

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

convenes the

WORKING GROUP MEETING

ADVISORY BOARD ON
RADIATION AND WORKER HEALTH

DAY THREE

The verbatim transcript of the Meeting of the
Advisory Board on Radiation and Worker Health held
at the NIOSH, Cincinnati, Ohio, on June 2, 2005.

C O N T E N T S

June 2, 2005

TASK 1, MALLINCKRODT SITE PROFILE REVIEW
NIOSH/ORAU
ARJUN MAKHIJANI, SC&A
HANS BEHLING, SC&A

TRANSCRIPT LEGEND

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

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

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

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

ABRWH MEMBER:

GRIFFON, Mark A.

President

Creative Pollution Solutions, Inc.

Salem, New Hampshire

OTHER ATTENDEES:

DR. HANS BEHLING, SC&A

MS. CINDY BLOOM, ORAU

MR. GREG MACIEVIC, NIOSH

DR. ARJUN MAKHIJANI, SC&A

DR. JIM NETON, NIOSH

STAFF/VENDORS

STEVEN RAY GREEN, Certified Merit Court Reporter

P R O C E E D I N G S

(9:00 a.m.)

1
2
3 **DR. NETON:** Okay. We're ready to start. Oh, let me
4 bring Mark Griffon -- I just hung up on Mark. Hang
5 on.

6 (Pause)

7 **DR. NETON:** Okay. We're ready to go then. Mark
8 Griffon is -- is participating via -- via telephone
9 connection and today we've got Cindy Bloom and Hans,
10 Arjun, myself, and -- and Greg Macievic. Where we
11 left off yesterday was we were now going to get into
12 the external dosimetry questions that SC&A had, so I
13 guess I'll turn it over to Arjun and he can start
14 the questioning.

15 **DR. MAKHIJANI:** Yeah. Hans, should I -- should I
16 just go through the questions --

17 **DR. BEHLING:** Yeah, yeah, yeah.

18 **DR. MAKHIJANI:** -- and then maybe you take over the
19 discussion --

20 **DR. BEHLING:** Well, we'll -- we'll -- yeah, I have
21 some questions here. I haven't even looked at the
22 questions you submitted but --

23 **DR. MAKHIJANI:** Okay. Should I run through my
24 questions first --

25 **DR. BEHLING:** Yeah.

1 **DR. MAKHIJANI:** -- and then you can run through
2 yours? Should we do it that way --

3 **DR. BEHLING:** Yeah.

4 **DR. MAKHIJANI:** -- since they -- they have it in
5 writing already? Okay. I'll just read the question
6 so it's in the record.

7 What proportion of employees have no external
8 monitoring data?

9 **DR. NETON:** Right. This is -- this is similar to
10 what we discussed yesterday for the internal. We
11 don't have the answer at this point but we'll
12 certainly try to get that fleshed out soon,
13 hopefully well advance of the board meeting.

14 **DR. BEHLING:** Is there any indication to whether or
15 not people were cohort badged or badged on the basis
16 of likely to be exposed? And there's a difference
17 obviously.

18 **DR. NETON:** It's -- it's -- exactly. It's our --
19 the indications that I have from looking at the
20 files are that people were individually badged. And
21 in fact I think there's a memo we can point to in
22 '49 that indicated that the badge was actually part
23 -- that the film badge was part of the security
24 credentials.

25 **DR. BEHLING:** Okay.

1 **DR. NETON:** And I guess I -- we do know a little
2 more than what I just indicated about percentages
3 that were monitored. If one looks at the SEC
4 evaluation report, there is a table on page 17 -- I
5 don't have copies to distribute -- that indicates by
6 year the approximate total number of employees at
7 the site during that year, and this is based on the
8 -- the epi study that was done by the Center for
9 Epidemiological Research, which -- in traditional
10 epi style they -- they only looked at white males.
11 But we believe that's it's a good indication of the
12 magnitude of the workforce at that time.
13 And then we have a listing of the number of
14 employees who were monitored during that year. And
15 for external monitoring after '49, the numbers
16 appear to be well over the majority. In 1949 we
17 have 506 employees monitored out of an estimated
18 workforce of 676 and it appears that the percentages
19 go up from there. And in the last year, you have
20 virtually -- well, 90-plus percent of the workers
21 being monitored, so a very large -- large percentage
22 of the workers had film badges --

23 **DR. BEHLING:** So you --

24 **DR. NETON:** -- after 1948.

25 **DR. BEHLING:** Yeah, the majority of people were

1 likely to have some radiation dosimetry records.

2 Now --

3 **DR. NETON:** Now -- now the other question which is
4 more relevant, do we have the --

5 **DR. BEHLING:** The records. That's true.

6 **DR. NETON:** -- records. Now I have looked through a
7 sampling of the records and it seems to be that the
8 majority of the people have some records, but I
9 don't know if that tracks with this table. Now I'm
10 assuming -- and we need to do a little homework here
11 -- that this information came from somewhere and
12 presumably it has to do with the records that we
13 have. But again, I have not, you know, followed
14 this thread all the way through. But a very, very
15 large percentage of the workers have monitors --
16 were monitored in those time -- in that time period.

17 **DR. MAKHIJANI:** Now, Jim, when you say 90 percent do
18 you mean 90 percent of all the workers in the AEC
19 area or 90 percent of the production workers?

20 **DR. NETON:** Oh, I would assume it's AEC area. I
21 mean is that -- Mallinckrodt of course was a
22 chemical factory and I -- there'd be no reason to
23 monitor workers who were working with chemicals.

24 **DR. MAKHIJANI:** I misstated my question. I meant 90
25 percent of the production workers in the AEC area or

1 90 percent of all workers in the AEC area?

2 **DR. NETON:** This -- well, I would say this is 90
3 percent of all white male workers in the AEC area,
4 not just production workers. Those other ten
5 percent then would presumably be people such as
6 clerical folks and --

7 **DR. MAKHIJANI:** Yeah.

8 **DR. NETON:** -- and such.

9 **DR. MAKHIJANI:** Of course a lot of the clerical
10 folks were women.

11 **DR. NETON:** Right.

12 **DR. MAKHIJANI:** So that would not fall in this 90
13 percent.

14 **DR. NETON:** That's correct. In fact, those women
15 would not be represented in this total number of
16 employees value because, again, this was a -- this
17 was taken from an epi study and they typically only
18 -- for statistics purposes pick all white male
19 workers at the facility to get the large bulk of the
20 population. But, you know, we will -- we will go
21 through and look at the individual cases that we
22 have, because as I indicated before, I believe we
23 only have about a 130 or so cases that -- that
24 initiated employment between 1949 and 1957 currently
25 in our possession.

1 **DR. MAKHIJANI:** Yeah. In -- in the context of this
2 men/women thing, I -- I interviewed a -- a woman
3 employee in whose records I found two urinalysis
4 samples. And she was a clerical employee, so I kind
5 of found that a little odd because I did not find --
6 they were low, in the two micrograms per liter
7 range, so they --

8 **DR. NETON:** (Unintelligible) limit of detection --

9 **DR. MAKHIJANI:** -- not within the detection limits,
10 so one doesn't know what to make of that. But I
11 wondered why there would be urinalysis samples in a
12 clerical worker's --

13 **MS. BLOOM:** We found at some sites that
14 stenographers frequently followed people into areas
15 to take dictation while somebody was doing a report.
16 That was in the records at Windy* we saw that.

17 **DR. NETON:** And I -- I don't --

18 **MS. BLOOM:** They also might have taken them as
19 blanks if they wanted to see, you know, what -- what
20 are other people looking like. It's hard to say.

21 **DR. NETON:** And also, I don't know what time frame
22 this was or what, but I know for instance at the
23 Fernald site not all workers were monitored, but
24 everyone when they started a new hire,
25 (unintelligible) that's part of the physical, have a

1 urine sample. And actually every year part of the
2 annual physical was a urine sample, whether you
3 worked in the plant or not.

4 **MS. BLOOM:** And that could have been true, the
5 initial and termination samples there.

6 **DR. NETON:** I -- I don't know. We do have to look
7 at the specific case --

8 **DR. MAKHIJANI:** Yeah.

9 **MS. BLOOM:** (Unintelligible)

10 **DR. NETON:** -- and if you've got a number I'd be
11 interested in --

12 **DR. MAKHIJANI:** I'll try to bring it up later. I
13 think I have it in my notes. Maybe not. The -- I
14 looked at the medical records sections in some of
15 those large DOE files, and there wasn't a column for
16 -- so they have routine medical type of urinalysis,
17 whatever they do in the medical side --

18 **DR. NETON:** Right.

19 **DR. MAKHIJANI:** -- but there wasn't a column in the
20 form for uranium.

21 **DR. NETON:** That -- that would not normally show up
22 in the medical form itself.

23 **DR. MAKHIJANI:** It would not show up --

24 **DR. NETON:** It would be -- like I know at Fernald, I
25 don't know that this holds true at Weldon Springs,

1 but -- or Mallinckrodt, but they would just split
2 the sample and half would go down to the bioassay
3 laboratory and, you know, we would analyze it and
4 then keep it in the dosimetry record file. Now
5 early on, though, some of the medical files had
6 dosimetry records but they weren't typically on the
7 same form.

8 **DR. MAKHIJANI:** Okay.

9 **DR. NETON:** Physicians -- physicians really didn't
10 know what to do with it.

11 **MS. BLOOM:** I would say they might not even be the
12 sample at some of these sites --

13 **DR. NETON:** Yeah.

14 **MS. BLOOM:** -- that you'd collect the urine during a
15 physical --

16 **DR. BEHLING:** I mean (unintelligible) --

17 **MS. BLOOM:** -- (unintelligible) you'd take the --

18 **DR. NETON:** (Unintelligible)

19 **DR. BEHLING:** -- pre-employment requisite which
20 obviously would preclude the need for doing
21 urinalysis for isotopes, so it's not likely to be a
22 split sample.

23 **MS. BLOOM:** Uh-huh.

24 **DR. BEHLING:** I mean it's -- as part of your
25 employment that you submit to a physical, that

1 includes a urinalysis but there would be no reason
2 to at this point assess you for internal exposure --

3 **MS. BLOOM:** Sometimes they did baselines --

4 **DR. NETON:** Oh, yeah. Baseline --

5 **DR. BEHLING:** Baseline?

6 **MS. BLOOM:** Yeah.

7 **DR. NETON:** -- workers coming in, sure. I mean
8 there's -- there's issues -- and I don't know how up
9 these people were back then, but -- but people
10 coming in who have well water that has high uranium
11 values or for whatever reason would show positive,
12 you'd like to know that up front.

13 **DR. BEHLING:** Yeah, well, I know in contemporary
14 times you use baseline --

15 **DR. NETON:** And I don't know exactly what --

16 **DR. BEHLING:** -- but in those days I'm sure they
17 were concerned --

18 **DR. NETON:** And I don't know that this is even part
19 of the medical. We -- I'd like to look at the file.

20 **DR. MAKHIJANI:** Yeah. I -- I'll -- I'll -- during a
21 break I'll just come up with a name. Maybe we can
22 pull up the (unintelligible).

23 **DR. NETON:** That's fine.

24 **DR. MAKHIJANI:** Okay. Hans, any other follow-up on
25 the number of records question? Okay.

1 Next question is are there claims where zeroes were
2 entered into the records but no monitoring was done
3 and no back records exist?

4 **DR. NETON:** I guess I'd like to get a little more
5 clarity on this. We've talked among ourselves about
6 this and there is a -- and I know Mark I think has
7 brought this up, where zeroes were entered in lieu
8 of no monitoring. I -- I'm not that familiar with
9 this issue. Mark, can you --

10 **MR. GRIFFON:** Oh, I don't -- I -- I'm trying to
11 remember exactly how -- it -- it was actually
12 brought up by one of the -- the petitioners, I
13 believe, initially.

14 **DR. NETON:** Right. That's true. That was in the
15 evaluation report.

16 **MR. GRIFFON:** Yeah. And I -- I've just been
17 following up on it as to whether we've resolved
18 anything on that because I think they're going to
19 raise it again. But the question of -- of, you
20 know, sort of putting zeroes in for entries that --

21 **DR. NETON:** Right. See --

22 **MR. GRIFFON:** -- there was actually some question of
23 whether they were actually putting zeroes in for
24 values that -- that were a positive value.

25 **DR. NETON:** Well, see that's what I was going to

1 raise is I don't know that we have any indication
2 that that happened.

3 **MR. GRIFFON:** Right, right.

4 **DR. NETON:** I think they're -- you're right. Now
5 you refreshed my memory, there were assertions by
6 petitioners that if a person weren't monitored, they
7 would put zeroes in there. And I -- we've discussed
8 this with Janet and she's not, as far as I can
9 recall, aware of this happening. But we don't have
10 any more to answer. This is sort of proving a
11 negative-type situation.

12 **MR. GRIFFON:** Right. I don't know how -- yeah, how
13 do you prove it, that's --

14 **DR. NETON:** Right.

15 **MR. GRIFFON:** -- the problem I think.

16 **DR. NETON:** And I guess the worst case I could --if
17 -- if we -- accept the fact that that happened and
18 they -- and we can -- we can hopefully get
19 comfortable that they didn't take high values and
20 make them zeroes, and maybe that's part of this
21 validation thing I'm trying to do. But if they
22 entered zeroes where there was no monitoring, what
23 could conceivably happen is we would --

24 **DR. BEHLING:** Assign dose --

25 **DR. NETON:** -- compute missed dose --

1 **DR. BEHLING:** Yeah, because there was no dose.

2 **DR. NETON:** -- well, but -- but worse I think --

3 **MR. GRIFFON:** Well, they were unmonitored --

4 **DR. NETON:** If they were unmonitored we would assign
5 missed dose versus unmonitored dose, and that --

6 **MR. GRIFFON:** Right.

7 **DR. NETON:** -- that would -- I suspect could make a
8 difference, albeit this would be on the low end of
9 the -- of the dose reconstruction spectrum, but --
10 and honestly I'm not sure how we would deal with
11 that. If -- if we could find evidence that it
12 happened, we'd have to deal with it somehow. This I
13 guess is not unlike the situation where people are
14 saying well, I had a badge but I never wore it,
15 because then that's, you know, monitored dose --
16 unmonitored dose when we're assigning zero missed
17 dose.

18 **MR. GRIFFON:** But I don't know if there's any kind
19 of -- of record that you have that show who was
20 assigned dosimetry. I don't think you've seen those
21 kind of records, have you? I mean you just have the
22 cards with their film data --

23 **DR. NETON:** Right.

24 **MR. GRIFFON:** -- you don't have -- yeah.

25 **DR. NETON:** Yeah, and if there's a zero in there --

1 **MR. GRIFFON:** Right.

2 **DR. NETON:** -- it would normally be concluded by us
3 that, well --

4 **MR. GRIFFON:** That they (unintelligible) --

5 **DR. NETON:** -- that particular person wore the
6 badge.

7 **MR. GRIFFON:** -- dosimeter. Yeah.

8 **DR. NETON:** So...

9 **MR. GRIFFON:** Yeah.

10 **DR. BEHLING:** Couldn't you, on the basis of job
11 description, determine whether the person should
12 have been monitored and -- and realize that the job
13 description itself would almost mandate the issue of
14 monitoring. If he worked in -- in --

15 **DR. NETON:** Right.

16 **DR. BEHLING:** -- Building 6 and he was a certain
17 assigned job and there's no records, you can clearly
18 understand that either the records are missing or he
19 was not monitored but should have been monitored.

20 **DR. NETON:** Right. I -- I think that's a good
21 point. We -- based on the job description, I would
22 -- I would guess that if a person was not monitored
23 and our professional opinion was they did not need
24 to be monitored, then -- and they had zeroes, the
25 missed dose would be larger than the ambient dose

1 that we would have assigned them. So --

2 **MR. GRIFFON:** Right.

3 **DR. NETON:** -- in -- in most situations, that would
4 end up giving them a little more dose than we
5 otherwise would have. But the -- the worst
6 situation, though, is if we made the judgment that
7 they were monitored -- or should have -- did not
8 need to be monitored and should have been.

9 **DR. BEHLING:** Yes.

10 **DR. NETON:** But then that's an area where -- I don't
11 know. You know, there's --

12 **MR. GRIFFON:** I -- I think -- Jim, I think what
13 you're saying is, you know, you don't have evidence
14 that this happened but, you know, if -- if, you
15 know, the worst case would be that you could
16 consider individual claims or verify on a case by
17 case basis maybe, I don't know. Because it seems to
18 me that you're right, that if their -- there were
19 zeroes but they say I never was monitored and you
20 look at them and -- and it turns out that they were,
21 you know, administrative or whatever --

22 **DR. NETON:** Right.

23 **MR. GRIFFON:** -- then -- then you probably are --
24 are going to give them the higher of the two doses,
25 coworker versus -- versus a missed dose and the

1 missed dose is likely to be higher anyway, so...

2 **DR. NETON:** Right.

3 **DR. BEHLING:** Just a quick question of the
4 approximately -- I think yesterday you said there
5 was about 120 claims that have yet to be processed,
6 is that correct?

7 **DR. NETON:** For this time period.

8 **DR. BEHLING:** For this '49 to '57 time period. Of
9 those 120 claims, any idea how many of those
10 individuals are alive or being -- claims being
11 submitted by survivors, which allows you at least to
12 interrogate the claimant himself and sort of assess
13 whether or not he worked where and under what
14 circumstances and what the probability was that
15 these uncertainties can be resolved by a direct
16 interview.

17 **MR. MACIEVIC:** Well, see, I think a
18 misinterpretation comes to people from -- I mean
19 over time you have a person -- and I noticed this in
20 several files of different sites, and that a person
21 would be assigned a gamma dose and -- this is not
22 exactly what's happening here, but they'll be
23 assigned or have a dosimeter that they're checking
24 for gamma. They never had neutron dosimetry, but a
25 zero will go into that value --

1 **DR. BEHLING:** Okay.

2 **MR. MACIEVIC:** -- but it -- so technically they were
3 never monitored for neutrons, but they throw a zero
4 in there for the record-keeping purposes. Now that
5 you can see by, you know, looking at different files
6 and how it's laid out. But yeah, this -- this
7 question is --

8 **MR. GRIFFON:** A little different, yeah.

9 **MR. MACIEVIC:** -- yeah, different than what that is,
10 yes.

11 **DR. NETON:** To answer to Hans's original question, I
12 think -- I don't know exactly, but if -- if it holds
13 true for the rest of the sites, it's about 50
14 percent of the cases are --

15 **DR. BEHLING:** Are survivors?

16 **DR. NETON:** -- survivors.

17 **DR. BEHLING:** Yes. How about also --

18 **MS. BLOOM:** I think we also find, if you look at the
19 interviews, that somebody will say I didn't wear a
20 badge. And you go to the records and you go yes,
21 you did.

22 **DR. NETON:** Now see, this is when it's part of
23 security credential, they don't know.

24 **MS. BLOOM:** Yeah.

25 **UNIDENTIFIED:** Right.

1 **DR. NETON:** I mean they might not know, but --

2 **DR. BEHLING:** The other thing I was just thinking of
3 as a cross-reference would be looking at if there
4 are -- and again I don't know because I haven't
5 looked at the records, but are there occupational
6 medical exposure records and would you have given a
7 person who's not a radiation worker an occupational
8 medical. Is that the criteria? In other words,
9 were people given occupational medical exposures who
10 were not radiation workers? And if that's the case,
11 then any time you see an occupational medical
12 exposure with no dosimetry records, you say chances
13 are you're missing records.

14 **MS. BLOOM:** I think it changed over time and at a
15 lot of the sites there was a pre-employment physical
16 that included routine X-rays, I think.

17 **DR. BEHLING:** So that's not a distinguishing factor.

18 **MS. BLOOM:** I -- I think it changes and --

19 **DR. NETON:** I don't think we can hang our hat on
20 that, no.

21 **MS. BLOOM:** -- finding documentation of the exact
22 criteria is really tough.

23 **UNIDENTIFIED:** (unintelligible)

24 **MS. BLOOM:** The other thing that I -- I did find in
25 the records when I was looking at one claim

1 yesterday, some letters that said oh, by the way,
2 you haven't turned in your badge, we've sent these
3 in. And so there is some indication that they were
4 tracking badges, they were following up and you
5 might be able to go back to records and see what was
6 entered for that time period, did it come in later,
7 did it come in at all, was it a zero between two,
8 you know, large numbers.

9 **MR. GRIFFON:** Hey, Jim --

10 **DR. NETON:** Yeah.

11 **MR. GRIFFON:** -- the other thing I'm trying to
12 remember is I'm not sure that this claim wasn't
13 partly based on -- on some Mont Mason memos that
14 they were referring to. I'm --

15 **DR. NETON:** I think you're right, Mark, that there
16 was some issue about --

17 **MR. GRIFFON:** There was some kind of claim in one of
18 those memos that there could have been, you know,
19 and -- and I think the -- the petitioners picked up
20 on that, so --

21 **DR. NETON:** Yeah, I need to maybe go back --

22 **MR. GRIFFON:** -- so I think we need to track that
23 back, too -- yeah, and I forget what the issue was.

24 **DR. NETON:** Right. I -- I think that I agree with
25 your -- your -- your statement earlier, though,

1 Mark, that, you know, if -- if we can't find any
2 evidence that it did happen, we do have zeroes in
3 the record and we do a case by case evaluation of
4 the -- of the job title and either could make a
5 determination to assign either -- well, missed dose,
6 which would -- would probably -- we would probably
7 assign missed dose at a minimum since they --

8 **MR. GRIFFON:** Yeah.

9 **DR. NETON:** -- were monitored.

10 **MR. GRIFFON:** And I think you -- you -- I mean I
11 don't know. It's your decision, but you might offer
12 that, you know, if -- if there's a claim made by an
13 individual and in that particular case -- I mean I
14 can -- I can foresee a situation where -- it doesn't
15 seem like it because you've got 90 percent of the
16 (unintelligible) monitored here, but I can foresee -
17 - on some sites I've been on there's been situations
18 where maintenance people kind of fell through the
19 cracks because they were assigned to a maintenance
20 building, but they would go in other areas where
21 they -- they should have had a badge but they just
22 kind of fell through the cracks and they did work in
23 those areas and -- and never were monitored. So if
24 you saw a case like that, then you could say well,
25 in those cases we'll give the higher of the two,

1 coworker or missed dose, you know --

2 **DR. NETON:** Right.

3 **MR. GRIFFON:** -- if there's a claim made by -- and
4 we'll -- we'll handle that on a case by case basis.
5 So we don't have any evidence, but we will be
6 claimant-favorable in -- in those situations if --
7 if people make those allegations.

8 **DR. NETON:** Then maybe --

9 **MR. GRIFFON:** I don't know.

10 **DR. NETON:** You know, Mark, I'm -- I'm looking at
11 this -- the SEC evaluation report and it looks like
12 -- I can't tell exactly, but it looks like they're
13 referring to the zero recorded for site breath radon
14 results.

15 **MR. GRIFFON:** Oh.

16 **DR. NETON:** The TBD indicates technique
17 (unintelligible) for internal exposures for other
18 isotopes based on uranium. Site breath radon
19 results indicate a 0.000 will not affect the ability
20 to reconstruct doses to individuals because
21 surrogate information is available. At least that's
22 what we've said, so unless there -- it appears
23 somewhere else in here -- I'll -- I'll -- I'll go --
24 I've got to go through and -- and address this.

25 **MR. GRIFFON:** We should check back on that because I

1 recall them saying about the film, as well, that
2 maybe -- maybe that was more of a --

3 **DR. NETON:** Yeah --

4 **MR. GRIFFON:** -- a personal --

5 **DR. NETON:** -- you're probably right.

6 **MR. GRIFFON:** Yeah. I don't know.

7 **DR. NETON:** I'll -- I'll look through it and, you
8 know, I think the approach we were talking about
9 here is as best we're going to do and -- and in
10 fact, if it was a person such as like a chemical
11 operator and they were assigned zeroes -- well, see,
12 I -- I find it hard to believe with that many people
13 monitored that --

14 **MR. GRIFFON:** Right.

15 **DR. NETON:** -- someone like a chemical operator
16 would not have -- have a badge result.

17 **MR. GRIFFON:** But -- but -- yeah. It -- it does --
18 it's a little trickier than that 'cause your
19 percentage of people monitored is based on all those
20 zeroes counting as real -- real monitoring, right?
21 So anyway...

22 **DR. NETON:** Well -- well, you've got a point there
23 if -- if that is indeed true.

24 **MR. GRIFFON:** But I -- I tend to think you're right.
25 I mean it's like the majority of these people were

1 monitored, so...

2 **DR. NETON:** I -- I think if we go through and pull
3 out the ones that weren't monitored, sort of a
4 sampling, and get a feel for the -- the job titles,
5 you know --

6 **MR. GRIFFON:** I think that would be --

7 **DR. NETON:** -- I'm envisioning something like a
8 little histogram or something. Yeah. Okay, I -- I
9 think we've -- we've got the thread here.

10 **DR. MAKHIJANI:** A couple -- couple -- couple other
11 things in this area is I think -- from my worker
12 interviews, it seems that guards were not monitored.

13 **DR. BEHLING:** Well, I think they were --

14 **DR. MAKHIJANI:** And guards may have --

15 **DR. BEHLING:** -- in -- in some instances.

16 **DR. MAKHIJANI:** -- some of the guards may have
17 fallen through the cracks, but that -- I don't know
18 whether that's true or not.

19 **DR. NETON:** (Unintelligible)

20 **DR. MAKHIJANI:** (Unintelligible) the guards were
21 monitored? I mean this is just --

22 **MS. BLOOM:** I believe guards were monitored.

23 **MR. MACIEVIC:** And I just read that this morning in
24 here --

25 **DR. MAKHIJANI:** Okay.

1 **MR. MACIEVIC:** -- somewhere and I can't quite find
2 it.

3 **DR. MAKHIJANI:** All right. And I -- it's in the
4 TBD. I'll check it.

5 **MR. MACIEVIC:** Yes.

6 **DR. MAKHIJANI:** I will check it. The other thing is
7 that, you know, as you said earlier, Jim, that 90 --
8 that 90 percent of the white male workers were
9 monitored --

10 **DR. NETON:** Well, at the very least.

11 **DR. MAKHIJANI:** -- but you may not have -- you may
12 not -- in the recent -- in the last years --

13 **DR. NETON:** Yeah.

14 **DR. MAKHIJANI:** -- but you may not have all the
15 records.

16 **DR. NETON:** Right.

17 **DR. MAKHIJANI:** And so I think in a way the zeroes
18 question and the lost records question is sort of
19 tied up with, you know, your ability to -- to define
20 a job category and make an assessment of what that
21 situation is. And so this raises sort of -- one of
22 the questions that we brought up in our review is,
23 in the case of the survivor claimants sometimes you
24 have a tougher time with the job history if you
25 don't have the records because they may know only

1 the last one. I've -- I've looked at lots of
2 interviews and really it's --

3 **MS. BLOOM:** Uh-huh.

4 **DR. MAKHIJANI:** -- it's a lot of don't knows, and
5 you can -- you can understand that. And so in -- in
6 those cases I think -- I think it's kind of
7 important to know what -- what fraction of the --
8 what portion of the universe you're dealing with
9 here in terms of unavailable records as well as
10 records that we think where the data might not be --

11 **DR. NETON:** Right.

12 **DR. MAKHIJANI:** -- of the integrity --

13 **MS. BLOOM:** I think when you're talking about job
14 title and it -- I don't think it matters whether you
15 have the employee's recollection or the survivor's
16 recollection, you should take it with a grain of
17 salt. And I -- I think one of the claims you were
18 talking about yesterday, I went back and looked at
19 that. There was a strike in 1963. That person who
20 became an administrative worker went back and in
21 1963 during the strike was the foreman in
22 maintenance again and that's in the record.

23 **DR. NETON:** Interesting.

24 **MS. BLOOM:** I've got a page number for you so you
25 can take a look at that.

1 **DR. NETON:** Excellent.

2 **MS. BLOOM:** So I think as you pull the threads and
3 you find data, what you realize is that you can
4 probably figure out how to put your arms around
5 things, but you should never think that your data is
6 all, you know, that -- that you know everything you
7 need to know, because I think every time I pull on
8 those threads, I find out I missed something. Also
9 although that sounds really good, the dates are off.
10 And they're off in a way that makes that not exactly
11 the answer, but just a compounding factor to the
12 information so...

13 **DR. MAKHIJANI:** Okay. Yeah -- no, I mean I -- I
14 raised the question --

15 **MS. BLOOM:** Uh-huh.

16 **DR. MAKHIJANI:** -- yesterday about I think Mr. B it
17 was --

18 **MS. BLOOM:** No, I think it's a good -- I think it's
19 a good question and a good example.

20 **DR. MAKHIJANI:** -- purely, truly, as I don't know
21 what's going on here --

22 **MS. BLOOM:** Uh-huh, yeah.

23 **DR. MAKHIJANI:** -- because we know -- well, you
24 know, if you take Fernald -- which is a facility
25 that I know perhaps best of all the ones that we

1 talk about because I've studied it for the longest -
2 - in 1955 they had enormous emissions of
3 radioactivity. And if you -- if you were across the
4 street from Fernald rather than, you know, two miles
5 away, you could have gotten pretty big doses.

6 **MS. BLOOM:** Uh-huh.

7 **DR. MAKHIJANI:** If you were in an office building on
8 the Fernald site, you could have gotten pretty big
9 doses. And so not to prejudge what goes in Fernald,
10 but just from the -- the stack records and the
11 scrubber records and so on, you can say quite a lot.
12 So I just raised that as a question without knowing
13 the answer because we don't -- we haven't done a
14 source term evaluation for Mallinckrodt. I don't
15 even know whether it's possible to do such a thing
16 in terms of what went up the stacks. I haven't
17 looked at any of the records so I -- I'm not
18 prejudging that answer. So this is actually very
19 useful information --

20 **MS. BLOOM:** Uh-huh.

21 **DR. MAKHIJANI:** -- because people forget after --
22 it's true, people do forget after so many years.

23 **MS. BLOOM:** And it was an odd situation but I think,
24 you know, that's certainly something that you
25 probably wouldn't necessarily remember.

1 **DR. NETON:** Right.

2 **DR. MAKHIJANI:** Yeah.

3 **DR. NETON:** I forgot where we were going here
4 (unintelligible).

5 **DR. MAKHIJANI:** Okay. So is there a kind of -- how
6 do -- is there -- are you going to come back to us
7 with some kind of information about the proportion
8 of records -- roughly? You know, I realize that you
9 cannot --

10 **DR. NETON:** It's just like with the internal
11 monitoring, we're going to come back with some type
12 of a -- of a distribution. I mean with 120 claims
13 it's, you know, it would be some -- worth of work,
14 but it would not be that hard to go through each one
15 --

16 **DR. MAKHIJANI:** Right.

17 **DR. NETON:** -- and -- and just check a box. You
18 know, it's going to be a little harder so it's going
19 to be a rough cut. We're going to say some or none
20 because, you know, just because there's some does
21 not necessarily mean that it's complete monitoring
22 history but at least it's an indication you've got
23 something on the guy and the monitoring status
24 (unintelligible). It may be instructive to
25 determine what percentage of those are zeroes, yeah.

1 **DR. MAKHIJANI:** Right. But if in that same thing
2 you could give us an idea of --

3 (Whereupon, an unrelated discussion ensued off
4 the record.)

5 **DR. MAKHIJANI:** If in that same thing you could give
6 us an idea of job titles, you know, whether you have
7 -- not what the job title was, whether you have the
8 job title information.

9 **DR. NETON:** Right.

10 **DR. MAKHIJANI:** Because I think then your ability to
11 assign missed is obviously improved --

12 **DR. NETON:** Right.

13 **DR. MAKHIJANI:** -- a great deal.

14 **DR. NETON:** Sure. Now again, you know, we have to
15 be careful in generalizing this for all cases. If
16 you don't have a job title and as -- as we went over
17 that case yesterday where the lady -- I think it was
18 a uterine cancer -- we assigned her the highest --
19 average of the highest ten doses at the facility for
20 each year without knowing anything about her job and
21 demonstrating that it was not likely that her
22 uterine cancer was caused by her exposure at work.
23 So, you know, these things -- yeah, I -- I'm very
24 reluctant to generalize and say if we don't have job
25 titles, this is how we're going to do it. It's --

1 it depends on the case. I think that was an
2 instance of a short latency period possibly
3 (unintelligible) -- there' s other factors that come
4 into play.

5 **MR. MACIEVIC:** And when you're talking about missing
6 data, too, I mean it depends if you're talking a
7 person who worked ten years and you're missing eight
8 of those years or a person who missed a few months
9 out of those years and you can interpolate in
10 between. So I mean missing data is --

11 **DR. NETON:** Yeah. Well, this will be a little rough
12 and we're going to -- we're going to provide an idea
13 of are there bioassay, are there external results
14 (unintelligible) -- I know there's some with none.
15 I mean clearly we had one yesterday, but I don't
16 think we knew the job title of that person. We just
17 knew she worked here. I'm sure by -- by all
18 accounts -- I mean she could have been a secretary;
19 she could have been a chemical operator.

20 **DR. MAKHIJANI:** Okay. I think that --

21 **DR. NETON:** Okay.

22 **DR. MAKHIJANI:** -- the next question is how is NIOSH
23 addressing the issue of organ versus badge location
24 geometry for workers such as those who scoop
25 residue, shovel pitchblende into digesters, stamped

1 ID numbers on ingots. I think here the stamped ID
2 numbers on ingots -- I wrote this before I went to
3 St. Louis, I think -- may not be as big an issue as
4 maybe at Fernald because I don't think they were
5 doing it in the same way. But -- but the others do
6 appear to be somewhat -- I don't know how you
7 address the geometry problem. It was -- it was
8 there at Iowa, we brought it up where the pits were
9 in front -- in the pelvic area and we all estimated
10 a factor of 2.5 or something like that. But I don't
11 know how you would do that, approach that here, what
12 the magnitude of the problem is.

13 **DR. NETON:** Well, we -- you know, we -- we've looked
14 -- we've looked at this issue some since you raised
15 it and we need to do some analysis. I mean we can't
16 just out of hand reject it and say that it's not
17 important, but it's our opinion that for area -- for
18 functions like shoveling, it's not going to be a
19 huge difference. I don't think we're talking as
20 large a difference as the pits holding up at the
21 abdomen. But, you know, it may be -- you know, I'm
22 speculating here but, you know, something that's a
23 25 percent or something of that magnitude. So we're
24 not -- I don't -- I don't think it's going to be as
25 large an issue. But it was not addressed in the TBD

1 and is something that we have to answer.

2 **DR. MAKHIJANI:** And is there kind of an approach
3 that you've thought of -- thought of to developing
4 an answer to --

5 **MR. MACIEVIC:** Well, one of the things that I'm
6 going to be looking into is we have a new software.
7 It's a transport -- radiation transport software
8 called Attila that -- it's a deterministic model as
9 opposed to the probabilistic like the MCNP, and
10 we're going to try to do some calculations using
11 that for different scenarios for body position with
12 the band badge and organ position with respect to
13 the source to get -- see what kind of limits there
14 are. And you probably will see that as a person is
15 moving off from that source by a certain percentage,
16 as long as that distance between the badge and
17 whatever organ are, you know, pretty much the same,
18 there's not going to be that much difference. It's
19 going to be in the cases where -- you know, like
20 you're saying, where the person's definitely got it
21 close to one place and the badge is now distinctly
22 different that you'll see it. But this, hopefully
23 will be able to generate some numbers for that and
24 get a good feel for the kinds of distributions
25 (unintelligible).

1 **DR. NETON:** Right.

2 **DR. MAKHIJANI:** One -- one of the things -- I have a
3 picture that I'll show you at the break from
4 Fernald. But one of the things that seems to be an
5 issue -- and Hans, correct me if I'm not on the mark
6 here. But the -- the -- the angle -- the geometry
7 of the radiation source where sometimes the badge is
8 kind of dangling down and when the source is beneath
9 you, you know, you -- you don't have a perpendicular
10 incidence of -- of the radiation on the badge.

11 **DR. BEHLING:** The issue of angular, angular
12 sensitivity.

13 **DR. MAKHIJANI:** Angular -- so the angular -- this
14 question came up in my mind reading the TBD and
15 trying to study the operations actually first from
16 an angular dependent point of view, because you've
17 obviously got the work beneath you --

18 **MR. MACIEVIC:** Right.

19 **DR. MAKHIJANI:** -- and you're -- whenever you're
20 bending down, as you'll see in the picture that I
21 show you, the badge is dangling vertically and
22 you've kind of lost your near-perpendicular
23 incidence.

24 **MR. MACIEVIC:** Well, yes, and I think that's part of
25 the thing because some people wore badges like that

1 where you had a strap and the dosimeter was on this,
2 and as you move forward that would also swing out as
3 opposed to having it attached to the clothing at the
4 chest level. So --

5 **DR. BEHLING:** Right.

6 **MR. MACIEVIC:** But that kind of thing I think you
7 could model up relatively easy with the Attila. I
8 say relatively easy, but I think to -- to get some
9 different types of scenarios, and if the -- the --
10 the effects of geometry get even more important with
11 -- as the energy or the beta -- like with the beta
12 particle and the -- the mean free path across. If
13 you've got photons and that which have a high enough
14 energy, the -- it will interact with the film on the
15 -- the angularity effect is a lot less for something
16 like that as opposed to a -- a beta particle which
17 now you're hitting it at different angles so that
18 penetration through or not hitting the filters is
19 different. So you can mock that kind of scenario up
20 a little bit better with -- using this Attila
21 software and try to come up with some kind of
22 factors in -- now as far as what you make as an
23 assumption as to how many people wore straps where
24 the dosimeter hung -- swung free versus how many
25 would have kept it to their chest, I don't know.

1 **DR. BEHLING:** Well, it's not even the swing. I mean
2 angular dependence is something that you have to
3 worry about if you deal --

4 **MR. MACIEVIC:** Sure.

5 **DR. BEHLING:** -- with an isotropic source because
6 you're getting simultaneous radiation from all
7 angles other than normal.

8 **MR. MACIEVIC:** Sure.

9 **DR. BEHLING:** And of course, especially the deep
10 dose where you go through 1,000 milligram of fill
11 dirt material, whether it's cadmium or silver, the -
12 - the thickness obviously is a function of -- of
13 deviation from normality in terms of deviance in
14 radiation. So you know -- and I've gone through --
15 I think in some of my write-ups regarding -- was it
16 Iowa? -- as well as the discussion in -- under task
17 3, I provided some data that comes straight out of
18 the classic textbook (unintelligible) that measured
19 the angular dependence of early film dosimeters.
20 And it's clear that any deviation from normality is
21 -- is going to affect the -- the response of the
22 film, so --

23 **MR. MACIEVIC:** There's also an energy
24 (unintelligible) --

25 **DR. BEHLING:** Oh, yeah --

1 **DR. NETON:** Yes.

2 **DR. BEHLING:** -- of course there is, but in fact in
3 some instances if you're actually at 90 degree
4 angle, your -- your film dosimeter will -- will not
5 even be -- I think if -- if -- and it's an unusual
6 case which would never happen, but I think in the
7 early day they actually had the little lead marker
8 that says if it didn't show up then that exposure
9 wouldn't even be registered because they would
10 assume that it's a false positive at 90 degrees. It
11 would give you a high dose because you're obviously
12 avoiding the actual shield or the cadmium shield,
13 but that would also be indicated to the reader
14 because the -- the -- the lead marker wouldn't be
15 seen on the film and therefore he would say ah, this
16 is -- this is an artifact and it would essentially
17 be recorded as zero when in fact it was a positive
18 dose. Those are all issues that are obviously
19 limitations when you talk about film dosimeters,
20 angular dependence.

21 **DR. MAKHIJANI:** Is it -- is it -- Hans, is it -- is
22 it sort of more with the two-element thing, two-
23 element dosimeter as opposed to the other ones where
24 you might have --

25 **DR. BEHLING:** Well, it's -- it's -- it's -- all --

1 all dosimeters have that problem. Think of this as
2 -- as the filter that overlies your -- your -- your
3 deep dose portion of the badge. If you go at right
4 angles, it goes through basically one millimeter of
5 silver or cadmium, whatever it has. If it goes
6 through at an angle, you realize that --

7 **DR. MAKHIJANI:** Yeah.

8 **DR. BEHLING:** -- the path is considerably thicker
9 and -- and so therefore you -- you see some
10 attenuation effect. And there are some data in the
11 early measurements that were done, empirical
12 measurements (unintelligible), that tell you exactly
13 at -- you know, at angle of 45 or 30 degrees, 90
14 degrees, et cetera, what -- what the reduced
15 response for a -- for a mono-energetic beam would be
16 --

17 **MR. MACIEVIC:** But you would also have to look at --
18 I mean for that kind of thing -- and that's true if
19 you were under a certain condition all the time --

20 **DR. BEHLING:** Yes.

21 **MR. MACIEVIC:** -- it will do that. But the
22 assumption is -- I mean you're moving around
23 continuously (unintelligible) --

24 **DR. BEHLING:** Yeah. You're basically dealing with
25 one --

1 **MR. MACIEVIC:** -- (unintelligible) geometry --

2 **DR. BEHLING:** -- isotropic source --

3 **MR. MACIEVIC:** -- at -- at all times.

4 **DR. BEHLING:** Either the source is truly isotropic
5 or your body motion makes it an isotropic. If you
6 spin on your own axis, even a point source
7 essentially appears to the dosimeter as an isotropic
8 source.

9 **DR. MAKHIJANI:** So some idea of an approach may be
10 with an illustrative calculation or two?

11 **DR. BEHLING:** Well, I think it's part of the
12 uncertainty that's normally introduced, although I
13 think from the uncertainty -- and this is one of the
14 things that I've always taken exception to because
15 I've been in the utilities where you -- you do your
16 uncertainty by taking obviously several dozen badges
17 and you put it in -- in a circular fashion. You
18 rotate about a point source and then you essentially
19 determine what the average value is and you find
20 your sigma value. But in most instances you're
21 dealing with a controlled exposure. It's acute
22 exposure, it's mono-energetic exposure, and all
23 badges are always normal to the incident radiation.
24 So you get a sigma value that is an artificially low
25 value. It doesn't, for instance, take into

1 consideration many of the other issues, including
2 the -- you know, the -- and if you remember this --
3 the -- and I wrote up about this, the National
4 Research Council report on film dosimetry and
5 atmospheric testing, and they go through all of the
6 different types of contributions due to laboratory,
7 radiological and environmental as being contributors
8 to the uncertainty. And in most instances there,
9 you only deal with one uncertainty as opposed to the
10 environmental and -- and laborat-- not laboratory,
11 the radiological uncertainty that includes, for
12 instance, angular dependence, which is never
13 captured when you do that sigma value under
14 controlled conditions because you don't rotate the
15 badge or you don't necessarily subject it to high
16 temperatures. In fact in some -- one of statements
17 here involved a very high false positive read that
18 was ultimately interpreted as being temperature-
19 induced. And, you know, for -- for TLDs you have so
20 many factors, everything from chemiluminescence,
21 (unintelligible) luminescence, you name it, they can
22 all contribute, which is usually not captured when
23 we deal with badges under controlled exposures. You
24 know -- you know, in a field you -- you put people
25 into environment that are hot, humid --

1 **MR. MACIEVIC:** The -- the thing is -- is -- I mean
2 the assumption there is that you're not backing it
3 up by some kind of --

4 **DR. BEHLING:** Yeah.

5 **MR. MACIEVIC:** -- dose investigation because many of
6 these cases that you're talking about, like with the
7 film and my working at Landauer for about five or --
8 five years over there and doing research on
9 different types of dosimetry, film, TLD, track etch
10 types of things and all that, you can define what
11 you -- you are -- the one nice thing about film is
12 that you do have a picture and you can determine
13 that there's something wrong when you're monitoring
14 it. And several of these places, if there's
15 something wrong with the badge, they'll put it in a
16 code that there was something wrong with the badge.
17 So in a case like that, you would have some kind of
18 estimate or there'd be something to state that there
19 is a problem here out of the ordinary. So I don't
20 think you would -- you could say that all these off-
21 conditions were a routine practice that it would
22 account for some huge variation in the badge. I
23 mean there's the -- the motion of the person and
24 things like that which will cause some variation in
25 the badge, but some of these things -- like in

1 chemiluminescence and that on a dosime-- on the TLD,
2 one of the things that you do in having a heating
3 ramp is that you basically burn off all the crap
4 that might do that when before the photomultiplier
5 even starts reading the number. If you read out a
6 dosimeter and you anneal it -- because when you read
7 it, you anneal it -- if that still has another read
8 and what your process should be and has -- is, in
9 reading several of these documents on rereading a
10 dosimeter, if there's a residual of a certain
11 percent left in the thermoluminescence, that again
12 indicates that there's a problem with this badge and
13 then you would go back. And having done that kind
14 of thing at Fernald, too, is that you see people
15 will take their dosimetry through the shower and get
16 soap into the material --

17 **DR. BEHLING:** They put it in microwave ovens --

18 **MR. MACIEVIC:** That's right.

19 **DR. BEHLING:** -- all kinds of things.

20 **MR. MACIEVIC:** -- and it will -- but it will show
21 that that kind of duplication comes up each time.
22 You'll see a dose for a person one month; they get
23 the next dosimeter, there's zero; then the next
24 month they're getting a reading again. And when you
25 go investigate you find out that dosimeter is messed

1 up so you have to go back and do an investigation on
2 those. So I -- the assumption is is that -- or in
3 what you're saying is that when a reading has gotten
4 on a badge that no one would have gone back and
5 looked if something stood out as strange on it. And
6 I think in many cases if the badge is operating
7 normally, you're not going to have the
8 investigation. But if something were -- if -- if
9 you can see it --

10 **DR. BEHLING:** Yeah, of course. No, I -- I'm fully
11 aware of it, but invariably it would -- would never
12 been identified as an artifact or a -- a critical
13 problem, it's still an issue of underresponse due to
14 such things as angular dependence.

15 **DR. NETON:** All right. I -- I think we're getting
16 far afield from the film badges at Mallinckrodt
17 here, and let's focus on that I think. And I think
18 what Greg is saying is true that, you know, you -- I
19 don't know that we've got such an exaggerated
20 sequence as you're suggesting where a guy is at 90
21 degrees to the source --

22 **DR. BEHLING:** No, no --

23 **DR. NETON:** -- and you've got a worker who's
24 shoveling. And I think our -- our contention here
25 is that we can do some bounding estimates using

1 Attila to demonstrate that when a person is three
2 feet away with a shovel from a -- from a vat of
3 something, that the -- the response of that film is
4 going to be probably -- I'm -- I'm guessing here,
5 but plus or minus 25 percent or something of that
6 nature. And so I don't -- I don't think we have a
7 huge issue here that is unsolvable. We need --

8 **DR. BEHLING:** In fact --

9 **DR. NETON:** -- to do some sort of demonstration that
10 we believe it's probably within the uncertainty of
11 the whole process, so...

12 **DR. BEHLING:** But if there's an uncertainty, it's
13 probably in favor of the claimant, and that is film
14 badge contamination. That turned out to be a major
15 problem in --

16 **DR. NETON:** Sure.

17 **DR. BEHLING:** -- specific testing place because of
18 fallout. You know, people do things, they touch
19 things, and they place their hands on it, and that
20 contamination is going to contribute to dose until
21 the moment you read out the film. And so you
22 realize --

23 **DR. NETON:** Right.

24 **DR. BEHLING:** -- badge contamination is a major
25 problem.

1 **MS. BLOOM:** In the -- in our program for the other
2 sites, we've started moving towards assigning 100
3 percent AP exposures. That's been our assumption.
4 I'm not sure that that's what we're doing on
5 Mallinckrodt right now. I know just for the AWEs in
6 general, though, that's the direction we've headed.
7 Does that change any of your concerns?

8 **DR. BEHLING:** Well, I have problems with the -- the
9 whole issue of the DCF because one of the things
10 that I believe all of the Appendix B and others are
11 -- are wrong because they make assumptions that I
12 think start out as an air dose and then they convert
13 it into tissue doses, which is not correct. For
14 instance, you know, you can tell in Appendix B that
15 for low energy photons if you have the PA geometry
16 exposure, the DCFs are virtually the same as in AP.
17 The problem is you're always wearing a badge up
18 front --

19 **MS. BLOOM:** On your --

20 **DR. BEHLING:** -- and so you realize those numbers
21 are off the wall. They don't -- they're not
22 correct.

23 **DR. NETON:** And that's -- that's an issue we need to
24 address in that document itself. I don't know that
25 --

1 **DR. BEHLING:** No, no, I'm not saying it is here.

2 **DR. NETON:** It's captured in another review
3 (unintelligible).

4 **DR. BEHLING:** But -- but when -- when -- when the
5 dose -- the doses are calculated that are not organ-
6 specific and you convert a recorded dose into an
7 organ dose, you still have to defer to the -- the
8 Appendix B DCFs. And for instance, I -- I look at
9 the numbers and -- and for all of them -- if you
10 look at, for instance, the eye or the thyroid and
11 you have a PA geometry, well, you know, you realize
12 that all those tissues have to have a DCF greater
13 than one because you're dealing with an exit dose.

14 **MS. BLOOM:** Uh-huh.

15 **DR. BEHLING:** The dose is here. Okay? And if the -
16 - the source is behind you, what you're measuring on
17 your -- on your TLD or film is an exit dose, which
18 means that --

19 **MS. BLOOM:** Right.

20 **DR. BEHLING:** -- any tissue that is in between the
21 source -- and that's starting on your back, the skin
22 on your back throughout your torso -- is going to
23 have a higher exposure than what's recorded on that
24 film --

25 **MS. BLOOM:** Right.

1 DR. BEHLING: -- badge by definition. So --

2 DR. NETON: We're aware of that --

3 DR. BEHLING: -- when I look at those DCFs I know
4 for a fact --

5 DR. NETON: We have that comment and we will address
6 that comment. That's in procedures review and I'm
7 aware of that. I don't want to get off on -- on
8 that issue here.

9 DR. MAKHIJANI: And so basically, just for my
10 clarity, what -- what's in the procedures review
11 pipeline automatically get reflected in the dose
12 reconstructions --

13 DR. NETON: Everything, across the board --

14 DR. MAKHIJANI: (Unintelligible)

15 DR. NETON: -- those will all be reworked 100
16 percent.

17 DR. MAKHIJANI: Okay.

18 DR. NETON: Any -- anything that is of a broad,
19 sweeping -- such as that, we would go back and redo
20 every single dose reconstruction that used that
21 concept.

22 DR. MAKHIJANI: Okay. So that's not an issue in
23 terms of reconstructability --

24 DR. NETON: Right.

25 DR. MAKHIJANI: -- it's just a procedures thing that

1 --

2 **DR. NETON:** It's a matter of interpretation of the
3 existing data.

4 **DR. MAKHIJANI:** But what I can expect in terms of my
5 producing a draft on this particular question is
6 that Greg will do a little exploration and then --

7 **MR. MACIEVIC:** Yes, right.

8 **DR. MAKHIJANI:** -- you'll -- you'll send us
9 something?

10 **MR. MACIEVIC:** Yes.

11 **DR. MAKHIJANI:** So I can look at it and I could call
12 you. Presumably you'd have some (unintelligible).

13 **MR. MACIEVIC:** (Unintelligible) have the right
14 number, but yes, you can call me.

15 **DR. MAKHIJANI:** Okay.

16 **MR. MACIEVIC:** Yes, I'll (unintelligible).

17 **DR. MAKHIJANI:** Thank you. My -- my aim is to
18 produce a rough draft at least by the 15th and
19 closer to a final by the 20th so we can have our
20 internal --

21 **DR. NETON:** Need to get something. Can you do
22 something like that fairly quickly, do you know,
23 Greg? I mean --

24 **MR. MACIEVIC:** Yeah, I'm already talking with the
25 people who do the software about ginning-up some

1 scenarios like this. I'll -- I'll call them and
2 talk today --

3 **DR. NETON:** The software is very nice, actually
4 provides -- one of the features of it provides some
5 very nice graphics. I mean, you know, images that
6 you can show, you know, the source strength and all
7 this stuff in relation to the -- you know, magnitude
8 of the exposure at different positions relative to
9 the person and badge and things so --

10 **DR. MAKHIJANI:** So, Hans, do you -- do you have --
11 are you familiar with this?

12 **MR. MACIEVIC:** It's pretty much brand new. I mean
13 this is -- they've used this transport software.
14 What this does is you model up -- whatever your
15 universe is that you're going to create, if you have
16 the person, the source, you'll model an area. It
17 meshes this area and you calculate the radiation
18 transport (sic) at all points within the entire
19 area that you have. So what it's going to do is
20 give you isoflux lines; it'll give you dose lines
21 and all that through different materials and through
22 all the particles. It's a -- it's a very -- it's
23 quicker and more -- it's not -- it's just as
24 accurate as Monte Carlo. But with Monte Carlo you
25 end up picking a few points and do the calculation.

1 This will compute for the entire area and you'll get
2 doses at all points, which is why this will be nice
3 and you get nice graphics to show. If you have
4 something here, it'll show you the dose and the flux
5 distributions through the entire body at different
6 organs, and if you placed a dosimeter here, you'll
7 get to see what the lines are that pass through this
8 point and all that. It's a really neat software for
9 -- for doing this, and it's a -- I think people are
10 just starting to use it. I mean it's been around a
11 lot. I mean radiation transport using this method
12 has been around a long time, but the computer
13 capacity -- it's had to have so much to crank these
14 numbers to follow every photon through that, it just
15 took too much. Now it's starting to come into its
16 own light so...

17 **DR. MAKHIJANI:** Greg, could I make a request that
18 the -- the -- that we get the assumptions that
19 you're going to put into this in very simple
20 language that I can understand --

21 **MR. MACIEVIC:** Sure.

22 **DR. MAKHIJANI:** -- so that we can do some back of
23 the envelope checks? Because whenever there is a
24 new complex model that's in the computer, it makes
25 me very nervous and I like back of the envelope

1 checks because it makes it sense. And of course,
2 Hans is our point person on this and --

3 **MR. MACIEVIC:** Well, Bob Anigstein would probably be
4 the person that looked at the computer.

5 **DR. MAKHIJANI:** -- and Bob, Bob Anigstein. And I
6 will call Bob also and convey this to him and get
7 him ready for, you know, whatever you have to say
8 because this is an area, you know, in which in -- in
9 our team basically it's Hans and Bob who look at the
10 issues (unintelligible).

11 Mark, shall we move on to the next or did you have
12 something?

13 **MR. GRIFFON:** No, that's fine.

14 **DR. MAKHIJANI:** Okay. Next question, external dose
15 data did not provide job categories for -- in the
16 five -- six boxes did not provide job categories for
17 personnel whose badges had doses below 200 m-rem and
18 in some cases below 300 m-rem, hence external dose
19 data do not appear amenable to being grouped into
20 job categories in ways that will enable the
21 construction of external dose distributions for
22 various job categories. How is NIOSH going to
23 construct surrogate worker cohorts given the lack of
24 job categories for data applying to majority of
25 workers?

1 **DR. NETON:** This is just of course, referring to the
2 five or six boxes. I think if you look through the
3 list of the 12,000 TLDs or whatever, most people
4 have a job title or category associated with them.
5 So I think -- I'm not -- and I don't know what --
6 I'm not familiar with what you're talking about in
7 the five or six boxes, but I -- I do know that
8 people have individual badge readings with job
9 categories -- in the CER database, at least.

10 **DR. MAKHIJANI:** Right. So -- so I guess what you're
11 saying is that you're going to construct the -- this
12 may be a more straightforward -- the question was
13 long and maybe the answer is more straightforward,
14 is that when I looked at these records the way they
15 were, was -- they were simply identifying the most
16 exposed --

17 **DR. NETON:** Right.

18 **DR. MAKHIJANI:** -- personnel, and they were calling
19 them out by job category. And for most of the
20 people -- the vast majority, 90-plus percent of the
21 people -- there was no job category. But I don't
22 know why they were collected in that way, but -- so
23 I didn't -- I don't think that that data can be used
24 for --

25 **DR. NETON:** Right.

1 **DR. MAKHIJANI:** -- coworker analysis.

2 **MS. BLOOM:** I would say that that's probably just a
3 partial set of data, and as you go through records
4 you find you've got lots of partial sets that you
5 need to pull together and make sure they match and
6 that they -- you know, you've got an issue of
7 zeroes, sometimes you find out the worker wasn't
8 here and that's what the zero means when you -- but
9 you find it in another record. And so that would be
10 similar with that, that that's just supplemental
11 data that we need to pull all together to make the
12 big set of coworker data.

13 **DR. MAKHIJANI:** Yeah. So -- but my -- my -- my
14 feeling is, looking at that data in, you know, more
15 detail than were able to do before the Iowa meeting,
16 it seems to me that -- that pretty much when -- when
17 you're constructing coworker data you have to do it
18 from the individual records.

19 **DR. NETON:** Right.

20 **DR. MAKHIJANI:** It would not be possible to use
21 those aggregate -- at least the aggregate record
22 that are in --

23 **MS. BLOOM:** You -- you cannot --

24 **DR. MAKHIJANI:** -- those boxes.

25 **MS. BLOOM:** What I've found is you cannot use any

1 set of records by itself, whether it's the original
2 or the summary or anything else. And part of the --
3 one of the main reasons is illegibility. You can't
4 read names or numbers or dates, and sometimes you
5 can find that in the summary when you can't read it
6 on the card. Sometimes you find it in the card and
7 you -- you know, so you need to look at it all and
8 pull it together. That's why some of this takes
9 time.

10 **DR. MAKHIJANI:** Yeah. Okay. I -- I think -- I
11 think that's fair because -- because I've looked at
12 a fair number of individual dose records and I do
13 know that -- actually as -- as we said yesterday,
14 the job title information at Mallinckrodt is pretty
15 good.

16 **DR. NETON:** Yeah, it is. It's actually -- I -- I --
17 it's not in the exact dosimetry file, now that I'm
18 looking at this, but there are work history
19 information tied to all of the film badge records,
20 and that was what I was going to end up sending
21 Mark. Yeah, we do have a lot of job -- job titles,
22 categories for Mallinckrodt workers, and that's --
23 that's clearly what we'd use.

24 **DR. MAKHIJANI:** Okay. I think that -- that
25 (unintelligible) can consider it taken care of.

1 Table 33 has only scattered data for external dose.
2 How is NIOSH going to construct claimant-favorable
3 and scientifically-defensible values for surrogate
4 worker cohort external dose? I guess this is a
5 different -- different incarnation of the same
6 question.

7 **DR. NETON:** Yeah, I think so. I was going to look
8 at Table --

9 **MS. BLOOM:** Table 33 is the workplace exposure rates
10 --

11 **DR. BEHLING:** Yes.

12 **MS. BLOOM:** -- and that's -- that's to provide
13 people information on the kind of exposure rates
14 that did exist at Mallinckrodt. It's not
15 necessarily to reconstruct any specific job. It's
16 not meant at this time to reconstruct doses but it's
17 a supplemental information table to orient you to
18 the site. You know, on a case by case basis it's
19 possible that it might be useful for somebody to
20 say, you know, look at these dose rates and look at
21 the badges, and this makes sense or it doesn't make
22 sense --

23 **DR. NETON:** Right.

24 **MS. BLOOM:** -- but it -- it's not meant to be a
25 stand-alone, we're going to assign doses from this

1 table.

2 **DR. BEHLING:** Yeah, that was my question, how will
3 this table be used --

4 **DR. NETON:** Right.

5 **DR. BEHLING:** -- if at all.

6 **MS. BLOOM:** It's informationally and a case by case
7 basis.

8 **MR. MACIEVIC:** And it does help to fill in the holes
9 --

10 **MS. BLOOM:** Yeah.

11 **MR. MACIEVIC:** -- where you've got data over here
12 and now you have some pieces here and see that it --
13 it makes sense what you --

14 **DR. BEHLING:** Any idea what instrument was used to
15 measure these dose rates?

16 **DR. NETON:** That's a good question. I was just
17 looking --

18 **DR. BEHLING:** Something like an R02 or something?

19 **DR. NETON:** Yeah, I'm sure --

20 **MS. BLOOM:** I don't -- did the R02 exist at that
21 point?

22 **DR. BEHLING:** Probably not.

23 **MS. BLOOM:** Junos were very common at that point. I
24 -- I'd have to go back to the records and find the
25 individual information. A lot of times you will

1 find some information, but typically it was an
2 ionization chamber.

3 **DR. BEHLING:** (Unintelligible) unit or something,
4 ANPDR --

5 **MS. BLOOM:** Sometimes --

6 **DR. BEHLING:** -- 37.

7 **MS. BLOOM:** I have not heard that instrument model
8 number.

9 **DR. BEHLING:** I used it in the field a lot, the
10 ANPDR-37.

11 **MS. BLOOM:** I've not seen that in the older records.
12 It might be there. Juno was the typical one,
13 Victoreen, Nuclear -- Nuclear Chicago was another
14 common instrument --

15 **DR. BEHLING:** Yeah.

16 **MS. BLOOM:** -- the 20 -- I can't remember if the
17 2650 was both a exposure rate measurement instrument
18 as -- I think it may have been. Sometimes
19 (unintelligible) detectors were used.

20 **DR. MAKHIJANI:** The -- I think there's an
21 intersection there between Table 33 and the data in
22 the five, six boxes. And of course, you know, it's
23 not possible for me to go and check through, but in
24 terms of dose rates it may be -- I think there's
25 kind of quite valuable information in those boxes

1 that may be useful in modifying Table 33 and
2 updating it because I think some of the dose rates
3 indicates in -- in that collection of data may be
4 higher or may be more useful as a guide for job
5 titles because Table 33 is organized by job titles
6 and areas, if I remember it correctly.

7 **DR. NETON:** Right. You know, my -- my thought on
8 this table --

9 **DR. MAKHIJANI:** No, so I -- I just -- the data
10 seemed very, very sketchy in terms of years and --
11 even as a guide. and it seemed to me that -- that
12 what there is in terms of the -- not -- it's not a
13 criticism of what's there, obviously --

14 **DR. NETON:** No, sure.

15 **DR. MAKHIJANI:** -- you know, a very -- Janet did a
16 monumental job of compiling all of that. We've said
17 that I think a number of times, but -- but I think
18 there is some information in those boxes that could
19 be used as a complement to that data in particular.
20 But that may not be so because I made a -- SC&A made
21 a partial compilation of the data in those boxes and
22 --

23 **DR. NETON:** Right.

24 **DR. MAKHIJANI:** -- if you take a look at it, it
25 might be useful.

1 **MS. BLOOM:** And I think that's -- because this is
2 supplemental at this point, I think that's still
3 something to look at and we should look at it, but -
4 -

5 **DR. NETON:** All right. You know, I'd like to point
6 out --

7 **MS. BLOOM:** -- I don't see this as a primary --

8 **DR. MAKHIJANI:** Okay.

9 **DR. NETON:** Right. You -- you need to look at the -
10 - you know, the hierarchy of data usage. And
11 clearly in cases where we have all these film badges
12 and we can validate them, then we would
13 preferentially use that, then followed by these area
14 results which are supplemental. And in the case
15 where you have zero information, these of course
16 would become very valuable. But I -- I think that
17 the second level, though, would like -- more likely
18 be coworker dose distributions rather than these
19 area badges.

20 **MS. BLOOM:** That seems unlikely that you'd use this
21 --

22 **DR. NETON:** Right, but they do --

23 **MS. BLOOM:** -- unless you saw an incident or
24 something --

25 **DR. NETON:** I -- I think they do sort of provide

1 some kind of a sanity check, though. If you have a
2 worker who spent like all year in one of these
3 places where you're seeing 50 mr per hour and his
4 CATI says I -- I held these boxes, you know, for
5 hours on end and -- and you're showing zero result,
6 you might question that and do a sanity check on
7 what you're -- what you're proceeding with.

8 **DR. BEHLING:** There are a couple of good ones here
9 at the feinc filter and that you talk about some of
10 those people who spent a lot of time handling these
11 filters --

12 **DR. NETON:** Right.

13 **DR. BEHLING:** -- and on page --

14 **DR. NETON:** Right.

15 **DR. BEHLING:** -- 232 you'll see some values here in
16 terms of what the dose rates would have been --

17 **DR. NETON:** Right.

18 **DR. BEHLING:** -- in front of the filter -- at one
19 foot, 210 milli-r.

20 **DR. NETON:** Right. 210?

21 **DR. BEHLING:** No, I'm sorry. I'm sorry. No, no.
22 It's -- it's expressed in percent tolerance.

23 **DR. NETON:** Okay.

24 **DR. BEHLING:** So it's 210 percent, meaning that what
25 the tolerance dose was defined here as what -- 100

1 mr per eight-hour day.

2 **DR. NETON:** Right.

3 **DR. BEHLING:** That would have been then -- yeah, 210
4 mr for an eight-hour day, right?

5 **DR. NETON:** Yeah. So matter of fact, that crossed
6 my mind when we were talking about these raffinate
7 workers. If you had a person with almost no
8 recorded dose --

9 **DR. BEHLING:** Yeah.

10 **DR. NETON:** -- you've got a fairly good feeling that
11 this person was not working with these raffinate
12 streams where there are, you know, 50 mr per hour
13 fields. So that, in -- in my mind, is one approach
14 that we may take in this and to defining -- defining
15 some of these people at Plant 6 that we talked about
16 yesterday. I used the external to help bracket the
17 internal potential for exposure.

18 **DR. MAKHIJANI:** Well, I -- I -- I'm not sure that
19 you can actually go there, because the main issue
20 with the raffinates, apart from that -- for that
21 small group of workers I think you could do that,
22 but the main issue with the raffinates that came up
23 yesterday was on the reprocessing of the raffinates,
24 which is a bigger issue --

25 **DR. NETON:** Right, right.

1 DR. MAKHIJANI: -- at Plant 6.

2 DR. NETON: Right.

3 DR. MAKHIJANI: It's not an issue --

4 DR. NETON: Right.

5 DR. MAKHIJANI: -- just where those filters, so --

6 MS. BLOOM: But -- but you'd still have those high -
7 - much higher dose rates --

8 DR. NETON: I mean the radium is still --

9 MS. BLOOM: -- from handling the --

10 DR. NETON: -- there, right? I mean --

11 MS. BLOOM: The radium and the progeny.

12 DR. NETON: -- it depends on which -- which stream.

13 DR. MAKHIJANI: Yeah. I -- I'm not -- yeah, you
14 know, if you're talking about the digesters, you
15 know, the -- the external dose (unintelligible)
16 shielded by all the acid in the tanks and very --
17 pretty far, so --

18 DR. NETON: Right, but that means that you're not
19 having much particulate exposure if it's in a tank.
20 See, in my mind, these raffinate workers -- the --
21 the highest potential for exposure is the people
22 that are scraping the filters and drumming the
23 material.

24 DR. MAKHIJANI: Yes, I agree.

25 DR. NETON: At that point it's completely

1 unshielded, or almost unshielded, and you've got a
2 very large source term sitting right in front of
3 you, concentrated material. So I don't know where
4 I'm going with this, but it just -- it just --
5 thought crossed my mind that we could use that to
6 our advantage to bracket these things.

7 **DR. MAKHIJANI:** Okay. I think we're done with that
8 question. Hans, do you have anything more on that
9 question?

10 **DR. BEHLING:** No.

11 **DR. MAKHIJANI:** Okay. Okay. Now here's -- here's
12 your question, Hans. Hans/NIOSH addressing the
13 nonlinearity and the optical density and dose at low
14 exposures. Specifically it appeared that this could
15 lead to systematic underestimates of dose. Is NIOSH
16 developing a correction factor to address this
17 problem? Do you want to clarify that question? I'm
18 not sure --

19 **DR. BEHLING:** Yeah --

20 **DR. MAKHIJANI:** -- I got it exactly right.

21 **DR. BEHLING:** On page 116 -- and this is commonly
22 done here and I'm not sure to what extent that error
23 is -- is going to amount to a -- a value that is
24 significant, but bullet number 7 -- and I think it's
25 stated elsewhere here on I guess page -- let's see,

1 where are we here.

2 **MS. BLOOM:** Is that page 92, the --

3 **DR. BEHLING:** Yeah, page 92 is the -- the use of
4 simple subtraction to segregate out beta from gamma
5 components. And it's not something you can just
6 look at and say okay, the open window is obviously a
7 shallow dose or that it was responding to both
8 photons and -- low energy photons and betas, and the
9 shielded portion is obviously likely to be a
10 response to higher energy photons only, and simply
11 subtracting the two gives you an understanding of
12 the beta components. And -- and that issue is
13 discussed very -- in detail in the National Research
14 Council, the 1989 report of atmospheric testing and
15 film badge dosimetry. And they were very adamant in
16 those days to try to identify what part of that
17 exposure in the open window was due to betas as
18 opposed to photons, and you will read in that
19 description the difficulties -- and they finally
20 quit in trying to make that distinction. And the
21 reason being is that the film is not a linear
22 response (unintelligible) in terms of optical
23 density. When you plot net optical density as a
24 function of exposure usually it's a sigmoid curve
25 and -- and in essence simply subtracting optical

1 density from the shielded portion from the open
2 window is not necessarily the approach. In fact it
3 gives you a false reading. And what they tell you
4 do is -- and it has to be calibrated properly -- is
5 to convert each value first into a dose, and then
6 subtract the dose as opposed to the optical density.
7 And that apparently is exactly what is done here and
8 this is something that's -- at least in -- in that
9 report -- was identified as a difficulty that was
10 not easily overcome. You have to go back to the
11 report and -- and again here, I -- they used
12 basically the same film badges here, the Dupont 502
13 and the Dupont 510 for the low dose/high dose so
14 that you could capture even doses in the, you know,
15 in the tens of rads or even hundreds of rads. And I
16 realized the same problem would probably prevail
17 here in trying to assess the component, the beta
18 component from the -- from the gamma component.

19 **MR. MACIEVIC:** Well -- well, you're absolutely
20 right. I mean if you have a two-filter badge you've
21 got the -- the -- the thick shield, the -- that'll -
22 - the -- that'll --

23 **DR. BEHLING:** Yeah.

24 **MR. MACIEVIC:** -- wipe out all the low energy
25 photons. You're not going to have that overresponse

1 under that particular filter. But yes, in the open
2 window, if you've got beta and you have low energy
3 photons, trying to pull out which is the low energy
4 photon and which is the beta when all you have is
5 one other filter -- that's why the multi-filter
6 badges do much better because you can get that
7 intermediate energies in there to go and see ratios
8 between different filters. But I believe what we do
9 on there -- I mean that is addressed in the OCAS
10 Imp. guide as far as how to deal with these kind of
11 -- you -- you're going to make -- what is it,
12 calculation based on -- I believe that it's a photon
13 exposure as opposed to the beta because the photon
14 is going to give you the most conservative --

15 **DR. BEHLING:** Yeah.

16 **MR. MACIEVIC:** -- number. So when you're in the
17 state of not knowing, you're going to go with the
18 most conservative and say it's a photon exposure and
19 that the overresponse is in there and you're going
20 to compute that number. I think I'm going in the
21 right (unintelligible).

22 **DR. BEHLING:** But I'm -- I'm not sure that necessary
23 is the issue here. This is basically the -- the
24 methodology of subtracting the optical density under
25 the shielded portion of the film from the net

1 optical density on the open window. And according
2 to that study -- as I mentioned, this is Frank
3 Massey's* report -- that is something you should not
4 be doing. You should first convert each of those
5 portions of the -- if you have a two-element film
6 badge -- into dose and then subtract the dose from
7 each other rather than subtracting that optical
8 density from -- one from the other.

9 **MR. MACIEVIC:** I -- oh, I (unintelligible) --

10 **DR. BEHLING:** You have to go back --

11 **MR. MACIEVIC:** -- in there. I think what -- see,
12 what you -- what you would do and -- and how I
13 computed the doses in working with film is that you
14 -- you're going to subtract off from all of them a
15 blank which is a control --

16 **DR. BEHLING:** (Unintelligible)

17 **MR. MACIEVIC:** from that film. Now there -- then
18 you're right, you convert it to dose and then you do
19 your analysis between ratios and that between dose,
20 not with densities, because you work with the dose
21 numbers. Because yes, you don't -- don't work with
22 the density values. I don't recall them doing that
23 kind of thing where they're -- they're working in
24 density units and then the end result is where they
25 convert it. I think they are working with -- you

1 are -- you're subtracting off a blank in the
2 calibration. You have dose numbers under the filter
3 and in the open window and then you're doing the
4 subtraction there.

5 **DR. BEHLING:** Does anybody have a copy of that
6 report? The --

7 **DR. MAKHIJANI:** NPPR?

8 **DR. BEHLING:** Yeah.

9 **UNIDENTIFIED:** (Unintelligible)

10 **DR. BEHLING:** I think it's online. I have a hard
11 copy but I --

12 **MR. MACIEVIC:** Yes, that's --

13 **DR. BEHLING:** -- can point to you the exact page
14 number --

15 **DR. NETON:** I have the quote in our --

16 **DR. BEHLING:** Yes.

17 **DR. NETON:** -- you know, but what Greg -- Greg, it
18 does say in our profile, and I mean looking at it
19 here, that Mallinckrodt did subtract the optical
20 densities.

21 **DR. BEHLING:** Yes, and that's --

22 **DR. NETON:** So the relevant question then is --

23 **DR. BEHLING:** -- something they don't want you to
24 do.

25 **DR. NETON:** Right. Now this of course would only be

1 relevant to skin dose.

2 **DR. BEHLING:** Yes.

3 **MR. MACIEVIC:** That's right.

4 **DR. NETON:** This does not have anything to do with
5 full body.

6 **DR. BEHLING:** Yes.

7 **DR. NETON:** And that's -- that wasn't clear from the
8 way the question was phrased, so --

9 **DR. MAKHIJANI:** Yeah.

10 **DR. NETON:** And that's fine but --

11 **DR. MAKHIJANI:** I didn't --

12 **DR. NETON:** -- I just want to make clear that this
13 is really a skin dose issue --

14 **DR. BEHLING:** Yes, yes.

15 **DR. NETON:** -- not a deep dose.

16 **DR. MAKHIJANI:** And a -- it's a little more than a
17 skin dose issue. Right, Hans?

18 **DR. BEHLING:** Well --

19 **DR. MAKHIJANI:** It would be --

20 **MS. BLOOM:** Shallow or --

21 **DR. BEHLING:** -- if you also convert that into the
22 breast and the testes, then it becomes -- and -- and
23 on that issue I even wondered to what extent -- why
24 -- for instance, under the DC9 code you do have the
25 eye as one of the potentials -- organs of -- of

1 concern, and also the thyroid. If you're going to
2 consider testes and breasts as being part of that
3 problem with a potential low energy photon or
4 energetic beta, clearly the thyroid also would
5 qualify. For -- for one, it's not covered by
6 additional shielding such as clothing, as you would
7 in terms of testes and the female breast. The
8 thyroid is in fact an unprotected area. And
9 especially for -- for females and -- and thin
10 females, the overlying tissue of the thyroid is
11 about 300 milligrams of -- of tissue, so an
12 energetic beta could contribute to at least part of
13 the thyroid dose. But anyway --

14 **MR. MACIEVIC:** I'd like to check into -- I mean I
15 know that's what it says, but in my -- in the six
16 months I've been here and reading Technical Basis
17 Documents which are -- turn out to be mostly in
18 seven different languages and you have to interpret
19 what's being said in those documents -- I have a
20 feeling they are not -- they do not mean that they
21 are actually subtracting, 'cause that is not a
22 process that I have seen in any of the other
23 facilities where -- at -- at other sites and that in
24 doing that process where they work straight with the
25 densities. The only part where they're working with

1 the densities is you're subtracting off a blank, do
2 a dose conversion for filters, and then work with
3 the numbers.

4 **DR. BEHLING:** That's not --

5 **DR. NETON:** Okay. Then what --

6 **DR. BEHLING:** -- if that's the case --

7 **MR. MACIEVIC:** -- that has to be checked into. I --
8 I have a feeling that's -- they're saying it, but
9 that's not what they're doing. I think I -- I can
10 check into that and try to check some background --

11 **DR. NETON:** Yeah, let's --

12 **MR. MACIEVIC:** -- documents --

13 **DR. NETON:** -- let's get it --

14 **MR. MACIEVIC:** -- because yeah, I agree. That would
15 -- that -- that just doesn't seem -- as a process
16 that I've seen any other places. I've never done
17 that and I --

18 **DR. NETON:** I believe early on these were done by EM
19 -- HASL, right, or --

20 **DR. BEHLING:** It was an in-house processing.

21 **MR. MACIEVIC:** Well, they started outside and then
22 they went in-house.

23 **DR. NETON:** Yeah, I thought they did, also, but we -
24 -

25 **MR. MACIEVIC:** Right.

1 **DR. NETON:** -- we need to check into that --

2 **MR. MACIEVIC:** Let me check in that because --

3 **DR. BEHLING:** And as I said, it may not be a major
4 issue but I -- I noticed -- I mean it jumped out on
5 me when -- and I'm quite familiar with the film
6 dosimetry because of my work in the Marshall Islands
7 --

8 **DR. NETON:** Sure.

9 **DR. BEHLING:** -- and of course that was a -- a
10 direct report that corresponded to dose
11 reconstruction involving the Pacific testing period.
12 And -- and I remember distinctly that as a major
13 issue because there was so much interest in
14 understanding the different radiation components in
15 the badges and they -- they apparently gave up and
16 say we really don't have the means to do it.

17 **MR. MACIEVIC:** And when you're working with -- yes,
18 you're right. The process should work with the dose
19 and if you're working with -- it -- it's not good --
20 two -- two-filter badges leave a lot open.

21 **DR. BEHLING:** Yes.

22 **MR. MACIEVIC:** And using those when you have a very
23 good handle on the photon distributions and what
24 you've got, you can use that film and know what the
25 overresponse is and work with it. But if you're

1 working under conditions where other things are
2 happening, two-filter badges don't cut it as well --

3 **DR. BEHLING:** Yeah, yeah.

4 **MR. MACIEVIC:** -- and that's why there is --

5 **DR. BEHLING:** Yeah.

6 **MR. MACIEVIC:** -- but we do the --

7 **DR. BEHLING:** On -- on -- on that issue and -- and
8 it's only peripherally similar to -- to the concerns
9 here, what will happen in terms of assigning --
10 obviously IREP demands us to identify the type of
11 radiation that is potentially recorded under the
12 shallow dose or open window as either being a beta
13 component or less than 30 keV. And yet it certainly
14 makes a big difference to -- to -- to distinguish
15 between the two of them. One has a choice in saying
16 it's either very low energy photon radiation that
17 separates the deep dose from the shallow dose, or
18 it's a beta component that separates the deep dose
19 from shallow dose. And yet for IREP input it's a
20 significant difference in terms of the relative
21 effectiveness factor because when you look at, for
22 instance, electrons greater than 15 keV which would
23 correspond to beta particles -- and as I said, I --
24 I've done a calculation that compares the two in
25 terms of POC versus the less than 30 keV photons --

1 the POC goes from 14.81 percent to 37 for skin. And
2 so it's important to know how will this be treated,
3 because for -- for skin exposures -- and you will
4 probably encounter some squamous cell carcinomas --
5 the -- the interpretation of the shallow dose is
6 going to be heavily affected by -- or the -- the POC
7 will be heavily affected by your assignment of a
8 shallow dose based on either less than 30 keV
9 photons versus greater than 15 keV betas.

10 **MS. BLOOM:** Were you saying that the less than 30
11 keV photons are giving you the higher POC?

12 **DR. BEHLING:** Much higher.

13 **DR. NETON:** Oh, yeah.

14 **DR. BEHLING:** Much higher. And it's up like at two
15 and a half (unintelligible) --

16 **MR. MACIEVIC:** That's why I thought we --

17 **DR. BEHLING:** -- higher.

18 **MR. MACIEVIC:** -- defaulted to that as if there's
19 not a known...

20 **MS. BLOOM:** I think we've actually gone the other
21 way.

22 **DR. NETON:** It depends -- it depends on -- on the
23 facility. I mean --

24 **UNIDENTIFIED:** (Unintelligible)

25 **DR. NETON:** -- we know for -- for plutonium

1 facilities it's going to -- you know, the low energy
2 dose is going -- it's going to be less than 30 keV
3 photon.

4 **MS. BLOOM:** For uranium we've --

5 **DR. NETON:** At a uranium facility --

6 **MS. BLOOM:** -- typically gone the other way.

7 **DR. NETON:** -- you need -- yeah, you need to look at
8 the -- the relative magnitude of the contributions
9 of the different spectra and the protactinium 234
10 admittedly is --

11 **DR. BEHLING:** That's true.

12 **DR. NETON:** -- going to dominate -- dominate the
13 shallow dose.

14 **DR. BEHLING:** Yes, yes.

15 **DR. NETON:** In fact it's not unusual in uranium
16 facilities to get ten to one ratios of skin to deep
17 dose. I've seen that at -- consistently at Fernald
18 and we've seen that in the Mallinckrodt records --

19 **DR. BEHLING:** And I think there's --

20 **DR. NETON:** -- but most of that dose is going to be
21 due to the beta.

22 **DR. BEHLING:** Yeah.

23 **DR. NETON:** I -- I think you'd be very hard-pressed
24 to demonstrate that the predominance of those
25 shallow dose is from less than 30 keV photons. I

1 don't think we would --

2 **DR. BEHLING:** But there should be some guidance so
3 that we don't have different people selecting one as
4 opposed to the other --

5 **MS. BLOOM:** We have been putting --

6 **DR. BEHLING:** -- because I think it's important --

7 **MS. BLOOM:** -- that in the site profiles. I'm not
8 sure if it's in this one, but we have been selecting
9 --

10 **DR. NETON:** It's a replay of the first comment, that
11 we need to make sure that people don't arbitrarily -
12 -

13 **MS. BLOOM:** Verify that.

14 **DR. BEHLING:** Use one or the other.

15 **DR. NETON:** -- use one or the other because then you
16 get into consistency problems.

17 **DR. BEHLING:** Yeah, it's a two-and-a-half-fold
18 difference.

19 **DR. NETON:** I -- I think we've been doing these at
20 many uranium facilities, though, and maybe we've
21 just sort of gotten loose in our -- our write-ups.
22 But in uranium facilities -- I think it's -- it's in
23 general going to be the beta dose.

24 **DR. BEHLING:** Yeah.

25 **DR. MAKHIJANI:** Would you agree with that Hans?

1 **DR. BEHLING:** Yeah.

2 **DR. MAKHIJANI:** Okay.

3 **DR. NETON:** So -- yeah. I don't know if we have a
4 problem but I think you're right, for consistency
5 purposes we should -- we should point that out and
6 make sure that we do it that way.

7 **MR. MACIEVIC:** Look and see what I (unintelligible).

8 **DR. MAKHIJANI:** So that -- so that if -- well, I'm
9 just trying to make the issues clear in my head so I
10 don't get off in the wrong direction. So Greg, you
11 -- you agree that if -- you don't think that they
12 actually were subtracting optical densities --

13 **MR. MACIEVIC:** No, I don't.

14 **DR. MAKHIJANI:** -- in reading the -- because we
15 don't have the film badges.

16 **MR. MACIEVIC:** Right.

17 **DR. MAKHIJANI:** Right? So it's very important to
18 determine -- Cindy, do -- do we have the film
19 badges?

20 **MS. BLOOM:** I -- I don't believe we have the film
21 badges. I don't know that we don't have the optical
22 density readings. We may have that --

23 **DR. NETON:** It may be possible to go back --

24 **MS. BLOOM:** -- on some of them.

25 **DR. NETON:** -- and look at this but --

1 **MS. BLOOM:** I don't -- I don't think we have them
2 all.

3 **MR. MACIEVIC:** Look at some of them and see a
4 general case --

5 **DR. NETON:** Finding them and -- and doing it in a
6 systematic manner but --

7 **DR. MAKHIJANI:** Well, it would be useful to check
8 just a few if you have them because it seems --

9 **DR. NETON:** Yeah.

10 **DR. MAKHIJANI:** -- to me that this is a critical
11 issue --

12 **DR. NETON:** Well --

13 **DR. MAKHIJANI:** -- because we agree that if they did
14 -- if they did do it as it says in the TBD, this
15 would be a problem.

16 **DR. NETON:** Well, it's a critical issue for skin
17 dose.

18 **DR. MAKHIJANI:** Skin dose for these --

19 **DR. NETON:** For the shallow organs.

20 **DR. MAKHIJANI:** -- for the shallow dose or --

21 **DR. NETON:** (Unintelligible) certain organs, right.

22 **DR. MAKHIJANI:** -- no, I got that. Okay. So for --
23 for the shallow dose organs it's important to know
24 what they did, and you don't think they did that --

25 **MR. MACIEVIC:** No, I --

1 **DR. MAKHIJANI:** -- but some -- it would be useful to
2 have some verification, either from this site or the
3 (unintelligible) what was the general practice at
4 the time at least.

5 **DR. NETON:** Right.

6 **DR. MAKHIJANI:** If there could be evidence from the
7 time about that, that would be very useful.

8 **DR. NETON:** Some of the language --

9 **MR. MACIEVIC:** Because I have a feeling -- yeah, now
10 whether I can get it from Mallinckrodt or not, but I
11 know practice was not done that way at several other
12 sites. I mean that approach --

13 **DR. NETON:** Most of these people did not make up
14 their approaches. They all --

15 **MR. MACIEVIC:** That's right. They took it from one
16 place where they knew where they were working with
17 it and they took it, so --

18 **MS. BLOOM:** (Unintelligible) we have the densities
19 there because I know I --

20 **DR. NETON:** What are those two pages that you cited
21 earlier? Was it 92 --

22 **DR. BEHLING:** Yeah, 92 --

23 **DR. NETON:** Down at the bottom --

24 **DR. BEHLING:** -- bottom of page 92.

25 **DR. NETON:** And there was another one.

1 **DR. BEHLING:** -- in the --

2 **MR. MACIEVIC:** No, I --

3 **DR. NETON:** What I was going to --

4 **MR. MACIEVIC:** No, I agree --

5 **DR. NETON:** Greg, if you look at --

6 **MR. MACIEVIC:** -- what I'm saying is you're right.

7 **DR. NETON:** -- but if you do look at page 116 I mean
8 it gives you the exact references that you need to
9 look at.

10 **MR. MACIEVIC:** Yes.

11 **DR. MAKHIJANI:** On page 92 also it has a
12 Mallinckrodt reference from the time.

13 **DR. NETON:** Right.

14 **DR. MAKHIJANI:** So I -- I presume it is on the O
15 drive (unintelligible) --

16 **DR. NETON:** There are three references --

17 **DR. MAKHIJANI:** -- I looked at that also.

18 **DR. NETON:** There are three references in here and
19 then what -- what kind of looks suspicious is for
20 Mallinckrodt it is assumed that the beta readings
21 are subtracted so, you know, I don't know if these
22 memos were -- were bandying about the issue and --
23 and thinking about it and how the effects are, so if
24 you look into those it'll probably give you --

25 **MR. MACIEVIC:** Yes.

1 **DR. NETON:** -- a better feeling for what was
2 actually done.

3 **DR. BEHLING:** On that subject, can I make a comment,
4 and I -- I don't know who -- who writes these TBDs
5 but, you know, I did a -- I was curious. I did a
6 word search on this TBD and the word "assume" --
7 "assumes" comes up 21 times. The word assumed, past
8 tense, 175 times, and the word "suppose" comes up 14
9 times. Which leads you to question how much is
10 there that is really of substance. In fact it -- if
11 I point to the page 43, there were -- just in one
12 paragraph -- the word "was supposed to be worn",
13 "was supposed to be vacuumed", "was supposed to be
14 installed", et cetera, and it's --

15 **MR. MACIEVIC:** I think you're --

16 **DR. NETON:** Well, you know --

17 **MS. BLOOM:** I think we want to represent --

18 **DR. BEHLING:** No, I understand.

19 **MS. BLOOM:** -- what we know and what we don't know --
20 -

21 **DR. BEHLING:** I understand.

22 **MS. BLOOM:** -- and I think that you'd all have our
23 heads if we put it in black and white and --

24 **DR. NETON:** We're trying to do reasonable estimates
25 of doses here. A reasonable man would take those

1 things and say --

2 **DR. BEHLING:** Yeah. No, I understand but --

3 **DR. NETON:** So I mean to be fair to the -- to the
4 writer, you've got to put that kind of language in
5 there, otherwise our lawyers would have our heads.

6 **DR. BEHLING:** The stakeholders will read some of
7 that data and -- and sort of wince every time they
8 hear the words "were supposed to".

9 **MR. MACIEVIC:** It's equivalent to when you see on
10 the news when they say "the alleged killer" does
11 this, "the alleged" --

12 **DR. BEHLING:** Well --

13 **MR. MACIEVIC:** -- I mean you -- you're not going to
14 go and commit to saying -- because there is a
15 possibility there's more data on other things --

16 **DR. NETON:** The bigger -- the bigger issue is with
17 "assumed", and I've gotten called to task on this at
18 several -- several meetings, public meetings --

19 **DR. BEHLING:** So I'm not the first to --

20 **DR. NETON:** No, no. The claimants will get up there
21 and say this thing is fraught with assumptions.

22 **DR. BEHLING:** Yeah.

23 **DR. NETON:** They assume my exposure was this and
24 this. And they're really looking at it from a
25 different perspective, which is -- may be correct

1 because they're the claimants. But when we make
2 these assumptions in general, we will insert
3 assumptions that we believe are generous --

4 **DR. BEHLING:** Yeah.

5 **DR. NETON:** -- and claimant-favorable. I hate to
6 use that word so much anymore but -- so they are
7 assumptions, but that's what science does. I mean
8 science makes certain assumptions that bracket the
9 truth and reality. You -- you never know anything
10 with 100 percent certainty so -- I hear what you're
11 saying. I'm sensitive to it, but I'm not sure --

12 **DR. BEHLING:** It struck me odd to see that many
13 words that assume, assume, assume --

14 **DR. NETON:** I think there are some cases --

15 **DR. BEHLING:** -- were supposed to --

16 **MS. BLOOM:** That's less than one per page though.
17 That's not too bad.

18 **DR. NETON:** Although --

19 **UNIDENTIFIED:** Cindy --

20 **DR. NETON:** -- I would -- I would say that in
21 certain cases like this last one I just read, you
22 could probably get by with different language.

23 **DR. BEHLING:** Yes.

24 **DR. NETON:** You know, it's not -- it is assumed, but
25 based on the evidence provided, we will use this,

1 you know, that sort of -- but yeah, I -- I agree
2 that, you know, it's difficult when you have these
3 words, these -- these --

4 **DR. MAKHIJANI:** And sometimes there is a disconnect
5 between how would you use the word "assumption" in a
6 scientific --

7 **DR. NETON:** Yes.

8 **DR. MAKHIJANI:** -- tract and in a scientific context
9 as opposed to a general sort of literary context in
10 which --

11 **DR. NETON:** Right, exactly.

12 **DR. MAKHIJANI:** -- you imagine that when you don't
13 know anything you make that unfounded assumption.
14 There -- there might be some kind of --

15 **DR. NETON:** Right.

16 **DR. MAKHIJANI:** -- implication that you're making an
17 assumption because you don't know anything --

18 **DR. NETON:** Well, exactly --

19 **DR. MAKHIJANI:** -- as opposed to making an
20 assumption in a scientific context.

21 **MS. BLOOM:** Based on data.

22 **DR. NETON:** So --

23 **MS. BLOOM:** And I think we do both, and we get
24 called to task when we leave it with that very open,
25 you know, what I -- this is my best guess. And

1 that's one kind of assumption and that's a very wide
2 open one. And then you have your assumption where
3 you say okay, they said this and they said this and
4 they said that --

5 **DR. NETON:** Well, right --

6 **MS. BLOOM:** -- so we have to go somewhere with it.

7 **DR. NETON:** I mean, you know, oftentimes you'll read
8 -- I don't -- we assume Class Y, Type Y solubility.
9 Well, that's a great assumption for the claimant. I
10 mean --

11 **MS. BLOOM:** Uh-huh.

12 **DR. NETON:** -- but they -- they read that, like you
13 say, in -- in the general parlance and say geez,
14 they had to assume all these things.

15 **MS. BLOOM:** They didn't know what it was, so --

16 **DR. NETON:** They didn't know.

17 **MS. BLOOM:** Yeah, but we gave you ten times the
18 dose.

19 **DR. MAKHIJANI:** Mark, I think --

20 **DR. NETON:** Mark, did you have something to say?

21 **MR. GRIFFON:** No, I'm -- I'm assuming we're done
22 with this topic.

23 **DR. NETON:** I think we are. We've gone off and...
24 Okay. We just have a couple more questions --

25 **MS. BLOOM:** Which -- which --

1 **DR. NETON:** -- and then we're going to get into
2 other issues. Do we need to take a break yet or
3 should we finish up with these two? I -- I think
4 that we'll just take a ten-minute break, if that's
5 okay --

6 **DR. MAKHIJANI:** That's fine.

7 **DR. NETON:** -- for comfort and --

8 **MR. GRIFFON:** What is left, Jim, because I may have
9 to bail out at this point.

10 **DR. NETON:** Okay.

11 **MR. GRIFFON:** What topic --

12 **DR. MAKHIJANI:** What is left, has NIOSH -- the two
13 questions on my list, Mark, are has NIOSH evaluated
14 importance of issue of highly variable response of
15 films for photons at energies less than 100 keV for
16 uranium facilities. It's a kind of a continuation
17 of this --

18 **MR. GRIFFON:** Yeah.

19 **DR. MAKHIJANI:** -- film badge thing, and then the
20 last question, is NIOSH using the open window dose
21 as shallow dose for skin testing in breast dose
22 estimation. So both of them are kind of
23 elaborations of what we've been talking about.

24 **MR. GRIFFON:** Okay. All right. I -- I think -- if
25 it's okay, I think I probably won't -- won't come

1 back on.

2 **DR. NETON:** Okay.

3 **MR. GRIFFON:** You guys have got it covered and --

4 **DR. NETON:** All right. Then we'll --

5 **MR. GRIFFON:** -- I've got work to do.

6 **DR. NETON:** Yeah, well --

7 **MR. GRIFFON:** Okay.

8 **DR. NETON:** All right, Mark.

9 **MR. GRIFFON:** All right. Thanks.

10 **DR. MAKHIJANI:** Thank you, Mark.

11 **DR. NETON:** We'll take a -- we'll take a short break
12 here.

13 (Whereupon, a recess was taken from 10:25 a.m.
14 to 10:45 a.m.)

15 **DR. NETON:** We're back from our break and we're
16 continuing on. I think we have questions 7 and 8 to
17 complete --

18 **DR. MAKHIJANI:** Yeah.

19 **DR. NETON:** -- at least on my list --

20 **DR. MAKHIJANI:** Right.

21 **DR. NETON:** -- external (unintelligible).

22 **DR. MAKHIJANI:** Okay. Question 7, has NIOSH
23 evaluated the importance of the issue of the highly
24 variable response of the film to photons at energies
25 of less than 100 keV for uranium facilities? So

1 this is kind of a continuation of how you read these
2 film badges. Hans, did I --

3 **DR. BEHLING:** Yeah, because there is -- there are
4 two portions of it. For very, very low energy, the
5 film badges underrespond; for somewhat higher, they
6 overrespond due to the photoelectric effect that
7 obviously for -- for silver bromide and you realize
8 that obviously is an issue here. And I think in
9 other instances NIOSH has basically generously said
10 no, we'll -- we'll -- we won't make a correction.
11 We will accept the overresponse and deal with the --
12 the dose as-is. Is that correct?

13 **MS. BLOOM:** Uh-huh.

14 **MR. MACIEVIC:** Uh-huh. Yeah --

15 **DR. NETON:** Yeah. I think it's not -- it's not
16 unlike what we've done in other facilities.

17 **MR. MACIEVIC:** Exactly. Yes, it's -- it's true.

18 **DR. BEHLING:** Okay.

19 **DR. NETON:** Yeah, that was -- well, when I saw this,
20 I -- my -- my original impression was well, yeah,
21 we're going to be overestimating because of the
22 overresponse --

23 **DR. MAKHIJANI:** Yeah.

24 **DR. NETON:** -- you know, of low energies and --
25 yeah. It's -- that's what we're doing.

1 **DR. MAKHIJANI:** Okay. Well, that takes care of
2 that.

3 **DR. BEHLING:** And -- and the next one is basically
4 what we've already touched on and --

5 **DR. NETON:** Right.

6 **DR. BEHLING:** -- but for instance if -- if -- I want
7 to draw attention to page 48 of the TBD. It does
8 make some statements here that again goes to this
9 issue of the shallow dose. And -- and -- and I
10 guess sort of --

11 **DR. NETON:** Where on 48, Hans?

12 **DR. BEHLING:** Top of the first paragraph but middle
13 of that paragraph that starts out with "Dose rates
14 measured with instruments were combined with time
15 measurements", and it says that the gamma doses were
16 said to agree well with film badge reading, but not
17 the beta doses. And -- and I guess this is -- goes
18 all back to the issue of how do we deal with beta
19 components.

20 **DR. NETON:** Right.

21 **DR. MAKHIJANI:** Which -- which paragraph are you in,
22 Hans?

23 **DR. BEHLING:** I'm at the first --

24 **DR. NETON:** First major paragraph.

25 **DR. BEHLING:** -- paragraph on page 48 that starts

1 out with "As a result".

2 **DR. MAKHIJANI:** Okay.

3 **DR. BEHLING:** And middle of that paragraph it starts
4 a sentence, "Dose rates were measured with
5 instruments" --

6 **DR. MAKHIJANI:** Okay.

7 **DR. NETON:** So --

8 **DR. BEHLING:** -- and it just --

9 **DR. NETON:** -- you're saying that the instrument
10 readings for beta did not measure -- do not agree
11 well with film badge readings.

12 **DR. BEHLING:** Film badge data and -- and it goes
13 back to the same issue that we've been discussing.

14 **DR. NETON:** Yeah, I think we need to go back and
15 Greg needs to review the protocol for --

16 **MR. MACIEVIC:** I will, yes.

17 **DR. NETON:** -- looking at the beta doses --

18 **DR. BEHLING:** Yeah, yeah.

19 **DR. NETON:** -- and seeing what -- what we have.

20 **DR. BEHLING:** I mean maybe due to the way the -- the
21 film was processed that we discussed earlier, maybe
22 due to other factors, I don't know and I -- I -- get
23 --

24 **DR. NETON:** Well, it's not surprising that if
25 instruments -- survey instruments for beta would --

1 **DR. BEHLING:** Yeah.

2 **DR. NETON:** -- not agree with a -- a badge that may
3 have been calibrated theoretically properly --

4 **DR. BEHLING:** With uranium slag or something.

5 **DR. NETON:** -- uranium slag, which is what I think
6 they've used here.

7 **MR. MACIEVIC:** Yes. Uranium slag is what's used for
8 the (unintelligible).

9 **DR. NETON:** Standard uranium slag, so --

10 **MS. BLOOM:** Uh-huh.

11 **MR. MACIEVIC:** And I mean yes, the pics and other
12 things, too, don't agree well with the dosimeters
13 and it's --

14 **DR. NETON:** Particularly for these high energy betas
15 that we're talking about from -- from uranium, so...

16 **DR. MAKHIJANI:** So we'll get something on two issues
17 --

18 **MR. MACIEVIC:** I will --

19 **DR. NETON:** Right.

20 **DR. MAKHIJANI:** -- I think. If I might summarize,
21 though --

22 **DR. NETON:** Sure.

23 **DR. MAKHIJANI:** -- we dealt with question 8, for the
24 record. One will be this geometry question using
25 this Attila.

1 **MR. MACIEVIC:** Yes, number 3.

2 **DR. MAKHIJANI:** Sort of like Attila the Hun?

3 **MR. MACIEVIC:** Yes.

4 **DR. MAKHIJANI:** As in the Hun?

5 **MR. MACIEVIC:** Yes.

6 **DR. MAKHIJANI:** Because I want to tell Bob
7 Anigstein, you know, to maybe look into it. And the
8 other will be the shallow dose, this complex of
9 questions with --

10 **DR. NETON:** Right.

11 **DR. MAKHIJANI:** -- with the shallow dose, how it was
12 done, optical density --

13 **DR. NETON:** Right.

14 **DR. MAKHIJANI:** -- and so forth. Right, Hans?

15 **DR. BEHLING:** Yeah, yeah.

16 **DR. MAKHIJANI:** Do you have other --

17 **DR. BEHLING:** Yeah, I just have a couple of other
18 probably insignificant issues, but on page 51 there
19 is reference to 100 millirem radium beryllium source
20 that might have been the source of neutron exposure
21 which I'm not sure are a -- a significant issue here
22 if it's, you know, a source that was used in the
23 radium and it -- on the bottom of page 51 it talks
24 about in the early years --

25 **DR. NETON:** Oh, in the Shotgun Laboratory --

1 **DR. BEHLING:** -- Shotgun Laboratory. I don't know
2 if that's something that needs to be looked at.
3 It's probably something that was used by maybe one
4 or two people maybe and has no significance to the
5 workforce at large.

6 **DR. NETON:** Well, it -- it talks about that it ended
7 by September 1944.

8 **DR. BEHLING:** Okay. In that case it's obviously
9 academic anyway.

10 **DR. NETON:** In that case it's not relevant for --

11 **DR. BEHLING:** Yeah, yeah.

12 **DR. NETON:** -- this time period.

13 **DR. BEHLING:** I guess in internal exposures, we're
14 almost exclusively focusing on inhalation exposures
15 as opposed to ingestion.

16 **DR. NETON:** Correct.

17 **DR. BEHLING:** Given -- but given -- yeah, I know. I
18 wasn't there yesterday afternoon so I may be
19 redundant in some of my questions, but with regard
20 to the possibility that people were using their
21 hands to shovel stuff and touching stuff and
22 obviously there was a significant amount of
23 contamination all over the place that people might
24 have transferred to their mouth inadvertently when
25 they touched their lips or took a cigarette break or

1 a lunch break, whatever it is. The issue is one of
2 solubility. It's generally assumed that most metal
3 oxides are relatively insoluble but that's usually
4 as a result of tests that are done in a neutral
5 aqueous solution. When you ingest it obviously
6 these materials would encounter the acidity of the
7 stomach, which is basically one normal hydrochloric
8 acid which considerably changes solubility. Is that
9 an issue that needs to be looked at? It wouldn't
10 matter if we're dealing with urinalysis which
11 obviously doesn't care (unintelligible).

12 **DR. NETON:** Well, that's exactly right. We talked
13 about urinalysis --

14 **DR. BEHLING:** Yes.

15 **DR. NETON:** -- being okay but --

16 **DR. BEHLING:** If -- if it's --

17 **DR. NETON:** But the models that are in the ICRP
18 default for insoluble at .002 F1 and .02 for the
19 moderately soluble material. And I don't think that
20 those were done in aqueous media. Those were done
21 based on a number of studies, including human
22 ingestion studies.

23 **DR. BEHLING:** Yes. I -- I remember doing a lot of
24 work in the Marshall Islands where the issue of
25 fallout and ingestion of fallout became an issue and

1 when you look at for instance some of the fission
2 products that are metal oxides in --

3 **DR. NETON:** Right.

4 **DR. BEHLING:** -- in fallout, there is a quantum leap
5 between the -- the solubility based on the pH of the
6 -- of the solution in which they are being
7 dissolved, and of course --

8 **DR. NETON:** Oh, sure. Yeah, but I don't -- I think
9 that the physiologic models in the ICRP for the GI
10 tract, though, are not -- are --

11 **DR. BEHLING:** They account for --

12 **DR. NETON:** -- we believe them to be representative
13 of -- of the absorption (unintelligible) -- I mean
14 these were done in animal studies. Now whether the
15 pH of a -- of a, you know --

16 **DR. BEHLING:** As I said, it's academic if we're
17 talking about urinalysis because it doesn't really
18 matter how it came -- was transferred from the bowel
19 or the gut into the bloodstream, et cetera. Okay.

20 **DR. MAKHIJANI:** Yeah, yesterday -- if I remember
21 correctly -- we agreed that ingestion is an issue
22 only when you don't have bioassay (unintelligible).

23 **DR. NETON:** Yeah, (unintelligible) urine data we
24 will assume it's all inhalation, which provides a
25 higher estimate than ingestion pathway.

1 DR. NETON: Yeah, yeah. We talked about that.

2 DR. MAKHIJANI: About coworker.

3 DR. NETON: Right. It's only on hold for people who
4 we don't have monitoring data for. So again, we get
5 back to this relevant issue --

6 DR. MAKHIJANI: Yeah.

7 DR. NETON: -- how many people do we have data --

8 DR. MAKHIJANI: Right.

9 DR. NETON: -- and for those who don't, we -- the
10 coworker distributions are tended to be applied.

11 DR. MAKHIJANI: Right, so we've covered that.

12 DR. NETON: I believe so.

13 DR. MAKHIJANI: I think that we are -- we are done.
14 We -- is there a -- okay, here -- one -- one maybe
15 last thing is, is there a difference between how we
16 might handle infrequent incidents like uranium fires
17 compared to the more frequent ones that we kind of
18 agreed probably we've taken care of?

19 DR. NETON: With urine monitoring data available? I
20 don't think so. I think it's -- it's -- as the
21 incidents become more and more frequent, it becomes
22 a closer and closer approximation to a chronic
23 exposure.

24 DR. MAKHIJANI: Oh, yeah. That I agree.

25 DR. NETON: But for -- but for very infrequent

1 incidents, it's -- it's equally as valid that this
2 chronic exposure scenario brackets the --

3 **DR. MAKHIJANI:** The way you -- the way you model it
4 with the highest point --

5 **DR. NETON:** Right.

6 **DR. MAKHIJANI:** -- is that how you normally do it?

7 **DR. NETON:** Yeah.

8 **MS. BLOOM:** If -- if there was information that
9 showed that you had a peak in your data somewhere,
10 you would model that. And we've been looking at
11 that both in terms of the coworker studies --
12 generally it's a small chronic that you use to model
13 an incident because there's -- there's a cleanup
14 period and there's a -- there's higher exposures
15 associated with a number of things, but the -- the -
16 - I don't know about Mallinckrodt but I think
17 probably my sense is that the urinalysis data is --
18 one of the significant exposure scenarios is from
19 fires and they tended to be fairly routine in the
20 early days. I think that it -- it was part of the
21 ambient atmosphere in the workplace.

22 **DR. MAKHIJANI:** Yeah, there were uranium fires. I
23 know the -- we have some idea of what the frequency
24 was.

25 **MS. BLOOM:** I mean you had some bigger ones --

1 **DR. MAKHIJANI:** So very frequent --

2 **MS. BLOOM:** -- but I think you have some small sort
3 of routine --

4 **DR. MAKHIJANI:** Yeah.

5 **MS. BLOOM:** -- incidents at a number of facilities.

6 **DR. MAKHIJANI:** Yeah. The -- the -- the reason I
7 raise it, in looking at my list here, is that I -- I
8 think by now we know that -- that blowouts were
9 pretty -- frequent enough that they would fall into
10 this umbrella, you know, that it will be covered by
11 a routine exposure assumption. But I don't have an
12 idea about the -- I've not seen any documentation or
13 worker evidence about the frequency of fires, which
14 is why I raise that question. It may not be an
15 issue.

16 **DR. NETON:** But again, I think if you go the other
17 extreme where you have very infrequent incidents,
18 then it's an even stronger case that the chronic
19 exposure will bracket that because you have a very
20 short spike in an exposure for a period of -- of a
21 day. Yeah, we're giving this chronic that brackets
22 the entire, you know --

23 **MS. BLOOM:** I've done a lot of modeling --

24 **DR. MAKHIJANI:** I -- I think that that's --

25 **MS. BLOOM:** -- where they have that coworker data

1 and I've got this chronic; I've got an incident here
2 and I've got some more data out here, and if I model
3 that as a chronic exposure, it pulls it up to this
4 later, more acute type of data. It pulls up my
5 curve. If I drop out that incident data and model
6 my low level chronic and then add my short term on
7 it, you can see that the area under the curve is
8 much lower and that gives me much lower intakes.

9 **DR. MAKHIJANI:** Yeah. Well, Dave said that he was
10 going to send --

11 **MS. BLOOM:** Yeah. He's --

12 **DR. MAKHIJANI:** -- me something along those lines --

13 **MS. BLOOM:** -- working on that.

14 **DR. MAKHIJANI:** -- actually if there were a couple
15 of examples -- or specifically an example --

16 **MS. BLOOM:** Well, actually --

17 **DR. MAKHIJANI:** -- with one incident --

18 **MS. BLOOM:** -- the Simonds data --

19 **DR. MAKHIJANI:** -- that would actually be very
20 useful.

21 **MS. BLOOM:** -- or not the Simonds, the -- the
22 Bridgeport Brass data that's not out yet, but the
23 graphs on that in the draft site profile show that.

24 **DR. NETON:** Right. We -- we run into this -- and
25 this is going to be valuable to do for several

1 reasons. We've run into this with comments on
2 Chapman Valve. There was a fire at Chapman Valve.
3 We don't know exactly when the fire occurred --

4 **MS. BLOOM:** Actually that's in there, too.

5 **DR. NETON:** -- but -- but we have a lot -- we have
6 monitoring data well after the fire. But if you --
7 you take these chronic intake scenarios, it -- it
8 does account for the fact that there may have been a
9 fire, and we believe that we had bracketed the
10 exposure -- because you need to look at the
11 integration of the curve in microcurie days, coming
12 out as microcurie per liter days. And a chronic
13 intake scenario will -- will, at the end of the day,
14 be equivalent, if not more claimant-favorable.

15 **DR. BEHLING:** Is there any evidence from your review
16 of the bioassay data that bioassays were conducted
17 in response to specific incidents as opposed to
18 routine? I mean does a bioassay tell you that this
19 is a routine versus in response to a radiological
20 incident?

21 **DR. NETON:** I think there are codes, yeah. But I
22 think -- yes. I think that's true but, you know --

23 **MS. BLOOM:** Frequently you can see the frequency
24 change --

25 **DR. NETON:** Right.

1 **MS. BLOOM:** -- or you see (unintelligible).

2 **DR. NETON:** But that really doesn't matter too much
3 for our purposes, whether it was a routine or an
4 incident. We're going to have a curve that goes
5 through all the data points. In fact, if it were a
6 response to an incident, we would be more generous -
7 -

8 **DR. BEHLING:** You would be -- (unintelligible).

9 **DR. NETON:** -- because we would be assuming that --

10 **DR. BEHLING:** Yes.

11 **DR. NETON:** -- it was all --

12 **DR. BEHLING:** Yes.

13 **DR. MAKHIJANI:** No, I -- I tend to agree, it's just
14 that it would be nice to have the actual example --

15 **DR. NETON:** We'll try --

16 **DR. MAKHIJANI:** -- (unintelligible) cite that.

17 **DR. NETON:** -- and we -- I'm hoping Dave got the
18 message. We're going to try to tie it to a -- a
19 real case --

20 **DR. MAKHIJANI:** Yeah.

21 **DR. NETON:** -- so that we're not doing a
22 hypothetical anymore.

23 **MS. BLOOM:** Uh-huh.

24 **DR. NETON:** Yeah.

25 **DR. MAKHIJANI:** A real case. Okay.

1 **DR. NETON:** Okay. Well, that's great.

2 **DR. MAKHIJANI:** I think we are done. Thank you.

3 **DR. NETON:** I think this was a very good discussion,
4 worked out much better than I thought given that I
5 didn't think we were quite ready. But I think we --
6 we did get through a number of issues and I think --

7 **DR. MAKHIJANI:** Yeah.

8 **DR. NETON:** -- worked out well.

9 **DR. MAKHIJANI:** Thank you.

10 **DR. NETON:** Okay.

11 (Whereupon, the meeting concluded at 11:00 a.m.)

C E R T I F I C A T E O F C O U R T R E P O R T E R**STATE OF GEORGIA****COUNTY OF FULTON**

I, Steven Ray Green, Certified Merit Court Reporter, do hereby certify that I reported the above and foregoing on the day of June 2, 2005; and it is a true and accurate transcript of the testimony captioned herein.

I further certify that I am neither kin nor counsel to any of the parties herein, nor have any interest in the cause named herein.

WITNESS my hand and official seal this the 20th day of July, 2005.

STEVEN RAY GREEN, CCR

CERTIFIED MERIT COURT REPORTER**CERTIFICATE NUMBER: A-2102**