
16 the recipients if not the women who ran the
17 laundry?

18 **MR. CHEW:** You'd confine it to women who ran
19 the laundry, and they were not monitored.

20 **MR. ROLFES:** So this is implied that the
21 women were the individuals that were doing the
22 laundry of dust collector bags.

23 **MR. CHEW:** And they were not monitored.

24 **MR. ROLFES:** And they were not monitored.
25 So I honestly don't know if it was the women

1 or men or both that were doing laundry
2 studies. I would have to take a look at an
3 individual's records who actually did the
4 laundry to determine whether the individual
5 was monitored or not monitored. I think it's
6 a leap of faith to say only the women were
7 doing the laundry and were not monitored.

8 **DR. MAKHIJANI:** I think the point is not
9 that only women were doing laundry. The point
10 is that women who were doing laundry, apart
11 from any men who might have done it. We know
12 according to the TBD no women were monitored
13 in two periods at Fernald.

14 **MR. CHEW:** That's correct.

15 **DR. MAKHIJANI:** Unless you have some, and we
16 know that women were doing laundry. Maybe not
17 exclusively --

18 **DR. ZIEMER:** Do we know that?

19 **DR. MAKHIJANI:** There are pictures of it.

20 **MR. FAUST (by Telephone):** But it's got to
21 be at the right time.

22 **DR. MAKHIJANI:** At the right time. We don't
23 have pictures of it from every period, but we
24 do have a picture of a woman in the laundry
25 taken in the '80s. This would lead presumably

1 to interviews. So I think there's a kind of,
2 the logical set up of the question should be
3 correct is all I'm saying. Some women did
4 laundry. We have to fix the period and
5 perhaps amenable to an interview. But we know
6 that they were not monitored in two different
7 periods of time.

8 **MR. FAUST (by Telephone):** Yeah, but the
9 periods of time that they weren't monitored
10 was males only, 1951 through 1960 or to '60.
11 And again, from 1969 to 1978.

12 **DR. MAKHIJANI:** Correct.

13 **MR. CHEW:** And after that women were
14 monitored?

15 **MR. FAUST (by Telephone):** Well, in between
16 those times, in between those two times, yes,
17 they were. And after '78 they were.

18 **DR. ZIEMER:** Why did they add them and then
19 delete them again? Do we know?

20 **MR. FAUST (by Telephone):** I think it had,
21 well, the thing that I read about this whole
22 thing, the first time they didn't have to
23 based on the rules and regulations at the
24 time. The second time they did it because of
25 cost and the fact that they concluded they

1 didn't have to. Anybody that received the
2 less than I think ten percent of the allowable
3 limit at the time didn't have to be monitored.

4 **MR. CHEW:** Your reference in the document is
5 from 1958, and I think you mentioned that
6 there was a picture of women that was in 1980.

7 **DR. MAKHIJANI:** In the '80s.

8 **MR. FAUST (by Telephone):** Well, in 1980
9 they were monitored.

10 **DR. MAKHIJANI:** No, no, that's what I'm
11 saying. If we have a picture of it, women
12 were doing the laundry but not from the right
13 period.

14 **MR. CHEW:** (Unintelligible).

15 **MR. ROLFES:** Now, Leo, during 1958 would
16 women have been monitored?

17 **MR. FAUST (by Telephone):** Nineteen fifty-
18 eight? No.

19 **MR. ROLFES:** Okay. So if we have indication
20 that a woman was working with laundry, the
21 next question is could she have received in
22 excess, working with laundry that was
23 contaminated, could she have received in
24 excess of the default that we have in our
25 technical basis document? And I would like to

1 read into the record again that we do not feel
2 that this is an SEC issue.

3 Doses to female workers who were not
4 monitored during two operating periods can be
5 reconstructed by at least three methods. They
6 are: if the worker in question is doing the
7 same or very similar jobs during periods when
8 she is monitored, that dose could be used to
9 adjust the missing dose when she wasn't
10 monitored.

11 The second methodology is workers who
12 were doing the same job and were monitored at
13 the time the female wasn't, could have an
14 equivalent dose assigned to the unmonitored
15 worker. And three, assignment of the missed
16 dose as stated in the TBD, Volume 6, of 500
17 millirem per year for the missing time periods
18 is known to be very claimant favorable.

19 So there are three different
20 methodologies that are proposed, and
21 therefore, we do not believe this is an SEC
22 issue, more of a dose reconstruction issue
23 that depends upon the specifics of the case.

24 **MR. CLAWSON:** Mark, in the back of this you
25 kind of had some generic action items, and you

1 had a Gilbert report.

2 (no response)

3 **MR. CLAWSON:** Did that get put onto the O
4 drive? Did we ever get a hold of that Gilbert
5 report?

6 **MR. ROLFES:** Oh, I'm sorry. I didn't know
7 if you were talking to Mark Griffon or --

8 **MR. CLAWSON:** Oh, you, I'm sorry.

9 **MR. ROLFES:** Yes, we did have, the Gilbert
10 report was made available to the Advisory
11 Board members, and I did put that onto the O
12 drive. Let's see. We reviewed the Gilbert
13 report, the Tiger Team report and the
14 Westinghouse Transition report to assure, we
15 did review those, and we did not feel that
16 there was any impact on our ability to do a
17 dose reconstruction. Those reports are
18 available also for the Advisory Board working
19 group.

20 **MR. CLAWSON:** They're on the O drive?

21 **MR. ROLFES:** Correct.

22 **MR. GRIFFON (by Telephone):** And, Mark, did
23 they, parenthetically there it said that this
24 includes reviewing the data integrity but I
25 forget exactly what I meant. Did this,

1 reviewing those reports, did it shed any light
2 on any data integrity issues?

3 **MR. ROLFES:** Gene, are you still with us?
4 Gene Potter?

5 **MR. POTTER (by Telephone):** Yes, I am.

6 **MR. ROLFES:** Do you recall if there were any
7 discussions? I believe it was you that had
8 reviewed the mentioned reports in addition to
9 some other individuals. Do you recall any
10 data integrity issues from the various reports
11 that we were asked to review?

12 **MR. POTTER (by Telephone):** No, I looked at
13 the Gilbert report initially specifically for
14 issues with the mobile in vivo counter and the
15 qualifications of personnel. I believe the
16 issue had supposedly been raised in a report.
17 The Gilbert report did not contain any such
18 information. That's what I was looking for
19 specifically, and I'm not recalling any other
20 issues. I also looked at a series of other
21 reports that are on that SRDB trying to find
22 the appropriate report that may have raised
23 issues with the mobile in vivo counter, and I
24 was unable to find any information on that.

25 **MR. ROLFES:** Okay, so, Mark, it doesn't

1 appear that there were any data integrity
2 issues within the reports that were reviewed.

3 **MR. GRIFFON (by Telephone):** I think as a
4 follow up do we need SC&A, Brad, to look at
5 these reports as well? I don't know if we've
6 officially asked them to look at these.

7 **MR. CLAWSON:** No, I don't think we have. I
8 think we need to follow up with that though.

9 **MS. BALDRIDGE:** Brad, my recollection may
10 not be accurate, but I thought when you
11 suggested getting the Gilbert report, it was
12 to review it for the environmental impact, and
13 that it really didn't have anything to do with
14 the (inaudible).

15 **MR. CLAWSON:** Yeah, I brought that up, too,
16 because I wanted to correlate it with some of
17 the outside environmental ones that were
18 brought up, so forth.

19 **MS. BALDRIDGE:** And I think there are
20 multiple reports; they may not have gotten a
21 hold of the right reports.

22 **MR. CLAWSON:** Well, we'll, I guess we could
23 have SC&A take an action item to be able to
24 look at the Gilbert reports.

25 And I guess what I'd throw out there

1 is, I was looking at more from the data
2 integrity facts on that.

3 **DR. MAKHIJANI:** Brad, what did you mean by
4 data integrity in relation to these reports?

5 **MR. CLAWSON:** Well, because there was a
6 question of a Tiger Team report that went in
7 there and really slammed Fernald especially
8 from their Health Physics program, their air
9 sampling data and so forth. And this was an
10 internal one that was done. I just wanted to
11 make sure that we weren't missing anything on
12 that.

13 **DR. BEHLING:** What time period was that?

14 **MR. CLAWSON:** Nineteen eighty-five time era.

15 **DR. ZIEMER:** For which report?

16 **MR. CLAWSON:** My understanding was, I just
17 understood it as a Tiger Team.

18 **DR. ZIEMER:** Tiger Teams didn't exist in
19 '85.

20 **MR. CHEW:** Chuck Gilbert from EH --

21 **DR. ZIEMER:** Chuck Gilbert? Not Mark
22 Gilbert?

23 **MR. CHEW:** No, Chuck Gilbert from the
24 report, and what it was that there was a
25 transition from National Lead Ohio to

1 Westinghouse.

2 **MR. RICH:** That's just prior to.

3 **MR. CHEW:** Yes, just prior to. And it was
4 not part of the Tiger Team, Brad. It was
5 right before.

6 **MR. CLAWSON:** Well, yeah, I guess I used the
7 terminology that I'm using --

8 **MR. CHEW:** No, no, but it was a Tiger Team-
9 like report.

10 **MR. CLAWSON:** Right, and I wanted to make
11 sure that we had, and I think that's why we
12 hit so many of them, Tiger Team, Gilbert
13 report and Westinghouse transition was because
14 we wanted to be able to review that.

15 **MR. CHEW:** We also did look at the Tiger
16 Team.

17 Leo, I think you did that, right?

18 **MR. FAUST (by Telephone):** Yeah, I reviewed
19 the Tiger Team report of Health Physics
20 aspects of it. They were rather critical of
21 the internal dosimetry program. They were
22 complimentary of the external program for the
23 most part, but the internal program they were
24 very critical over. They were super critical
25 over the lack of completed SARs. But there

1 was nothing in it that I could find that would
2 impact dose reconstructions.

3 **MR. CHEW:** Can you be more specific about
4 the issue that they had with the internal
5 program, Leo, any more specificity?

6 **MR. FAUST (by Telephone):** Well, I think
7 that the time thing that they had with it was
8 the fact that they didn't do enough bioassays
9 nor did they do enough full body counting.
10 That's what I recall anyway.

11 **MR. CLAWSON:** Well, it's well past five
12 o'clock, which I apologize. I think I still
13 would like SC&A to be able to look into that
14 and just make sure that we're not missing
15 anything. I'd like to look at it from the
16 data integrity standpoint of it.

17 **MR. CHEW:** They tell me it was very
18 difficult to locate, believe it or not, the
19 Fernald Tiger Team report. Headquarters
20 didn't have it. I think it was very, I mean,
21 I'm just going to share that with SC&A not to
22 look too hard. We'll get it to you because
23 you'll spend another man-year looking for it,
24 Hans.

25 **DR. WADE:** Brad, you did have this issue of

1 SC&A was going to develop a plan to develop a
2 plan in terms of data completeness. Do you
3 want to give some thought to timing on that
4 now?

5 **MR. CLAWSON:** Well, I didn't know if that
6 had time to be able to really sit down.

7 **DR. MAKHIJANI:** I tried to call John but
8 couldn't reach him.

9 **DR. WADE:** Well, maybe then when SC&A gets
10 its head together let Brad know, then you can
11 decide when you want to reconvene the work
12 group.

13 **MR. CLAWSON:** Maybe what we may be able to
14 do is just have a conference call or something
15 like that and be able to discuss, we'll
16 evaluate that -- wait with everybody on the
17 Board when we get that information when I get
18 a time.

19 **DR. WADE:** Well, if SC&A gives you a sense,
20 and even on the call on the 27th you could in
21 your time use it to set a time for a work
22 group call.

23 **DR. MAKHIJANI:** I guess we can do that. We
24 can give a sense of when we'll produce this
25 memo, and it shouldn't take too long.

1 **MR. GRIFFON (by Telephone):** Hey, Brad?

2 **MR. CLAWSON:** Yes, Mark.

3 **MR. GRIFFON (by Telephone):** Since it's so
4 late I won't go back and read through all
5 these actions, but I will, I'll revise the
6 matrix based on what Mark had sent out
7 recently. I'll add in the new actions and
8 turn it around in a few days just so it's
9 fresh on our minds still and circulate it if
10 that's okay.

11 **MR. CLAWSON:** Okay, I appreciate that. I
12 appreciate everybody's continued support on
13 this.

14 **DR. WADE:** Well, thank you very much, all of
15 you, for your work. It's a long day, but it
16 needs to be done to do justice to the people
17 whose lives we're reviewing, so thank you very
18 much.

19 **MR. ROLFES:** Do we need to schedule another
20 meeting before we leave here?

21 **DR. WADE:** Well, I'm not going to be able to
22 do that. SC&A's going to get back to Mark
23 with its timeline on the plan to develop a
24 plan. And then maybe on the call on the 27th,
25 we'll look at scheduling a meeting.

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MR. SCHOFIELD: You're the only one's going to be back here. The rest of us get to leave.

MR. ROLFES: I'll be here.

MR. CLAWSON: With that said, we'll say goodbye and thank you.

(Whereupon, the work group meeting adjourned at 5:30 p.m.)

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I, Steven Ray Green, Certified Merit Court Reporter, do hereby certify that I reported the above and foregoing on the day of November 13, 2007; 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 3rd day of February, 2008.

STEVEN RAY GREEN, CCR, CVR-CM
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