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

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ADVISORY BOARD ON RADIATION AND
WORKER HEALTH

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URANIUM REFINING ATOMIC WEAPONS EMPLOYERS
(AWE) WORK GROUP

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FRIDAY
SEPTEMBER 27, 2013

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The Work Group convened via teleconference at 11:00 a.m., Eastern Daylight Time, Harry A. Anderson, Chairman, presiding.

PRESENT:
HARRY A. ANDERSON, Chairman
R. WILLIAM FIELD, Member
DAVID KOTELCHUCK, Member

ALSO PRESENT:
TED KATZ, Designated Federal Official
DeKEELY HARTSFIELD, HHS
JOHN MAURO, SC&A
JIM NETON, DCAS

T-A-B-L-E O-F C-O-N-T-E-N-T-S

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

11:05 a.m.

MR. KATZ: We've got everyone now. So, let's get started quickly, because I know Andy, for everyone's information, has a very short time with us for this meeting.

So, this is the Advisory Board on Radiation Worker Health, Uranium Refining AWEs Work Group. And let's begin with roll call. We're speaking about a specific site, DuPont Deepwater Plant. So, please state the conflict of interest, as well, for all Agency-related people. And let's get started with Board Members.

(Roll call.)

MR. KATZ: Very good. Okay. The agenda for the meeting and the two papers that we are discussing are on the website, NIOSH website, under the Board, under today's meetings, today's date, for anyone who needs to follow along there.

And, Andy, I'll turn it over to you.

And just let everybody know your time frame here, too, for today. Thanks.

CHAIRMAN ANDERSON: Yeah, I, unfortunately, I think, because of all of the budgetary stuff, we're having an emergency meeting at noon Eastern Time. So, I'm going to have to leave after the first hour here. And, Bill, I hope you got my email. I'd like you to take over chairing the session, as I suspect we may go beyond an hour.

So, today we're going to discuss the responses, NIOSH's responses and SC&A's review of DuPont Deepwater Works so far. And I think the first is to -- I think we can just go right into SC&A's review of the White Paper that NIOSH prepared last March.

And so, John, maybe you want to take over and -

DR. MAURO: Sure. I'd be glad to. And let me say that the issues here are minor and I think we're going to be able to move through them very quickly.

As you had mentioned, SC&A did review DuPont Deepwater about a year ago. NIOSH provided -- and we had seven findings. NIOSH provided a response in March of this year, and we prepared our response to that response in a report dated June of this year.

And what I'll do is -- just a quick background. We're dealing with a facility that was under contract to the MED back in the early `40s, into the late `40s, doing some of the original metal, uranium metal work and some uranium chemistry. It was really one of these old facilities. And we had seven findings.

Our first finding was one of our classic, simple findings, is that there were data available in the later time periods of operation. Later being 1945 time period. And one of our issues was, well, you could reconstruct doses from data available, from coworker data and various sources of data for the later years, but what about 1942 and `43 which is, in theory, when the operations began?

Jim and NIOSH clarified. They said, well, when you take a close look at the operating history of the facility, there really wasn't anything going on in those years.

And so, SC&A went back and went into the source documents that Jim and NIOSH referenced. Of particular importance was by Chambers. It's all in the write-up. And lo and behold, there really wasn't anything going on until about 1944 when the data are available.

And before then -- so, we were concerned that later data may not be very applicable to earlier years, but there really wasn't very much going on in the earlier years.

So, we agree with NIOSH's response and we recommend that we close Issue Number 1.

CHAIRMAN ANDERSON: I also just want to remind, in case there's some public on the phone here, that this is a review of a Site Profile, not an SEC petition. So, we're just going over the Site Profile documents.

So, Board Members, any comments on

this?

MEMBER KOTELCHUCK: Sounds perfectly reasonable.

CHAIRMAN ANDERSON: Okay.

MEMBER FIELD: Yeah, sounds good.

CHAIRMAN ANDERSON: So, as we go through these, the recommendation here is to close. And so it sounds like we're all in agreement. So, Finding Number 1, we think the documentation here is sufficient and adequate. So, we think this issue has been completed and we'll close out Finding Number 1.

MEMBER KOTELCHUCK: Good.

DR. MAURO: We will move on, then, to Finding Number 2. Finding Number 2 has to do with the assumptions and methods used in the Site Profile by NIOSH to calculate ingestion dose.

When we reviewed that, we found that the method that was used apparently did not follow our understanding of the standardized method, which is TIB-9, and I guess our inquiry was something seems to be wrong here.

And NIOSH's response was, you're right. The way in which it was implemented here needs to be -- you know, we have to revisit that.

And so SC&A's position is that, yeah, right now this item is open to the extent that we believe that -- and I haven't seen anything, but we believe that NIOSH is going to correct whatever the issues were associated with the ingestion pathway.

And, Jim, if you're on the line, do you know the status of that revisit of that particular issue?

DR. NETON: Yeah, we're working on that, John. The issue was, really, it was an inappropriate application -- or inappropriate application of TIB-9.

If you recall, TIB-9 sets the ingestion intake at some fraction of the measured air concentration; 0.2 times the air concentration, I think.

DR. MAURO: Yes.

DR. NETON: And that's fine. But

the reality of what we did, though, was that is assuming that you have some sort of an air concentration that was measured based on some operation in the plant, you know, like some airborne-generating operation.

And in this particular case, what we did was we used a resuspension value of material from the ground into the air and said, ah, there's the air concentration and multiplied that times 0.2. And that resulted in an extremely low value of ingestion which we thought is way too low.

So, the way around this is one has to then -- you can't use that TIB-9 value. You have to come up with a surface concentration value and then use something like what's in the RESRAD document, an ingestion rate in meters squared per hour. And that's what we're going to do to correct that problem.

We haven't done that yet, but we will revise the TIB -- I mean, the Site Profile, to reflect that.

DR. MAURO: I could speak for SC&A. That strategy is acceptable to SC&A. And in a situation like this, what has been done in the past, and certainly it's up to the Work Group, you know, we accept that strategy in principle and, you know, whether or not you would want to close on that basis or wait until that actual -- that revision is made. But I'm familiar with Jim's description that he just provided as being the fix. And that fix is the fix that we would expect.

CHAIRMAN ANDERSON: So, Jim, do we have any timeline for when that might be done?

DR. NETON: You know, I don't. I would actually suggest we probably hold this in, what do you call it, abeyance.

DR. MAURO: In abeyance, yeah.

CHAIRMAN ANDERSON: Okay. That's what I was going to suggest.

DR. NETON: Yeah.

CHAIRMAN ANDERSON: If you were saying, well, somebody is actually writing on it

now, that would be different.

DR. NETON: No.

CHAIRMAN ANDERSON: Let's just hold this in abeyance.

DR. NETON: Right.

CHAIRMAN ANDERSON: You know, I mean, partly we're going to report on today's meeting at the full Board meeting. And I think we can just say this is in abeyance and we'll just continue to kind of track it.

DR. NETON: Right.

CHAIRMAN ANDERSON: When you get it done, you can bring it back to us and -

DR. NETON: Right. I think it's safe to say we have an agreement.

CHAIRMAN ANDERSON: Then we can close it out. So, let's just do that.

DR. NETON: Right. We have agreement in principle, but, you know, you guys certainly should review what we've put forth to make sure that it's what you think we're doing.

CHAIRMAN ANDERSON: Okay.

DR. MAURO: Good.

CHAIRMAN ANDERSON: Moving right along to Finding 3.

DR. MAURO: Yes. Finding 3, I'll give it briefly. Our original concern was something called the Putzier effect. You know, when you're working with -- when you're reducing -- you've probably heard this before. Maybe some of you haven't.

When you're making uranium and you go through a reduction process, one of the outcomes of this process very often is you accumulate thorium-234, the progeny, short-lived progeny of uranium, on the outside crust of the uranium ingot.

And we felt that, in our original review, that -- and that has about a 15-fold effect on the external beta field until it decays away, this unusual transient circumstance called the Putzier effect.

Jim and NIOSH responded back as, well, it really doesn't apply here, because the

Putzier effect really comes as a result of the second refinement step in the development of a uranium ingot, not in the first step. And we agreed.

So, we concluded that our concern regarding the Putzier effect was misplaced. And that, in fact, there is no Putzier effect at this particular facility because of the nature of the operations. And we recommend closing this issue.

CHAIRMAN ANDERSON: Any Board Member questions?

MEMBER KOTELCHUCK: No.

MEMBER FIELD: No.

CHAIRMAN ANDERSON: I mean, I think we have a good explanation here down in writing. So, it's helpful to have that documentation should questions come up in the future. So, I would agree, I think we all agree, we'll close Finding Number 3.

And Four and Five you have now combined?

DR. MAURO: Yes, I have combined Four and Five because they are connected at the hip. And NIOSH's response also is -- when they responded, it was sort of connected. So, it's easy to do Four and Five in one.

And this is one where it may take a few more minutes. Now, let me say this: I don't think we have a problem here. I think we, in fact, in my opinion, the outcome is fine; the doses, the approach, the exposures.

What I wanted to bring to the attention of the Work Group is the methodology is a little bit, in my mind, what I'll call bizarre.

The outcome numbers are okay, and I'll try to explain what we did and how that differs from what NIOSH did. And so that then we can hear a little bit about the wisdom of the approach that NIOSH used, which, in my mind, was a little unusual.

As I said before, though, the outcome doesn't disturb me at all. The numbers

are perfectly reasonable.

What the issue has to do with is you have a uranium operation. And there's people working next to, let's say, a slab of uranium or maybe a drum filled with uranium, and we know and we all agree on what the radiation field is as a function of distance from this source. The gamma and beta radiation field.

And it's a look-up number. We've checked it many, many times. It's become standard. So, we all agree on that radiation field at one foot, which is 1.2 mR per hour. And it's 0.3 mR per hour at one meter.

So, therefore, it's a source, understanding the source and what kind of external exposure.

And NIOSH made certain assumptions regarding how long a person might be at one foot, working at one foot, and at one meter from these sources. And, thereby, you could calculate easily by hand the skin dose and the organ dose, whatever the organ might be.

Now, but it turns out NIOSH -- and that was what we expected to see. A very, very conventional calculation. But NIOSH did something unusual. The numbers -- let's go with like the 1.3 mR per hour at one foot. Well, that is the number -- in other words, the physics of it. That's what you would get at one foot from a slab of uranium, natural uranium. But NIOSH didn't use that number.

They decided to say, well, we're going to treat that number -- and certainly, Jim, anyplace along the line you want to help me out, but my understanding is they said, well, no, we don't want to work with that number, because we consider that to be the average number at that location, or an average number.

And so they converted it into the geometric mean by assuming that that exposure rate at that point has a certain distribution. I forget what the geometric standard deviation was that was used. And then you could derive what the geometric mean and geometric standard

deviation is.

So that instead of using what I consider to be a deterministic fixed value, NIOSH converted into a statistical number where that radiation field is expressed more in terms of a geometric mean and geometric standard deviation at that location, and then went ahead and did the calculation.

And it turns out that the outcome -- so, NIOSH used what I would call the statistical approach. Because most of NIOSH's work, virtually all of its work, really operates within the framework of assigning a geometric mean to a metric, to whatever the parameter is, and a standard deviation and use that as input into an IREP, into a PoC calculation.

In this instance, it seemed kind of strange to do that, because there really isn't any uncertainty in the dose rate or exposure rate as a function of distance from a slab of uranium. So, it seems that they applied their statistical approach in a manner that really doesn't

intuitively seem to make sense to a problem of this class.

Now, don't get me wrong. What they did, they came up with a different result, which I consider to be perfectly reasonable also. But it just seemed to be a little strange to do that here. You know, it's a physical -- this dose at one foot, there's no uncertainty there.

So, I felt that it seemed to be unusual to assign a geometric mean and geometric standard deviation to a value that actually is fixed, unlike a lot of the other things we work with.

So, all I wanted to do here was to alert the Work Group that this is a practice that NIOSH has employed here. But in this particular case, it does seem to be unusual. But I'm not troubled by the outcome.

And, Jim, you may want to weigh in and, you know, explain, you know, why this is a standard approach and why you're comfortable with it. I don't have any problems with the

outcome. I'm just a little bit, I guess, surprised by treating the problem in that fashion.

DR. NETON: Yeah. First, I'd say it's somewhat convoluted. I wouldn't necessarily characterize it as bizarre.

DR. MAURO: I'm sorry. That's the first word that came to mind.

DR. NETON: Okay. But I look at this --

CHAIRMAN ANDERSON: I'm comfortable with convoluted.

(Laughter.)

DR. NETON: I looked at this to some degree, and I honestly was having trouble justifying our rationale as well.

I think what happened here, if you remember, there was originally a TBD-6001. And that was cancelled. So, then some of these sites ended up having their own little mini- Site Profiles, so to speak. And in the port over from there, I think we kind of got our wires crossed

a bit, is the way I'm thinking here.

And, to me, I think the calculation is -- I agree. It's a somewhat convoluted method to get to an answer. And I'm more comfortable, after looking at this, going with a more traditional approach, which would be to say that the person -- and this GSD of 5, by the way, is a recommendation in the TBD, the original TBD, to apply to values that you don't have any particular distribution. It's a default recommendation. And the idea was that the GSD of 5 would account for a variation in distances from the source.

I agree that there is no uncertainty on the dose rate of one foot from, you know, a slab of uranium and such, but we're trying to account for variation in distances of the worker from the actual source itself.

After looking at this for some time, I think a better approach here, and you end up in the same situation, is to take a simpler approach. And that is to take a one-meter

value, which is 0.3 mR per hour, and put a GSD of 5 on that. So, then you assume that the worker was at one meter for the entire 2,400 hours of operation. And with a GSD of 5, you end up at pretty much the same place.

So, it gets us away from this convoluted, you know, one foot, one meter, and then taking the average of those two values.

DR. MAURO: Okay. So, in effect, rather than think about it as uncertainty in the dose rate at a given distance, it's really an uncertainty in what the distance is.

DR. NETON: Exactly.

DR. MAURO: And I agree with that completely. And, by the way, that's how I interpreted it also when I read the write-up. I said, well, what they're really effectively doing is taking into consideration a non-deterministic approach to distance as a way to say, well, listen, we don't know how long the guy -- but, you know, he may have been a foot away, a meter away.

DR. NETON: Right.

DR. MAURO: And, you know, how long he's there and this is one way to accommodate that. And that's why I'm fine with the outcome. As you explained it, it's a convoluted way to come at it.

There may be another way to package it. Like you just said, there may be a better packaging that makes better optics for anyone else that might be reading it.

CHAIRMAN ANDERSON: Yeah.

DR. MAURO: But I'm fine with how you -- in other words, bottom line again is I completely agree with the strategy Jim just laid out. Even if he left it as it was, I would be okay with that. But I just wanted to alert the Work Group regarding this unusual circumstance.

CHAIRMAN ANDERSON: Right.

DR. MAURO: And that goes for Four and Five.

CHAIRMAN ANDERSON: So, we'll just keep this open, or do you want to put it in

abeyance?

DR. MAURO: I would recommend abeyance, because I think we agree in principle. And usually when we agree in principle, it goes into abeyance until we actually see the calculation.

DR. NETON: Yeah, I agree with that.

CHAIRMAN ANDERSON: Any Board comments?

MEMBER KOTELCHUCK: Yeah, a comment. Dave.

CHAIRMAN ANDERSON: Yes, go for it.

MEMBER KOTELCHUCK: I have a couple of questions. If you started out by saying he'll spend half of his 2,400 hours at one foot and half at one meter, and then you're going to say, well, let's just assume a certain distance and a distribution, why do you choose a meter? Why don't you choose something between a foot and a meter?

I mean, you're suggesting half the time was spent closer than a meter and I don't

think your geometric distribution would at one meter, would give you -- I guess I don't see why a distance wasn't used that was between one foot and one meter. Could somebody respond to that?

DR. NETON: Yeah. My feeling is that I think the one foot was a holdover from when we would have someone working directly with metal, like metalworking and such.

And this is a drumming operation, not a metalworking operation. So, I personally feel that a one-meter distance is more appropriate for a full-time 2,400-hour a year scenario. A one-meter distance is more appropriate than a one-foot distance.

MEMBER KOTELCHUCK: I would be very comfortable with that.

DR. NETON: Okay.

MEMBER KOTELCHUCK: That would suggest to me that the original calculation, if you'll excuse me, was, in a sense, in error. That is, looking at the occupation of the person.

DR. NETON: Yes, I 100 percent agree

with you.

MEMBER KOTELCHUCK: And then I'm fine with that. The other question I have is just something about process.

NIOSH originally derived this using MCNP, the Monte Carlo calculation. Could somebody just tell me why a Monte Carlo was needed rather than a -- well, why it was needed in the first place?

DR. NETON: Well, this is something we did very early on in the program. I mean, you have a drum of uranium.

And it was rather than rely on -- I guess what you're saying is why wouldn't we just rely on a measurement of a drum of uranium?

MEMBER KOTELCHUCK: Yeah.

DR. NETON: Yeah, I'm not really sure why we ended up doing the Monte Carlo. I think what we had was different heights in the drum. You could model it based on how much was in the drum. That sort of thing and the various --

MEMBER KOTELCHUCK: I see. I see.

DR. NETON: And there are various material compositions and such. It's just easier to do that way and --

MEMBER KOTELCHUCK: Oh, okay. I see. I see. I just wanted to -- fine. That's fine.

CHAIRMAN ANDERSON: There was a rationale for it.

MEMBER KOTELCHUCK: Pardon?

CHAIRMAN ANDERSON: There was a rationale for it.

MEMBER KOTELCHUCK: Right. Right. Okay. And we're going to something different now and I'm very comfortable with that.

DR. MAURO: A further point regarding MCNP. In theory, if we had some measurements, you know, you always ask yourself the question, which should I depend on? Measurements or a model?

I think in a circumstance like this, you know, certainly out there are probably some

measurements taken at different distances using some survey instrument by some people of what the radiation field is. But in a case like this, I trust the calculation. Because it's a physics calculation. This is what has to be.

Now, you know, when you have a physics calculation, you say, listen, I've got a source. I know what the source is. I know it's sitting in this kind of drum and I picked a distance I'm interested in. You could derive that number with a high level of precision.

So, you know, there are times when I prefer modeling to measured data. I'd like to have both; it's always stronger. And, quite frankly, when you use many of the standard guidelines, like TBD-6000, very often they do use this modeled approach because it is -- it can't be wrong, you know.

MEMBER KOTELCHUCK: Right. In other words, the physics is known to be correct.

DR. MAURO: Yes. Right. The instruments, yeah, if you do it right, they'll

be right, too.

MEMBER KOTELCHUCK: Yeah.

DR. MAURO: But they better be the same number as the one you modeled.

MEMBER KOTELCHUCK: Yes.

DR. MAURO: Now, there's another thing, and I'll try to move quickly, that I think is important that I'd point out regarding the use of models. MCNP is the preferred -- many people use MicroShield which is sort of the well-known point kernel model that people use.

MCNP does have its problems, especially when you're dealing with a field as created by Bremsstrahlung. And in the case of uranium, a lot of the photon field is a relatively low-energy distribution of photons that are coming from the Bremsstrahlung interaction of the betas.

And MCNP does a wonderful job with that, but MicroShield doesn't. So, often you'll see, historically, when I went through the system, I still use MicroShield, but MCNP is

really the tool of preference when you want to do -- especially when you're dealing with -- if you have cobalt-60, it doesn't matter.

But when you have a radionuclide where you're dealing with low-energy photons, when you're dealing with -- I guess it really is with low-energy photons, and that's certainly associated with uranium and some other radionuclides. You're better off going with MCNP.

CHAIRMAN ANDERSON: Good.

DR. MAURO: Yeah.

CHAIRMAN ANDERSON: Okay.

DR. MAURO: Now, one last thing, and we're going to get through this quickly. One of the things in my report that I put in -- and I think, Jim, you very much want this in the record also. One of the things that NIOSH does often is it works with the geometric mean and a large geometric standard deviation as being the input for your dose calculation into IREP.

Now, one of the concerns that I have

had in the past is that, well, why are you using the geometric mean? If you know what the absolute value is, you know, that's a single value, what the number is. And in this particular case, the absolute value is actually higher than the derived statistical method geometric mean.

So, what we're saying is, let's envision you have two circumstances. We want to calculate the Probability of Causation for a person who has been exposed to a certain scenario. And I have two approaches I could use. I could say, listen, I'm going to put in the actual radiation field and the dose that this guy got. And let's make believe it's ten, you know.

And but you say, no, we're going to go through a statistical treatment of this problem and I'm going to put in the geometric mean of this particular number, not the best estimate or the average or the real number. I'm going to put in a geometric mean and a large

standard deviation. And in this case, it's because of this uncertainty in distance.

What we found, and what Jim has demonstrated and we also confirmed, is that you might put in the geometric mean that could be like four times lower than, let's say, the arithmetic average or the -- we'll say the arithmetic mean. The geometric mean is often quite a bit lower than the arithmetic mean.

And there's actually an example in the write-up. But in one case you have a deterministic calculation. You put no uncertainty. So, you have a value of 10 millirem per hour. I'm making this number up. And I put that in as a fixed value into IREP. And then Jim says, no, we're going to go with the geometric mean and we're going to put in two millirem per hour with a geometric standard deviation of five. Okay. And you say to yourself, well, which one is going to give you a higher PoC?

It turns out, interestingly enough,

even though you're working with a substantially lower value, this two versus ten, because you have a large geometric standard deviation of that number, and the way in which IREP works where it's estimating the upper 99 percentile confidence level, you actually end up with a higher PoC, when you use what I call the statistical approach that Jim is using, than the deterministic approach that I like to use because it's simple.

So, what I'm saying is -- and this came up in yesterday's conversation dealing with SECs, but I just wanted to alert the Work Group that there is this convention that NIOSH has adopted by using geometric means and geometric standard deviations. And at one time, I was concerned that they were not working with arithmetic means.

And if you're experienced with these kinds of distributions, arithmetic means are often three or four times higher than a geometric mean in a log-normal distribution. And I was

always concerned that they weren't using the arithmetic mean.

I am no longer concerned because of the large standard deviation you put on and the fact that when you calculate Probability of Causation, you're sampling from a population of numbers and you're picking off the upper 99^{th} percentile. What happens is you end up with a higher PoC, a more claimant-favorable outcome when you do it Jim's way.

And, Jim, I know that that came up yesterday and I thought it was important. And there's actually a write-up in our response that talks about this with an example. And I think it was very enlightening to go through this process to convince myself that, yeah, the geometric mean approach makes sense and is claimant-favorable.

MEMBER KOTELCHUCK: Yeah, that table was interesting.

DR. MAURO: Yeah, I found it -- you know, when we went through this exercise, the

first time we did it was here. And it solved something that was sort of like nagging at me for quite some time.

And I think it's important, because, you know, sometimes you ask us, well, why are you using -- you know, here you have a person, why aren't you using the average exposure? Why would you work with the geometric mean? And it makes sense to me as applied to this particular kind of program where you're deriving a PoC at a 99 percent confidence level.

Anyway, Jim, do you want to add anything to that?

DR. NETON: No, I think you summarized it perfectly.

DR. MAURO: Thank you. Thank you.

DR. NETON: I'm good with that.

DR. MAURO: Okay. So, that was Four and Five. We're up to Number 6.

CHAIRMAN ANDERSON: We're going to leave that one in abeyance, too.

MEMBER KOTELCHUCK: Right.

DR. MAURO: Yeah, I would agree with that.

CHAIRMAN ANDERSON: Okay. Next.

DR. MAURO: Okay. All right. Here is a place where I believe you have overestimated. Number 6.

We want to calculate the dose to a person from any residual radioactivity that's on the floor. Okay. So, you got uranium dust on the floor and there's a guy walking around exposed to that material.

Now, it turns out that measurements were made of what the open window reading -- survey instruments, now -- were at this facility. And it's around 0.05, 0.03 millirep per hour.

That's how far back we go that we're using millirep and opposed to millirem. They're really the same number.

And they have a measurement and say, oh, this is what we measured and it's open window. All right. So, what that means is you

are reading something that is the outcome of a reading that includes both the photons and the beta that's penetrating the detector that's giving your readings.

Now, what NIOSH did was say, okay, well, we're going to go with 0.04 millirad per hour as being the exposure rate. And that's perfectly reasonable given that the data they have said was between 0.03 and 0.05, but then they did something that I was surprised. They said, we're going to assume 50 percent of that 0.04 millirad per hour is due to beta and 50 percent is due to gamma.

Now, that can't be correct. It turns out that virtually, I would say, at least the ratio of beta-to-gamma at one meter, basically you're at a 0.1 meter off the floor, when you measure that 0.04 millirep per hour, probably 90 percent of it, if not more, was from the beta, not the gamma.

So, what you're doing is you're probably, by taking the approach that there was

a 50/50 split in terms of what was creating that signal, that 50 is beta and 50 is photon, I think it's more likely 90/10 or on that order. So, we think that this approach is technically incorrect.

The reality is that most of that 0.04 mR per hour at one meter is probably from the beta. And what this means is that they probably overestimated the photon dose, because only a small fraction of that reading should be photon.

Jim, do you agree with that perspective?

DR. NETON: Yeah, I agree. I think we commented in our response that we thought the one-to-one probably was an overestimate and we thought maybe 10-to-one would be more appropriate.

DR. MAURO: Yeah. By the way, you know, TBD-6000 actually has it at a hundred-to-one.

DR. NETON: Well, that's sort of for an infinitely thin surface, you know.

DR. MAURO: Yeah.

DR. NETON: A slab of uranium would be about a hundred to one. In this particular case, though, we felt that the material had migrated into the concrete and they were actually having to scabble to a fair depth indicating that, you know, the uranium was embedded. And that that would reduce the beta contribution down from a hundred.

Now, I agree that one-to-one probably overdid it. Although, you know, we're only talking about 80 millirem a year here total.

DR. MAURO: Yeah. Yeah.

DR. NETON: But we do think it shouldn't be a hundred-to-one, it shouldn't be one-to-one. We feel 10-to-one is probably more appropriate at this point.

DR. MAURO: And I'm fine with that. Again, here we got a situation where I think they overestimated the penetrating dose and it should be lower. And I think the 10-to-one ratio is certainly within reason as applied to this

problem.

DR. NETON: And there's good evidence for this in the plants that you see 10-to-one ratios. They're quite common in an operating plant where there's uranium on surfaces and such.

CHAIRMAN ANDERSON: So, any questions?

MEMBER KOTELCHUCK: No.

MEMBER FIELD: No.

CHAIRMAN ANDERSON: So, we're going to put this in abeyance, too?

DR. NETON: I believe so.

CHAIRMAN ANDERSON: Okay. We're making headway here. Finding 7.

DR. MAURO: I think Seven is very similar to the one we just talked about.

CHAIRMAN ANDERSON: Yeah.

DR. MAURO: It's the same issue. Yeah, really, when I'm looking at it, it's again the 10-to-one issue; isn't it, Jim?

CHAIRMAN ANDERSON: Yes.

DR. NETON: Yeah, it is.

DR. MAURO: So, I mean, I don't know why we have two separate findings here, quite frankly. But it's the same exact, I think, problem/issue and I think the fix is going to the 10-to-one ratio. And that would solve the problem, also.

DR. NETON: Exactly.

DR. MAURO: Yeah. So, again, same problem. Maybe a different setting. Quite frankly, I don't know why it's a separate question. Let me just take a quick look.

DR. NETON: I'm looking at this again. I mean, it's definitely a 10-to-one issue, but I don't know why this came out --

DR. MAURO: As a standalone item separate from the previous one, yeah.

DR. NETON: It had something to do with this 0.05. Oh, yeah, John. I think one was photon dose, and one was beta dose. That's what the difference is.

DR. MAURO: Oh, okay. It's simply

split that way.

DR. NETON: Yeah, yeah.

DR. MAURO: Yeah, it's the same issue that we just discussed and the 10-to-one adjustment is the certainly appropriate solution.

CHAIRMAN ANDERSON: Okay. So, we don't need to combine those now, but I would -- that's in abeyance as well.

MEMBER KOTELCHUCK: Right. Could somebody just tell me what's the difference -- this is Dave. Could somebody tell me the difference between a rep and a rem? I'm not sure what a rep is. Maybe I'm not old enough.

DR. MAURO: You know, I wasn't around when they used reps, but I keep running into them. And everybody tells me that for all intents and purposes it's the same thing as a rad.

DR. NETON: Yeah, a rep stands for, I think, roentgen equivalent physical.

MEMBER KOTELCHUCK: Ah, okay.

DR. NETON: For most photons and stuff it comes out 00 it's about a --

MEMBER KOTELCHUCK: Sure. Sure. Okay.

CHAIRMAN ANDERSON: I'm glad you didn't ask me.

MEMBER KOTELCHUCK: Well, I was afraid to ask at first. But when I saw it again, I --

CHAIRMAN ANDERSON: I was thinking it. Okay. So, do we have any other issues on this?

DR. NETON: I think that's it.

CHAIRMAN ANDERSON: I think that's it. So, as far as the Committee is concerned, I think, John, we can just, you know, take your summary and the conclusions and recommendations and make just a few brief slides for me to present with --

DR. MAURO: Sure. I'll be glad -- I can put that --

CHAIRMAN ANDERSON: And then we can

go through the findings and report on it to the Board?

DR. MAURO: I'll get that to you right away. This is an easy one.

CHAIRMAN ANDERSON: Yeah, I think so. And mostly this is just cleanup activity of somebody writing at some point in time.

DR. MAURO: Yeah. Well, there you go, we've got you done before 12:00 o'clock.

MR. KATZ: So, John, just for that presentation, because the Work Group hasn't discussed DuPont with the Board at all, even though it's been through it, if you could just in the presentation sort of get Andy started from the beginning?

DR. MAURO: Sure. I'll set it up.

CHAIRMAN ANDERSON: I think, you know, some of the stuff from the introduction, I think we have some from the earlier document as well.

MR. KATZ: Right.

DR. MAURO: Yeah, I have everything

written up here from all the documents. I'll pull out, you know, the history of the process we went through and have a couple of slides, as always, introducing the process we went through, when the various reports were issued, what the type of operation was and what the findings and resolution was.

It will be a standard set of slides. Andy, I'll get it to you shortly. You can take a look at it and see if you're comfortable. We can certainly iterate a little bit to make sure you get what you like.

CHAIRMAN ANDERSON: Sure.

DR. MAURO: This is going to -- like I said, this is an easy one.

CHAIRMAN ANDERSON: Okay.

MR. KATZ: Right. A little bit in there, John, about the plant itself and what it did before.

DR. MAURO: I will. I have that in the introduction of our report. I'll pull some of that out. Sure.

CHAIRMAN ANDERSON: Okay. I think we're at a point where -- I don't know. Are there any public participants that want to make a comment?

MR. KATZ: Andy, I don't believe there is anybody from the public on the line.

CHAIRMAN ANDERSON: Okay. Then we're good to go. Any other issues for the Committee?

MEMBER KOTELCHUCK: No.

CHAIRMAN ANDERSON: I saw there were some other --

MR. KATZ: So, Andy --

CHAIRMAN ANDERSON: -- another site coming to us?

MR. KATZ: Yeah, Andy. This is Ted. There are no other issues with this, but we do have a report from SC&A on the Hooker Site Profile that the Work Group should take up.

The Work Group really can't take it up, I guess, until the folks at NIOSH have a chance to respond to your review. That would

be, you know, to the SC&A review. That would be the first step. And then we could have a meeting and discuss that.

CHAIRMAN ANDERSON: Okay. That sounds good. Because I think that's the only other thing right now we have on our calendar, isn't it?

MR. KATZ: Yeah, that's correct.

CHAIRMAN ANDERSON: Yeah. Okay, with that if there's no other comments, I want to thank everybody. It's good to close out some of these like this. So, I think we're making good headway.

MR. KATZ: Good.

MEMBER FIELD: Thanks, John and Jim.

CHAIRMAN ANDERSON: Thank you, everybody. Have a good weekend. And if there's no other comments, we'll close off.

(Whereupon, at 11:50 o'clock a.m. the meeting in the above-entitled matter was adjourned.)