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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WORK GROUP ON LINDE

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THURSDAY
OCTOBER 14, 2010

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The Working Group convened in the Zurich Room of the Cincinnati Airport Marriott, 2395 Progress Drive, Hebron, Kentucky, at 9:00 a.m., Genevieve S. Roessler, Chair, presiding.

PRESENT:

GENEVIEVE S. ROESSLER, Chair
JOSIE BEACH, Member
MICHAEL H. GIBSON, Member
JAMES E. LOCKEY, Member

ALSO PRESENT:

TED KATZ, Designated Federal Official
R. WILLIAM FIELD, Consultant to the WG *

NANCY ADAMS, NIOSH Contractor*
DAVE ALLEN, DCAS
ROBERT ANIGSTEIN, SC&A
ANTOINETTE BONSIGNORE, Linde Ceramics
Petitioner*
CHRIS CRAWFORD, DCAS
MONICA HARRISON-MAPLES, ORAU Team*
STUART HINNEFELD, DCAS*
JENNY LIN, HHS
JOHN MAURO, SC&A
JAMES NETON, DCAS
STEVE OSTROW, SC&A
MICHAEL RAFKY, HHS*
MUTTY SHARFI, ORAU Team*

*Participating via telephone

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

(9:00 a.m.)

MR. KATZ: Good morning everyone in the room and on the line. This is the Advisory Board on Radiation and Worker Health, it is the Linde Working Group. My name is Ted Katz, I am the Designated Federal Official for the Advisory Board and we are about to get going. Before we go on the record we will begin with roll call. Starting with Board Members in the room.

CHAIR ROESSLER: I am Gen Roessler, Member of the Board and Chair of the Linde Working Group.

MEMBER BEACH: Josie Beach, Board Member, Work Group Member and no conflict.

MR. KATZ: Thank you, please address conflicts.

CHAIR ROESSLER: No conflict from Gen Roessler.

MEMBER LOCKEY: Jim Lockey, Board Member, Working Group Member, no conflict.

MR. KATZ: And on the line, Board Members? Mike Gibson are you on the line? And were you expecting Bill Field?

CHAIR ROESSLER: Yes. The line sounds pretty dead to me.

MR. KATZ: Bill, are you on the line? There are at least eight people on the line. Well let's go through more roll call and we will return to Board Members. NIOSH-ORAU Team in the room?

DR. NETON: Jim Neton, NIOSH, no conflict.

MR. CRAWFORD: Chris Crawford, NIOSH, no conflict.

MR. ALLEN: Dave Allen, NIOSH, no conflict.

MR. KATZ: And any NIOSH-ORAU Team on the line?

MR. HINNEFELD: Stu Hinnefeld, no conflict.

MR. SHARFI: Mutty Sharfi, ORAU Team no conflict.

MS. HARRISON-MAPLES: Monica Harrison- Maples, ORAU Team. No conflict.

MR. KATZ: Very good, thank you. Welcome all, and SC&A in the room?

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

DR. OSTROW: Steve Ostrow, SC&A, no conflict.

DR. ANIGSTEIN: Bob Anigstein, SC&A, no conflict.

MR. KATZ: And any SC&A members on the line? None expected. Okay. How about HHS and other federal officials or contractors to the feds in the room?

MS. LIN: Jenny Lin, HHS.

MR. KATZ: And on the line?

MR. RAFKY: Michael Rafky, HHS

MS. ADAMS: Nancy Adams, NIOSH contractor.

MR. KATZ: Any others? Okay, let me return before I get to public members, Board Members. Has Mike Gibson joined us on

the line? Or how about Bill Field on the line? Nancy, or Zaida, are you on the line?

MS. ADAMS: I am here, I can try to call them.

MR. KATZ: Can you try to call Mike and Bill?

MS. ADAMS: Sure.

MR. KATZ: Just remind them about this call.

MR. ADAMS: Okay.

MR. KATZ: Thank you. Okay, then let's to on the line. There are no members of the public in the room, but on the line, members of the public.

MS. BONSIGNORE: Antoinette Bonsignore, Linde petitioner.

MR. KATZ: Welcome Antoinette.

MS. BONSIGNORE: Thank you.

MR. KATZ: Okay, do we want to give it a minute for Mike and Bill or do you want to get started Gen?

CHAIR ROESSLER: I would think

that they would be on.

MR. KATZ: Zaida is calling them, if you pop them an email -- I can do that.

CHAIR ROESSLER: I just sent one to Bill. It would be nice to have Mike on.

MR. KATZ: Yes. Let me check my emails and see if I didn't get a message from anyone. I have got a message from Mike 8:56 saying, "On the way. Sitting in traffic." So that is Mike. He is driving here, sometimes traffic is pretty bad where he is. So Mike is on the way.

CHAIR ROESSLER: I think we ought to wait a little bit and see if he arrives and then if he doesn't, perhaps we should start with DCAS's report which he has received.

MR. KATZ: Yes he has received it, why don't we try to give him another -- let's give him at least until ten after and then go from there.

CHAIR ROESSLER: Does anybody have a really tight schedule today? If not, why

don't we give him until 15 after? We will start when he gets here.

MR. KATZ: Okay. So I will just go ahead and put the phone on mute and we will go ahead and pick at quarter after, unless Mike pops in sooner.

(Whereupon, the above-entitled matter went off the record at 9:08 a.m. and resumed at 9:13 a.m.)

MR. KATZ: Gen, it is your agenda, and let me just remind everyone on the line to just mute your phones, except when you are speaking to the group, and if you don't have a mute button use *6 and to unmute your phone use *6 again. Thank you.

CHAIR ROESSLER: Good morning, everyone. This is the Linde Ceramics Work Group meeting. Just as a reminder, we are discussing SEC 107, which is the Linde renovation and residual period, January 1st, 1954 to July 31st, 2006.

We have had Work Group meetings

since -- well, just over the past year, -- we started September 2009 -- NIOSH in their first report to us stated that they found that available monitoring records, process descriptions, and source term data were available in adequately complete dose reconstruction for this time period.

SC&A has reviewed. And we have gone back and forth with various papers and discussions between NIOSH and SC&A on the Work Group. SC&A has accepted NIOSH's proposal for bounding the doses in the Linde buildings, including radon.

The final issue that we're discussing has to do with radon doses in the tunnels. And at our last meeting, NIOSH said that they could better come up with a bounding method for doing radon doses in the tunnels by doing some diffusion calculations. And we had also talked about some possible measurements.

So we got a White Paper from NIOSH everybody has. And we also have a response

from SC&A on these diffusion equations.

I'll mention, by the way, that I invited Bill Field. Dr. Field is a Board Member. He's a radon expert, internationally and nationally known. And I thought his participation in the discussion would be helpful. And he is now on the phone.

Unfortunately, Bill, you probably didn't get SC&A's response to NIOSH's White Paper until this morning. And that's my fault because I didn't get it until this morning. I apparently didn't go on -- no. I didn't go on my CDC email. And so I didn't see it until this morning. So I'm sorry about that, Bill, if you're just now looking at it.

MEMBER FIELD: Right. I just received it as well.

CHAIR ROESSLER: Perhaps as I stammer around here, you can take a quick look at it. And then we'll be ready to go by the time they make their presentation.

So we'll start then, with DCAS'

White Paper. And I believe Dave Allen is going to be the one making a summary of your paper?

MR. ALLEN: Yes. I don't know how summarized you want this. So I'll start going through. And if you want less detail or more detail, just let me know. And I'll provide it.

The White Paper was an attempt to model the radon in the utility tunnels at Linde. And there were two primary sources of radon that we can think of for the tunnels, one being radium contamination inside the tunnel on the various surfaces and the second being radon-diffused -- or radium contamination in the soils around the tunnels creating radon gas and that diffusing into the tunnel.

So the paper was broken up into two parts to discuss each of those mechanisms, the first one being the simpler one to model, which is the radium contamination in the

tunnel surfaces. And the theory behind that one was simply that radium decays produces a radon atom. And that decay gives us our introduction rate.

And the removal mechanisms are the decay of radon itself as long -- also the ventilation of the air in the tunnel. And it's a relatively simple equation to put the three together and determine what the equilibrium value would be. And that was done in the first part of this paper.

The parameters used are listed in the first table on page 3. And, with those parameters, the value came out to be approximately 18 picocuries per liter from that mechanism.

The second part was a little more complicated. And that is the diffusion of radon in the soils leaking into the tunnels. And that simply started with a standard diffusion type of theory.

Actually, the first couple of

equations start with the same equations I was using for the part one, which is the two removal mechanisms from the tunnel, being the radon decay and the ventilation, but this time, instead of the introduction mechanism being decay of radium that is in the tunnel, it was simply an introduction rate.

And then the paper moves on to show the introduction rate being the diffusion equation or fairly standard diffusion theory, the equations of which are in here and I don't think you really want me to go through the equation there or anything.

But once it's set up with the production mechanism and the two removal mechanisms, it's not that difficult to solve this. It turns out to be a second order differential equation. It's not too difficult to solve it in a general form. We tried to simplify the model and solve it in a one-dimensional form.

And a solution to that is equation

9 on page 5. And the solution to any second order differential equation is going to contain two constants, the value of which has to be determined from boundary conditions. And that is one of the tougher parts of this type of situation.

So, starting on page 6, I discussed the boundary conditions. And I developed three different sets of boundary conditions. The one that was consistent with all three was to assume a continuity condition between the soil and the tunnel, essentially that the radon at the tunnel-soil interface was the same in the soil as it was in the tunnel. And that is, like I said, just a continuity condition. You can't have a drastic difference right there.

As far as the rest of the conditions, the three sets of boundaries conditions that I derived or came up with were I called large source, small source, and symmetrical. And the theory behind the large

source was essentially that the source of radium contamination in the soil is large enough, that area is large enough, that the -- in the center, the radon reaches a theoretical maximum that you would reach with no removal mechanisms other than decay.

And the second boundary condition was small source. That one was essentially that the source is so small that towards the opposite end of the boundary, the radon concentration in the soil would reach zero.

And I developed a third one, kind of similar to that small source, that basically said, instead of zero, it would be the same concentration as the tunnel. And that is the condition I used for all three, that continuity condition. And, therefore, it essentially made it a symmetrical gradient for the radon concentration in the soil.

In the attachments I won't go into here. I went through the math to solve the constants and the equation based on those

three boundary conditions. And then starting on page 8 is where I have analyzed the three various parameters of various sizes of sources to try to determine which is most legitimate or, you know, if there is any one that is favorable than the others. What we found is that they all three give very similar results for the conditions they apply to.

Page 9 there is a draft that shows the various sizes of sources, the estimated tunnel concentration of radon. And in that one, you can see where the small source condition gets extremely high when the source gets very large.

And the problem was essentially when the source gets to a certain point, the condition of a small source is violated is what it amounts to. You simply can't get to zero at the boundary. There was so much diffusion when the source is so big that it will give you a radon concentration beyond the boundaries of the contaminated soil.

And the same exact graph is on the next page, on page 10, but it is a closer view, see what's going on closer into the tunnel. And from that, you can see, of course, the right-hand side of the graph that all three give very similar results until you get to about 200 centimeters for the parameters I put in there. Two hundred centimeters or smaller of the source is where they depart.

There are actually three lines on there. The small source and the symmetrical source give you essentially the same numbers on down to zero, but the large source, the concentration from that one gets extremely large as the source gets very small.

Again, that ends up being a violation of the condition itself because the condition of a large source was that in the center of the source, the radon reaches a theoretical maximum as if there is no diffusion.

Once the source gets so small it simply can't reach that condition, there will be some diffusion away from that. So it ends up, like I said, violating the conditions of that boundary condition.

So we ended up using the symmetrical source because it gave us the same results as the other two in the areas where those other two apply.

And, using the parameters, the parameters are listed, I believe, in attachment B. And, from all of this put together, we ended up from those parameters and the symmetrical condition, we ended up estimating the concentration of 26 picocuries per liter from diffusion. And if you refer to the graph, that's where the size of the source is at least two or three hundred centimeters large and on out from there.

The reason I included all three in the paper was that it was kind of an interesting result. And, based on the theory

and the boundary conditions we applied to it, it kind of told us how large large is and how small small is with those conditions.

You could see that they give us similar results. All three give us similar results, as I said, starting around two or three hundred centimeters or larger.

The large source condition falls apart for sources smaller than that. And the small source condition falls apart for sizes bigger than about 1,500 centimeters.

So I thought that was kind of interesting itself because the obvious question on these is how large is large when you say a large source or how small is small? And the analysis actually kind of told us that.

And just to make sure we understand, the sizes, if you're interested, on the x-axis here, these are the sizes of the source assuming it's evenly distributed. And that is the distance from the tunnel wall to

the center of the source.

So when I say 300 centimeters, it's essentially roughly 9 feet from the tunnel out to the center of the source. And so you could say the source is roughly 18 feet out from the tunnel. And that seems to be about the limit of where diffusion makes much of a difference in the tunnel, at least for the parameters we put into this.

If you have high radon concentrations, you can even say 100 feet away from the tunnels. It really is not going to affect the tunnel concentration. And it makes sense to most people that that is not going to do a lot for tunnel concentration. It is the one radium concentration that's in closer to the tunnel that is going to affect that.

And that's all I have unless somebody wants some more detail.

CHAIR ROESSLER: I think it would be helpful to make the comment that you have on page 12 in comparing it to measurements. I

think, for a lot of people, this modeling is difficult to follow. And I think just are we in the realm of reality?

MR. ALLEN: Yes. And I --

CHAIR ROESSLER: Bring up your number that you have on page 11 and then compare it to the measurement. I think that would be helpful.

MR. ALLEN: Yes. I'm sorry. I forgot about including that part. The number I have on page 11, it was roughly 26 picocuries per liter from the diffusion. I simply added that to the radon concentration we derived for the surface contamination inside the tunnel.

We came up with a total of 44.47 picocuries per liter here in this paper. We did find one radon measurement at Linde, one radon measurement from quite a while back. It was not a utility tunnel. It was a conveyor tunnel that ran underneath building 30.

And, Chris, you're going to have

to correct me if I am wrong on any of this, but this was a conveyor tunnel where men were dumping the uranium ore on one end. And it conveyed it, I think, to actually a bucket elevator that then brought it up to a ball mill.

The areas where there would be spillage of ore in the tunnel would essentially be where they were loading the tunnel and then where that bucket elevator took it from the conveyor up, which is basically the two ends of the tunnel.

There were radon concentrations measured in various places throughout the tunnel, various links, both ends and a few places in the middle.

This was done November 19th of 1946, which is very near -- or I might have that wrong. I'm sorry. The report was dated that. The measurements were taken October 22nd of '46, very near the end of their operations with ore for the AEC. And this

radon would likely be caused by buildup of material from spillage as they were loading up the conveyor and as the conveyor dumped to the bucket elevator.

The highest concentration was at the bucket elevator end. It was 44 picocuries per liter. Near the middle of the tunnel, it was 13 picocuries per liter. And it was higher near the end where it was loaded up, though I don't recall what that number is. It's not in here.

As I said, these are probably primarily from material in the tunnel, rather than diffusion into the tunnel or anything like that, but it is near the time of the ore operations at Linde.

So soil contaminations you would expect to be near their maximum. So it should account for diffusion from soil contamination. And it would account for contamination in the tunnel, which I suspect in this case is probably more like a pile of material.

DR. NETON: Do you know what type of ore this was at that time?

MR. CRAWFORD: All of the ore was gone through there. Some thousands of tons of that was African ore with full radium content.

DR. NETON: That's what I thought.

MR. CRAWFORD: All the American ores have been pre-processed with the radium --

MR. KATZ: Could you just -- I don't know if people on the phone can hear you so well Chris, these mikes aren't the greatest.

MR. CRAWFORD: The conveyor tunnel would have conveyed all of the ore that was processed at Linde. And that was all done and finished in '46, probably the Summer of '46.

My memory is thousands of tons of African ore with radium in secular equilibrium with uranium would have run through that tunnel, I think approximately 9,000 tons, but I'm not sure of that figure.

So we're talking about a tunnel that is really heavily contaminated with processed material, which is quite a contrast to utility tunnels, which never had any processed material brought through them. They did have leakage from the outside.

By the way, the end, the dumping grill end, just to put a little more local color into that, the ore came in in burlap bags that were covered by a paper sleeve. I even saw documentation that the paper sleeves cost 27 cents each and they went through 1,800 of them a day. And they needed to economize on them. So we have a lot of detail on how this material was handled.

At any rate, when the ore bags were brought in, they were stored in a corner of building 30. And then the workers would take the ore bags, cut off the tops, dump them into the floor through a braiding, where they fell on a conveyor belt, which then took them across the building to the vertical conveyor,

which also weighed the ore as it was conveyed upwards. And then it was done through a storage area at the ball mill end. From there, it was scooped in the ball mill and crushed before being dissolved in acid and so forth.

So a lot of material went through that tunnel. It was a smaller tunnel than the utility tunnel. And it's only used for that purpose after the war and after the ore-handling period was over, that tunnel was essentially abandoned.

The grating end, by the way, actually had a lower radon measurement in 1946 when these October of '46 measurements were made of about 6 picocuries per liter. The ball mill end, for some reason, was much higher.

DR. OSTROW: I assume there was no ventilation fan in this tunnel.

MR. CRAWFORD: Not that I'm aware of. Workers did periodically have to go

through and spill processed material. And I found memos saying that they had to wear certain overalls, they had to wear respirators, and so forth. I can't prove they did, but nonetheless, they were aware of the hazards is all I can say. But, as far as I know, there was no ventilation.

CHAIR ROESSLER: One question. You mentioned, of course, the major contributor was the contamination from the material in there. But also that would include the diffusion from any soil also, which would be minor, but in case there was ever a question that it certainly would include that.

MR. ALLEN: If there was any diffusion from the soils, it would include that. And the soil should be at about their maximum concentrations since this is right at the end of the time frame when they were handling that ore. I think my speculation was that it is mostly from the material in there,

but it is essentially from all the same sources you would see with a utility tunnel.

DR. NETON: It's an underground tunnel, similar dimensions, I think.

CHAIR ROESSLER: The question I have is, with regard to -- you mentioned in your measurements. Apparently they had more than one reading. They had them at different locations. Did you know what the technology was for making radon measurements back at that time?

MR. ALLEN: No. I do not. Chris is trying to look at it, but it was essentially a one-page memo with results on it.

MR. CRAWFORD: Right. I don't have a description of the measurement process itself, only the results and the locations. And there are only two measurements at each location, six total measurements.

MR. KATZ: For the record, Mike is joining us. Welcome, Mike.

MR. CRAWFORD: By the way, this tunnel is relatively short. I believe, just looking at the description of it in building 30, I would say 60 to 90 feet.

CHAIR ROESSLER: Well, are there any other questions from the Work Group -- Mike Gibson has arrived -- or from Bill Field if you're still with us since you're our radon expert?

MEMBER LOCKEY: Jim Lockey. Is the tunnel that short tunnel from 30 to 56 on the map? Is that --

MR. CRAWFORD: No. It's entirely contained within building 30 itself. It has no other connection.

MEMBER LOCKEY: It's all from building 30?

MR. CRAWFORD: Right.

MR. ALLEN: This is not a utility tunnel. It was a conveyor tunnel under --

MEMBER LOCKEY: Right. I understood that, but I just wondered where it

was on this map. So it's all in building 30?

MR. CRAWFORD: Yes.

MEMBER LOCKEY: Okay.

DR. MAURO: A couple of questions, John. The concentration of radium in this rock -- I guess this ore is a rock. It's not finely divided, I assume.

MR. CRAWFORD: It goes to a ball mill.

DR. MAURO: Before it went to the ball mill. So it's a rock-like material. And do you know what -- I should know this, but I don't. What is the concentration, picocuries per gram, of the radium or the uranium?

MR. CRAWFORD: I would have to look it up. There were various grades of African ores --

DR. MAURO: Oh, I know. It has --

MR. CRAWFORD: Various concentrations. And they actually did record the number of tons at each richness.

DR. MAURO: Yes. The reason I

ask, I'm trying to put it into context. We know what the concentration of the radium was in the soil and the tunnel, tunnels. And they were on the order of 10, 9, 10, 12 picocuries per gram.

DR. ANIGSTEIN: It depends on how you look at it.

DR. MAURO: Okay but on that order.

DR. ANIGSTEIN: Thirty.

DR. MAURO: Thirty? I assume it is much, much higher than that. I don't know the numbers. I was trying to make -- and also, unlike the finely divided material that's in the soil around the tunnel that we are concerned with, this sounds like it's rock, which, of course, is going to -- the way in which radon leaves that might be a little bit different than the way in which radon would be diffused from the finely divided soils.

I just want to -- so there are

aspects that are different and aspects that are similar.

MR. CRAWFORD: Yes. I don't know if it's terribly relevant here, but during the production period when they were dealing with ores, we have building measurements of radon that are much higher than even these tunnel measurements, where they heat ore in hundreds of tons of work on the stacks. Some of those measurements were very high, I think, in excess of 100 feet.

DR. MAURO: But that was after they had been through the ball mill, they crushed it, and they finely divided it. And you're about to --

MR. CRAWFORD: We know the ball mill end did have a storage area. Quite a few tons of ore were kept.

DR. ANIGSTEIN: The ore from the African ore being brought in --

MR. KATZ: Bob, a lot of people have a hard time hearing your voice. So if

you could just speak up?

DR. ANIGSTEIN: Sure.

MR. KATZ: I think there's a mike right there, but if you can, with the green light -- everybody in the room can hear you fine, but -- no. I think it's the green. That's the telephone mike right there. If you could just pull that towards you? No. Don't push it. Just pull it towards you.

DR. ANIGSTEIN: That's what I'm doing. I was moving. Oh, this one?

MR. KATZ: Yes. There you go.

DR. ANIGSTEIN: I've got you.

MR. KATZ: There you go. Thank you.

DR. ANIGSTEIN: Okay. I was going to answer John's question because I remember we looked at the question of the radium in the burlap bags. And the processes -- I reviewed the whole thing, the whole burlap bag.

And when they came in, when the burlap bags -- as I say, in the paper sleeves,

only sometimes the paper sleeves I think were torn. And when they came in the boxcar, they actually had to open the doors of the boxcar and ventilate them for -- I don't know -- 24 hours, whatever --

MR. CRAWFORD: That's right.

DR. ANIGSTEIN: -- because it was impossible to enter. The radon levels were so high because the African ore was processed in Africa, in the Belgian Congo.

The only reason -- I can't resist making a little historical aside. The only reason we were able to get the African ores was that the Belgian government, unlike the king of Belgium, did not surrender to the Germans. They evacuated to England. And they controlled the Belgian Congo. And, therefore, they traded with the United States. Otherwise the Germans would have had it.

MR. CRAWFORD: They only gave up title to the radium in the ore in 1983.

DR. ANIGSTEIN: Yes. Okay. Yes.

But what they did was -- anyway, that aside, what they did in the Congo was they processed the ore, meaning they kind of separated the ore from the dirt. But they did not chemically separate it. So it came with all the radium that was in it normally.

Other ores, there was some pre-processing on location where some radium was removed is my understanding. But this one was as hot as you get.

And Chris is right. The radium was the valuable commodity as far as they were concerned. And they wanted to get the radium back.

To make a long story short, there was a lot of radium in the ores.

MR. KATZ: Do you want to check in on Bill Field?

CHAIR ROESSLER: Okay. Any other questions? Anybody on the phone have any questions?

MS. BONSIGNORE: I actually have a

question if I might ask it at this time.

CHAIR ROESSLER: I think it's Antoinette, right?

MS. BONSIGNORE: Yes, it is.

CHAIR ROESSLER: Go ahead.

MS. BONSIGNORE: This is the first that I'm hearing of anything being referred to as a conveyor tunnel. And I'm wondering. Someone made a statement that after the 1940s, that this conveyor tunnel was essentially abandoned and that nobody worked in it or went through it. I'm just wondering how you know that.

MR. CRAWFORD: The purpose of the tunnel was to convey ore from one part of building 30 to another. After '46, no more ore was ever processed. After that, they brought in uranium oxide, which had already been highly processed. That came in in barrels.

MS. BONSIGNORE: That's not my question. My question is: I know that there

wasn't any ore being conveyed there, but what I'm asking is since this is under building 30, how do you know that workers didn't use it for some other purpose in later years?

MR. CRAWFORD: Well, I can't think of a reason they would. So if that's the --

MS. BONSIGNORE: But you don't know.

MR. CRAWFORD: There was no -- it's hard to find negative documentation. Nobody writes a paper saying that there were no workers not using the tunnels. We have no worker testimony from anyone who ever said they were in such a tunnel.

MS. BONSIGNORE: Well, I would like the opportunity to actually ask the workers this question because they may have used a different term to describe this tunnel. And they may have actually worked in this tunnel.

I think that would be a relevant question to be asked so the Working Group

could have a full understanding of whether workers actually used this tunnel in later years.

MR. CRAWFORD: At any rate, it may not be as relevant as you think because the levels that are proposed in the radon model we now have are above that level that was measured directly in the tunnel.

In other words, if the workers are already exposed in the utility tunnel and we're allowing for that.

CHAIR ROESSLER: Antoinette, does that --

MS. BONSIGNORE: Well, I don't understand why you wouldn't want to have as much information from the workers as possible.

MR. CRAWFORD: Well, there's no reason not to have the information. I quite agree with you. I'm just saying I'm not sure it should hold up the Committee's deliberations unless it is really going to make a difference.

If we can think of some scenario under which it would make a difference --

MS. BONSIGNORE: Well, I'm not a health physicist. So I can't really, you know, challenge you on something like this. It's difficult for me to challenge anybody on these technical documents.

What I'm simply suggesting is that I be given an opportunity to ask the workers simple questions.

CHAIR ROESSLER: Antoinette, I think as we get on further in the day and wrap this up, we certainly will be talking about your comments here.

I think that my question at this point or I would like to have somebody say what we are looking at is the diffusion model that was presented and looking at this data to kind of evaluate that diffusion model. And I would like for somebody to state how pertinent this situation in these tunnels would be to, conveyor tunnels be to the utility tunnel --

with the diffusion from the soil, would all the parameters be about the same so that this could be looked at certainly bounding since there was not only diffusion from the soil but all this other material?

MR. ALLEN: I think the conveyor tunnel would be a -- it should in theory -- you would think it would exhibit more radon than utility tunnels. You're going to get the same radon diffusion. I mean, it's subject to radon diffusion from the soils just as much as utility tunnels.

The radon should never be any higher than what it was when it was first put on the ground there, which is that the material would have been visible material. I think Chris said that they went in from time to time to scoop up the material, you know, basically reclaim that material, and put it on a conveyor.

I don't think anybody has ever suggested there was enough material in the

utility tunnels to actually recover and scoop it up or anything like that. So it certainly sounds like there's considerably more material in the conveyor tunnel than in the utility tunnels.

As one would expect, there was no reason to believe the diffusion would be less in the conveyor tunnel than in the utility tunnels. And it certainly seems like the conveyor tunnel would have all the same mechanisms, just more of those mechanisms.

And we intended to be bounding with the utility tunnel model. It was simplified some with the one dimension, et cetera, but I think the utility tunnel or the conveyor tunnel survey kind of backs up that we're in the credible range and likely bounding.

MEMBER LOCKEY: John, let me ask you a question -- Jim Lockey. You had said that the diffusion for radon will be different from a rock than something that has been

ground into a finer particulate. Is that right?

DR. MAURO: Yes.

MEMBER LOCKEY: Would that be the reason that at the end of the ball mill -- at the ball mill, the radiation levels are higher than at the beginning of the tunnel?

DR. MAURO: I don't know.

DR. NETON: It's the same product at both ends. It just got dumped there.

DR. OSTROW: Yes. It sounds like the physical --

DR. NETON: It's a different physical product at that point. I think there are just more of it.

DR. OSTROW: Yes, it's not like the physical process that you add more ore at the ball mill side that, you know, landed on the floor. It sounds like --

MEMBER LOCKEY: Well, I was thinking a ball mill is something that is going to --

DR. MAURO: Yes. That's later, though. Is that upstairs?

MR. CRAWFORD: Yes.

DR. MAURO: This is just that they conveyed it. The rock is just moving through here to go to an elevator that went upstairs, where it was hit by the ball mill, where it was ground down to I guess a finer so that it would interact with the sulfuric acid, whatever was used to digest it.

MEMBER LOCKEY: What were the levels at the ball mill, then? Do you remember?

DR. NETON: Forty-four picocuries.

MR. ALLEN: That's in the conveyor at the ball mill end of it or in the tunnel.

MEMBER LOCKEY: Actually at the ball mill? Do you know that?

DR. NETON: No.

MR. ALLEN: I don't. Do you know that, Chris?

MEMBER BEACH: Well, I have a

question on the model. You said it was one-dimensional. Does that take into account all the possibilities of all the radon that was in that area? Is there another way to model it so that you can get more --

MR. ALLEN: It can get more sophisticated. You can get very hardcore into modeling, you know. It is one-dimensional, meaning just straight out from the tunnel.

It could be modeled to the vertical dimension, but the other, that is going to make the levels go down because that is one of the big removal mechanisms from the soil, is diffusion into the air. And that's not accounted for in this model.

MEMBER BEACH: Okay.

DR. MAURO: I did have a question. What you are doing is creating analogous situations. Here are the tunnels that we are interested in. Here is the conveyor tunnel.

I know you had several hundred bore holes where soil was collected in the

soil around the tunnel. Is the conveyor tunnel also encompassed? That is, is it also sitting in soil that has the same concentration or was it located where all those walls were taken so one could say that, you know, the contamination of the soil outside the conveyor tunnel was sort of more or less the same as it was outside the other tunnels or is this a different location altogether?

MR. ALLEN: There were holes drilled through the flooring of building 30, bore holes drilled through. I don't know how close they were to where this conveyor tunnel is. Do you know that one, Chris?

MR. CRAWFORD: Building 30 is rather a special case. In other words, I don't think it would necessarily be comparable to the general contamination of the grounds in between the buildings, which is mainly where the tunnels ran.

Building 30 processed all of the

ore. Yet, early in the history of building 30, it had dirt floors. Then they poured concrete. Now there is a foot concrete there on top of the floor for these measurements. In '93, for instance, that's what they found.

So whether there was contamination under building 30, I'm not sure that it's representative. And you could look at how close it was to the tunnel.

I think, actually, John, I think you mentioned, you or Steve, at the last meeting that five meters was the effective --

DR. MAURO: Yes. That was the number I pulled from the literature. I went back to try to find that.

MR. CRAWFORD: Right.

DR. MAURO: And I didn't.

MR. CRAWFORD: I think in this case, building 30 would have been located more than five meters from the utility tunnel. So if that helps anyone out.

Bob?

DR. ANIGSTEIN: Well, first of all, I've got some illustrations I was going to present. So maybe I'll wait until --

CHAIR ROESSLER: I think it would be good to jump to that next. I think what we're trying to do here, at least my objective in asking the question about these measurements, was to evaluate the reality of those measurements.

Were the conveyor tunnels, with their content, with their construction similar to the utility tunnels?

DR. MAURO: Yes. Everything else being equal -- and the only difference between the tunnels and the conveyor tunnels is the fact that the conveyor tunnels contained this inventory of some quantity of ore that clearly has relatively high concentration radium. One could make a fundamental argument. Of course, it's going to be worse in the conveyor tunnels.

However, the things that might be

different -- and that's why I posed the question -- is the level of the concentration of the radium in the soil around both tunnels. And the second one, which might be more important, is a fan.

I know that the tunnels we are concerned with had an exhaust fan, low turnover, joined negative pressure creating a vector transport. Did the conveyor tunnel have a similar situation because if it did, then we have a situation that the conveyor tunnel in many respects -- the only difference is the fact that it had some ore inside it.

DR. ANIGSTEIN: But isn't that a huge difference?

DR. MAURO: The ore inside should make a huge difference, make it far worse.

MEMBER BEACH: Were those conveyor tunnels connected to the utility tunnels in any way?

MR. CRAWFORD: No.

MS. BONSIGNORE: Are you sure?

MR. CRAWFORD: Yes.

CHAIR ROESSLER: So if the rock makes the huge difference, then these should be way over estimates. But I just want to read through the fine point that we're not missing something and not saying that these tunnels were different and, therefore, this is not a real upper bound.

MR. ALLEN: And I am just going to mention one thing as far as that ventilation. There were I think six places throughout the tunnel where the radon was measured and you see some significant differences like 44 at one end and I don't know what the other numbers are.

MR. CRAWFORD: Six in the middle.

MR. ALLEN: Six in the middle.

MR. CRAWFORD: Thirteen in the --

MR. ALLEN: The middle seemed to be the lowest concentration, which was maybe the furthest away from the material you would expect to spill. And having that variance in

the 60 to 90-foot-long tunnel, it seemed to me there couldn't have been a lot of flow or there would be better mixing than that.

It seems to imply there was little or no ventilation in that tunnel. And it would have been a conveyor tunnel, where you would not normally have people working other than to repair that conveyor. So it makes sense that there wouldn't be a great deal of ventilation.

DR. MAURO: Interestingly enough, the ventilation issue, just as a concept, one would think on first principle that, oh, ventilation would have helped to improve and reduce concentrations. But, in fact, the ventilation very often if there is a substantial source of radon outside the tunnel, it actually makes things worse because you're bringing the radon in.

So it is an interesting -- see, I'm just trying to say, everything else being equal except you have rock inside the tunnel,

I would say the story is over. You have made your case. I mean, I sort of come to the end pretty quick.

But, I mean, if they're both duplicates of each other except in one case you've got ore and everything else is equal, the tunnel, the basic structure of the tunnel, the concentrations in the soil around the tunnel, but the only difference is the conveyor tunnel had the rock, you've just established the bounding condition for all intents and purposes. But we don't know that necessarily would be the case.

I guess that's what I'm -- that's an important piece of information, this actual measurement. From the very beginning I've been arguing measurements in the end is what you got. In fact, quite frankly, I would love to have seen real measurements made in the tunnels themselves.

DR. NETON: Well, I do have some information on that. On August 23rd, we sent

a letter to the site manager asking for permission to take measurements in the tunnels -- well, first asking if they had any measurements; if they did, if they would provide them to us; and if they didn't, would they grant us permission to take measurements. It went from Stu Hinnefeld directly to the site manager. And we received no response up until a couple of weeks ago, maybe a week ago. I forget. But Stu finally --

CHAIR ROESSLER: I wonder if people can hear you, Jim. I think you --

DR. NETON: Stu finally got a hold of the site manager. And she indicated that it was her opinion that the tunnels are undergoing active remediation in any respects and to a large degree under the control of the Army Corps of Engineers. So she referred us to the Army Corps of Engineers for permission to enter the tunnel.

I talked to Chris Crawford about this. And we spoke to the Army Corps of

Engineers some time ago. And it was their impression that the tunnels were under the control of Praxair. We sort of got a little bit of a runaround here.

DR. MAURO: I am sorry, the tunnels are what?

DR. NETON: Under the control of Praxair, the current operator. Both may be true. It seems like some portions are undergoing remediation by the Corps and some are not. And so maybe there's -- depending on what is going on, certain people had jurisdiction.

So this all happened fairly recently. Chris -- I'm speaking for Chris, but I think what he did was he spoke to our Army Corps of Engineers contact and basically relayed our latest feedback from Praxair and asked him to sort of sort out the details for it as to what we might be able to do.

We do believe it was indicated by the site manager that some of the tunnels may

have already been remediated or destroyed, actually. So we're trying to find out what is left and what we might be able to measure. So it's still in the process.

That is still a possibility, but it's been somewhat difficult for us to get to the bottom line. You think it would be simple, but as Bob found out dealing with bureaucracies and agencies and with other issues. Sometimes you get to a bigger pointing at delay.

So, you know, that is actually still in the works. Of course, that would be a very interesting measurement to take as well. Interestingly, this tunnel, conveyor tunnel, measurement came to us after the calculations were done. This was not sort of a reverse engineered system, they developed this model and then, lo and behold, just about the time the calculations were done, ORAU through a data capture located this one day of measurement for radon -- and that is the only

piece we have right now -- underground. We thought it was a fairly interesting piece.

We're not suggesting that this validates the model, but I think it's certainly a piece of information that adds to this puzzle. And, you know, 40 picocuries per liter underground in a tunnel that conveyed fairly concentrated uranium ore -- you can makes a pretty good case that it is in that ballpark. I don't know that we can get things in 100 picocuries per liter.

DR. OSTROW: Jim, getting back to the dealings with the Army Corps of Engineers and Praxair, did they mention the fans still working? Do any of the fans still work?

DR. NETON: We haven't gotten to that level of detail at all.

DR. OSTROW: Okay.

DR. MAURO: As a part of the health and safety program, people are obviously working inside of that tunnel to remediate it. Are they taking radon

measurements to make sure that --

DR. NETON: Well, we asked that question. I mean, we're trying to find that out. And so far we don't know.

MR. CRAWFORD: Their concern seems to be asbestos.

DR. NETON: Interestingly enough, if you look at the Army Corps, the Army Corps did a characterization of the tunnel complex in 2002. January 2002, they issued a report. I don't remember exactly when. It was the first time people went in and actually did measurements.

And that is the basis of the surface contamination measurements, which I'll remind people that the calculation we did that gives up to 18 picocuries per liter in the tunnel, assumes that the entire complex is coated with the highest concentration per square meter that was measured. So it's a fairly conservative number.

But they did this survey with the

intent of trying to determine whether it really needed to be remediated. They only identified two or three locations where there was really sufficient in-tunnel contaminations to warrant remediation.

And they also did some calculations for the dose that would be associated with certain activities, you know, remediation activities in the tunnel. Their doses, frankly, are very low. And they have included radon in the calculation. They are like 25-30 millirem per year.

Interestingly, though, this does not include, as far as I can tell or anyone can tell, the diffusion of radon from the radium in the soil outside the tunnels. As far as this calculation goes, it only appears that they considered the surface contamination inside the tunnel. So that extra piece is what was missing from their analysis.

They certainly didn't appear to be concerned about radon in the tunnel, though.

There's nothing in there about measurement of radon. They've actually inferred it based on the radium contamination.

MEMBER LOCKEY: When was that done again?

DR. NETON: Well, the report was issued in 2002. I have forgotten when the measurements were taken. I believe like 2001.

DR. MAURO: Yes. It was one year earlier, 2001.

DR. NETON: About a year earlier. And so it's a fairly detailed square meter by square meter survey of the entire existing tunnel complex at the time. So we know very well what the levels of contamination are inside the tunnel.

The other thing I would point out is that we have to remember that the radon associated with natural radium in the soil for purposes of calculation is not included in the calculation because it's not covered under the residual period. Only the AEC-derived radium

is covered. That's why Dave's model only went down one meter and didn't consider what would normally be about a picocurie per gram of radium in all soils or something to that effect. That's not included in this calculation.

Now, the measurement of 46, whatever they measure in the conveyor tunnel, would include natural radon as well.

DR. MAURO: I have a question. I guess I know we have had other discussions regarding the contribution of natural. And I remember some words to the effect that if you can't make a distinction between what is from the source and what's been natural, you have to include --

DR. NETON: That's correct.

DR. MAURO: So I guess I'm --

DR. NETON: For example, if you have an actual measurement, you cannot distinguish how much of that measurement was continued from --

DR. MAURO: With a model --

DR. NETON: With a model you can. The model does not have to consider all --

DR. MAURO: I've got it. Very good.

CHAIR ROESSLER: I think we're at the point now of unless somebody else has questions going to SC&A. And, as I understand it, SC&A, you have no problems with the mathematics? That's good?

MEMBER FIELD: Gen?

CHAIR ROESSLER: Let me finish the sentence. Then we'll get Bill.

-- and that you agree with their calculations with regard to the contamination, but it's infiltration you want to talk about.

But I hear a voice on the phone.

MR. KATZ: Bill?

MEMBER FIELD: Gen, can you hear me okay?

MR. KATZ: Yes, very clearly.

MEMBER FIELD: Okay. Good. I

just had a couple of questions. I was just wondering if in any of the calculations you considered the contribution of thoron at all.

MR. ALLEN: I caught every other word there. Can you repeat that, please?

MEMBER FIELD: I was wondering in your assessments of exposures if you thought about the contribution of thoron at all.

MR. ALLEN: No, we haven't.

DR. NETON: I don't think they ever dealt with -- did they do a calculation at Linde at all?

MR. ALLEN: No. I don't have any information that they dealt with thorium.

DR. NETON: Any thoron that would be present would be from natural sources. And that would not be covered during the residual period.

MEMBER FIELD: And I had some other questions about where you came up with your emanation fraction from the soil.

MR. ALLEN: If I remember right, I

just used one for lack of a better number. I'm checking to make sure I'm not lying to you here. That is correct. Okay. Yes. We just assumed it all emanated from the matrix, none of it was held up.

MEMBER FIELD: Okay. And just a quick question, how -- I'm just getting into this late. So I'm trying to catch up with a lot of information. The soil samples that were taken, how representative do you think they are of the area in question?

MR. ALLEN: Well, we did not -- I didn't get a chance to actually do a hard core type of analysis that I would like to do, which would have been to simply essentially separate the site into exactly where the tunnels are and analyze only the samples that are within about I'd say 15-30 feet from the tunnels, instead of the entire site.

We had everything in a spreadsheet. And it was too much to sort through in a timely manner. It wasn't huge

differences other than, you know, some of the high outliers were well away from the tunnels.

So we ended up just analyzing that and coming up with a 95th of essentially all of the site samples that were zero to three feet deep.

DR. NETON: Didn't you exclude some of the ones that were obviously dumped material?

MR. ALLEN: No. We excluded some that were in the original spreadsheet that were actually another site.

DR. NETON: Right.

MR. ALLEN: We would obviously exclude those. It's simply an error in the spreadsheet. But for everything else that was at the Linde site, we used all the samples.

Like I said, I would have rather used just those close to the tunnels themselves, but you have to actually grid out where each sample was. And there's quite a few. And I didn't get to that point.

MEMBER FIELD: And I guess, just like you were mentioning, you could probably measure this now, which I think would be a great idea to do, take current measurements, where perhaps you can control the ventilation, you'll know what the soil moisture is around the tunnel. I think that's a great idea.

I guess I'm -- what you mentioned before is that you really don't know about the conditions of the measurements that were made previously, how long, what the duration was, anything regarding what kind of detector was used. Is that correct?

MR. ALLEN: That's for the conveyor tunnel measurements? That's correct. We came across the one-page memo essentially. And it's just the results.

DR. NETON: That was not HASL at that time, was it?

MR. CRAWFORD: I didn't see an author of the measurements.

DR. NETON: We should be able to

determine actually what entity made the measurements. And, you know, there were certain standards that didn't exist at the time. These measurements were in micromicrocuries per liter, sort of in vogue at the time, instead of picocuries per liter.

I don't know if this was like an evacuation flask, you know, like a Lucas flask or --

MR. CRAWFORD: Right.

DR. NETON: I think that is what they were using primarily in that era at Mallinckrodt if I'm not mistaken.

MEMBER FIELD: What this sounds like is some sort of grab sampling.

DR. NETON: That is right.

MEMBER FIELD: It will be a very short-term measurement that may or may not reflect the long-term concentration.

DR. NETON: Good point. Yes, this is always the case now. You look and look for measurements, but then once you get them, it

actually raises more questions than it answers.

CHAIR ROESSLER: Anything else, Bill?

MEMBER FIELD: Not now. Thank you.

CHAIR ROESSLER: Okay. Are we ready for Bob's presentation?

MR. KATZ: Bob, do you need to hook up your computer to the --

DR. ANIGSTEIN: Yes. Maybe we can just take a five-minute break?

MR. KATZ: Let's take a ten-minute break because we have to hook up Bob's computer to the projector here. It's five after by my watch. So a quarter after?

CHAIR ROESSLER: Okay.

(Whereupon, the above-entitled matter went off the record at 10:07 a.m. and resumed at 10:21 a.m.)

MR. KATZ: We are reconvening after a short break. And we are just about to

hear a presentation from Bob Anigstein, who led the SC&A review, did Allen's paper on the tunnels.

DR. ANIGSTEIN: We begin with -- I would preface this, we only got Dave Allen's report on October 1st. So this has been extremely limited in terms of what I will be able to review.

And the first thing we did was to go over the model, go over the equations. So the first set of equations, which modeled the radon emission from the surface, surface contamination of the radium in the tunnel we have no problem with.

The equation is simple, straightforward. It is correct. We verified all the parameters. And they're all either correct or reasonable. But, you know, either they were documented or they're reasonable assumptions. So there is nothing further to discuss that.

The diffusion model is much more

complicated. As you can tell from Dave's presentation, the first thing we did, I did, was go through and actually solve the differential equation and derive the general solution.

I did come across something interesting, which is just a side note, that one of the conditions that comes out when you evaluate an integral and for this to get this, this is one possible general solution, one possible functional form.

And this functional form I'll have to go back and verify before I make it formal. Before I make a formal write-up, it's not in my report.

But the tentative version I made was that this is valid only if product, K1 times K2, is a positive number. Either K1 and K2 both have to be positive or both have to be negative.

So in the case of the symmetrical boundary condition, that condition is met.

And I believe that is why you get a well-behaved function, which makes physical sense.

With the large and the small source, it's not the case. And I think that's the reason why, not because there is anything wrong with the physical assumptions behind, but this particular function does not apply to that.

It's just an aside because we concentrated on the symmetrical boundary conditions. And the mathematics there is correct.

MR. KATZ: One pause. Let me just check and make sure folks on the phone can hear Bob well because I hear some feedback. So, Bill or Antoinette or someone, can you tell me if you're hearing Bob well?

MS. BONSIGNORE: I'm fine.

MR. KATZ: Okay. Good. Thank you. Okay.

DR. ANIGSTEIN: Okay. So much for

the math. In going on to the actual parameters, the actual input data, the detail, it's said the devil is in the details.

First question, first comment that we have is the radium concentrations that were used. And it was already talked about to some extent.

Now, okay. We have this drawing that came out. It was obtained during the worker interviews. One of the workers apparently took a map.

And then the red is his markup in ink and showing the location of the tunnels. And, of course, they go through the site, but one particular area is they are around building 30. Here is one that seems to be under the edge of building 30, another branch of it passing near building 30. So that seems to be.

And the reason I am interested in this is I was trying to identify the various areas because the document that I used, I

didn't have the database. I didn't have time to obtain it. So I looked at one of the site remediation -- just now identified it at -- what was the name of that? SRB-9026 was -- let's see if I can find the name of it.

MR. CRAWFORD: The entire document if you want it --

DR. ANIGSTEIN: Wait a second. I have it here now. Okay. This is the Bechtel remedial investigation report right here.

And that contains several tables with the radium concentration by area for the different areas on the site. So the one I could identify that made sense -- others I didn't know where they were, quite frankly. So I picked area 4 because area 4 -- this is from the Site Profile -- is, in fact, where building 30 is, the tunnels, or at least a portion of the tunnels are.

Also area 4 -- they had areas 1, 2, 3 and 4, among other things -- the average concentration of area 4 is significantly

higher. And the calculation I made was I took the 46, a much smaller number of measurement. There were 46 measurements.

And to obtain the 95th percentile -- and this is a mathematical statistical difference we have that was used by NIOSH -- the method that was in Dave Allen's report is to take the median concentration; in other words, simply add them all up, take the middle one, and then calculate the geometric standard deviation, multiply it by the usual 1.645, and add that to the middle guy, the median. And that gives you the 95th percentile.

That is fine if you have a true log-normal distribution, which so far I have never seen in all of the data in all of the different sites and studies that we have done for NIOSH.

I'm not the lead on this, but I've never seen anything that's really, truly log-normal. They're typically skewed towards the high end.

Now, the method that seems to me to be unbiased and makes no assumption is to simply do the rank order, simply list all the concentrations, all the measurements in order, and take the 95th percentile. If you had 100, it would be easy, it would be the 95th member.

And, actually, Excel, I just discovered, I didn't even realize it -- has a function that will tell you the -- you simply tell it the array on your spreadsheet. And then you can take any percentiles. If you put in .95, it will read off the 95th percentile.

So it is a very easy calculation to make. And it's also a valid one because it makes no assumption about what kind of distribution. Is it normal? Is it log-normal? Is it standard, whatever?

So in this case, on the data that I was using, using Dave Allen's method, I came up with 16 picocuries per gram because it was a higher level than the others.

However, using this rank order

method, it is 28 picocuries per gram. It is significantly higher. And to my mind, it is a more appropriate measurement.

Okay. Having done that --

DR. MAURO: I'm sorry, Bob. So you come up with 28 as the 95th percentile for the value for the model as input and the number that David --

DR. ANIGSTEIN: 9.5.

DR. MAURO: 9.5 versus -- okay. I just wanted to get that clear. A factor of three.

DR. NETON: Where were these values, Bob?

DR. ANIGSTEIN: Pardon?

DR. NETON: Where were these values?

DR. ANIGSTEIN: Forty-six in area 4.

DR. NETON: Where in relation to --

DR. ANIGSTEIN: Okay. Just a

second. Just a second. It was here. Here we go.

DR. NETON: And didn't you take a formal --

DR. ANIGSTEIN: This is area 4. This is the building 30. I don't have a single map. I have to go --

DR. NETON: Right. But --

DR. ANIGSTEIN: Just one second. So here we go.

DR. NETON: How do you --

DR. ANIGSTEIN: Here. I'm pointing at screen. Here are the tunnels. A lot of them are around, not all of them but a lot of the area is around building 30. And now --

DR. NETON: Your maps --

DR. ANIGSTEIN: Here is area 4. So area 4 is around building 30. Now, what I'm suggesting -- I want to preface this. I said the same thing about other studies that I have been involved in, like JSI.

I am not saying that I have the right answer and this is the model. I am simply pointing out there are alternate assumptions, which are reasonable and plausible, which give you higher values. And that would -- and the message is to refine the models, not to accept our numbers.

DR. NETON: I'm just trying to get a sense of where these samples were taken within area 4.

DR. ANIGSTEIN: I have no idea.

DR. NETON: I thought at one point --

DR. ANIGSTEIN: I don't have a --

DR. NETON: You had cited a bore hole value --

DR. ANIGSTEIN: I don't have a bore hole map.

DR. NETON: Under building 30 or something like that.

DR. ANIGSTEIN: One was under building 30.

DR. NETON: Right.

DR. ANIGSTEIN: They did say there was one measurement.

DR. NETON: That was one of the higher ones, right?

DR. ANIGSTEIN: Yes. The --

DR. NETON: Again, you know, are these really representative as well of the area? I don't know.

DR. ANIGSTEIN: I think that Dave's point, which he said they didn't do what he acknowledged, is that it would make sense to go -- to take the map and take the locations --

DR. NETON: Correct.

DR. ANIGSTEIN: Of the bore holes and create a belt of a few meters around the edges of the tunnels. And if you would use those, that would be more reasonable. Again, I'm just throwing an alternate assumption.

DR. NETON: Interestingly, could you show up your map of the tunnels again? It

appears to be somewhat different than the FUSRAP, the map that's in the 2002 FUSRAP.

DR. ANIGSTEIN: Oh, the problem here, I'll tell you what the problem here is, orientation. Just one second.

DR. NETON: No. It's not where you take it but the location of the tunnels in relation to the buildings.

DR. ANIGSTEIN: Okay. Here we are. Here are the same orientations.

DR. NETON: For example, you seem to have a building 30 tunnel going virtually underneath building 30.

DR. ANIGSTEIN: Well, all I know is --

DR. NETON: In the FUSRAP map, it actually goes kind of in the middle of the street between --

DR. ANIGSTEIN: Just a second. I'm going to the wrong thing here. I was trying to stand it on its side. There we go. Okay. This is what we have. This is what

the worker gave. This is what I worked with.

Again, this was a very quick -- I only had two days on this. So I didn't have time for a lot of data collection. This is not a thorough, thorough going -- this is not a typical SC&A product in which I'm involved, which is thorough and exhaustive and takes months. This was done in a week.

So here is where this particular worker showed the tunnels to be in relation to building 30. I did not have the -- I did not look at the map.

DR. NETON: Yes. The figure 1.1 -- FUSRAP report has a very detailed, well drawn map of all the tunnels and the contamination level that was in the tunnels.

DR. ANIGSTEIN: And where is this?

DR. NETON: Figure 1.1 of the January 2002 FUSRAP report.

DR. ANIGSTEIN: Okay.

DR. NETON: Well, they look somewhat a little different than --

DR. ANIGSTEIN: That's volume one?

DR. NETON: No. It's just a report. It's --

DR. ANIGSTEIN: I mean, I was using the --

DR. NETON: It's in the 2002 report, January 2002.

DR. ANIGSTEIN: Oh, is that the IT report?

DR. NETON: U.S. Army Corps of Engineers, IT Corporation.

DR. ANIGSTEIN: Okay. Yes. I'll refer to that, but I confess I did not look at it.

DR. NETON: There's a fairly nice detailed map of all of the tunnels and --

DR. ANIGSTEIN: Okay. I will certainly make note of that. As we continue, I will certainly make note of that.

So, anyway, so I'll go on now that we've explained that point. The other issue that I have is with the model itself, not with

the mathematics but with the -- did I just skip it? Enlarge it.

So here is my understanding of the model, of Dave Allen's model. We have the tunnel, which is two by two meters. And that's --

CHAIR ROESSLER: Bob, could we let the people on the phone know that I think you're on page 3 of your report?

DR. ANIGSTEIN: Yes, yes. That is correct.

MR. KATZ: Figure 1.

DR. ANIGSTEIN: I'm looking at figure 1. What I am looking at, pointing to is figure 1 in the report. So we have the two by two meter tunnel, which is a reasonable configuration because that is about the -- smaller than that, men can't walk through. And someplace in the IT reported a dimension that small.

The depth is taken to be 100 centimeters. The depth of the bore holes are

mentioned vary. In one place in the Bechtel report, the remedial investigation report, it talks about contamination being down to a depth of 2.7 meters. So I don't think it can be said that contamination does not go below 100 centimeters.

Also, I believe this must be an oversight. The area for infiltration is taken as if the contamination was only on one side and not both sides of the tunnel because it's -- and there's no reason why the soil -- even if it was 100 centimeters depth, it would not be on both sides.

And, furthermore, to be conservative, I would have the contamination on all four sides because the tunnel, first of all, is most likely not flush with the surface. It's probably somewhat buried. Otherwise it's not really a tunnel. It's a covered trench.

So we probably have soil on top. It might very well be contaminated. And if it

does go down as far as 2.7 meters, there could be soil underneath that is contaminated and certainly on both sides.

So if we accept the ten percent crack, which my comment is simply I have no idea whether it's a good number or a bad number -- I think it needs to be -- before you can use that in a model, there needs to be rationale. There needs to be some documentation, some literature or some explanation of why ten percent is a good number.

But since I have no other number, I have provisionally adopted it, accepted it, adopted it, even though I don't agree with it, necessarily agree with it.

And, therefore, I come up with an infiltration area, which would be per linear centimeter would be 80 square centimeters. Dave's is ten square centimeters because he said, "Okay. We take one linear centimeter along the length of the tunnel. We assume 100

centimeter depth. So one times 100 is 100. Then we take ten percent of that. We get ten." By the same logic, by going eight times that, I get 80.

Also, the higher concentration of the 28, the next thing -- and let me just go to the parameters. Okay. The next thing is emanation coefficient here is a very -- it should be consistent with the drawing, however, that seems to be unrealistic, .3 is a typical emanation coefficient used for soils.

It could be a little higher. Sometimes it could be much lower. It depends. Interestingly enough, it depends on soil moisture. If the soil is moist, the water in the soil tracks the radon coming out of the soil particles.

And, whereas, if the soil is dry and there is only air there, one soil particle is embedded in another soil particle and never makes it into the air. So you can get as low

as .1, but, anyway, I took .3 as the number.

The actual soil density, particle density, assuming that the final soil density is 1.6 -- this is just a little technical matter because it won't affect the outcome. The soil porosity of .6 is not a realistic number, .3 is a common soil porosity. And you end up with a particle density of 2.29. The two cancel each other out. So it does not affect the outcome and, as I said, the radium concentration of .28.

This diffusion coefficient is not a conservative, climate-favorable number. This happens to be the value in RESRAD-BUILD in the original RESRAD for soil. And basically the default parameters in RESRAD are placeholders.

The programmer writes a program. He can't run the program without having some numbers in place. So he puts in some arbitrary numbers. They're based on some reasonable assumption, but they're not

guidance. And the same, there is the -- put out by the same group. Charley Yu is the senior author.

The data collection handbook for RESRAD discusses the range of measured values and reported values of radon coefficient. And the one -- I came on this value because they had a value listed of 3.5 times 10-6 meters, meters squared, which comes out to 3.5 times 10-2 in centimeters plus/minus 1.5.

So if we take the 1.5 to be a standard deviation and we take the 95th percentile, multiply standard deviation by the magic number of 1.645, I get 5.67 as the 95th percentile diffusion coefficient.

Then, as I said, the area of being 80, the other number, this number is -- I'm just mentioning it. Actually, it's not in the calculations. I'll get the 80.

And, using these numbers and using the equation for the median for the symmetrical situation, which we have confirmed

to be mathematically correct, I get 293 rounded off versus the 26.

The main driver is probably -- well, two main drivers ought to be I guess all of these, but eyeballing it, it seems to be the area that drives it, the area is 80 times increased. And the concentration seems to be more than 8 times or 12 times.

Okay. Then the other issue is going back -- I am sort of taking these in sequence, but it is important -- is the assumption is that all the radon comes in from diffusion except on the walls of the examination walls. And this is I believe 1988. And this is a posting on the web from the Nuclear Medicine Society journal, comes from the Journal of Nuclear Medicine. And this is sort of their position paper on radon in homes.

They give you the contributions from various sources of the radon. The soil-gas diffusion is the smallest on average,

.1 to .2 becquerel per second coming in, the soil-gas diffusion. Soil-gas transport, we call a vector transport. Air flow could be as low as zero, or as high as six. So it could be potentially 60 times or even at the high end 30 times higher than the diffusion. Building material which doesn't pertain here.

So, again, I did a very simple-minded calculation. I said, well, you have this one-tenth of an air change per hour. Now, what if the tunnels were completely sealed, there were no -- all the entrances were sealed and weather-stripped and the fan is pulling and the only place the fan can pull that air is through the soil so you have essentially the air in the pores of the soil being drawn into the tunnel and that's the only source of air?

So eventually you will have the equilibrium radon concentration in the soil, the soil pores, will be the concentration in the tunnel. And if you make this assumption,

you end up with 45,000 picocuries per liter.

Now, I'm not saying that you can get that number, but I'm saying -- I'm just pointing out that you cannot neglect the advective transport because, both by observation and by this simplistic calculation, it can account for more -- diffusion is an extremely slow process. Advection is not.

An example I ran across a couple of years ago working, doing a study on the -- I think the issue has been long ago settled -- the K- 65 silos at Fernald. They were concrete. They contained a lot of radium.

If you look at the diffusion calculation, the radon never gets out because it's so slow that it decays. By the time it reaches the outside air, it's mostly decayed. And there will be very little radon. And, yet, the measurements of radon are much higher.

And the reason is you had day and

night, the temperature, the air gets warm in the daytime and cool at night, in the silo, which remains pretty much constant. So you would have pressure differences.

Part of the day there would be lower pressure inside than outside. Other times, another 12 hours, there would be higher pressure. The silo breathed, once a day respiration. And a lot of radon got out. Houses in the same way breathe.

And there is no reason to believe that the tunnels would not somehow also have pressure differences, whether it's diurnal pressure differences caused by the ventilation or whatever or the pressure differences that would draw the soil, some of the pore air, into the tunnel. And they could be a much greater effect than the diffusion.

Finally, which, again, would be a smaller effect, is the concept of the one-dimensional model. If there is -- I figured there was contamination on both, on

all sides. It would not go linearly, would not go just this way, this way, this way. It would go around the corners. There would be other areas.

Furthermore, if there are cracks, this is already a macroscopic phenomenon. The cracks have some separation. And the radon would not simply stop dead when it comes to this.

Let's say these are the cracks, cracks right here, and in between, there is solid concrete. What happens when the diffusing radon hits the solid concrete? It's going to diffuse up and down. It's not going to simply stop dead.

So you no longer have a one-dimensional model. You would have a two-dimensional up and down. And then there would be also -- there would be a Y. If this is the X component, you would also have a Y and a Z component. If the cracks are in the Z direction, you would have Y.

And then there would be the stratification -- Dave actually mentioned that -- they would have in the Z direction, whether this would give you higher or lower. Yet, some of it might diffuse out, but some of it also might diffuse downward and pass through this part. Even if you accept 100-centimeter depth, they might go towards this part of the tunnel.

So the one-dimensional model in my mind really is not bounding. It would be fine if you say, well, that is more bounding than a three-dimensional model. I'm not convinced. I think that remains to be seen. I recognize that it would be extremely difficult.

You probably could not solve the differential equation. You would have to do a numerical solution by mapping the field and doing computer simulation. And I, for one, wouldn't know how to do it, but I wouldn't want that task at this moment. But that is still another critique.

So I think that's pretty much -- I think I pretty much summarized this. Basically in this instance, we don't have the answers, but we have questions.

DR. OSTROW: Bob, could I ask a question?

DR. ANIGSTEIN: Yes.

DR. OSTROW: Crack size. You are assuming now, NIOSH's model assumes, ten percent crack fraction.

DR. ANIGSTEIN: Right.

DR. OSTROW: The result of the concentration, is that linear with crack fraction? If you assume there was no concrete whatsoever, in the extreme, 100 percent crack, would that multiply it by ten --

DR. ANIGSTEIN: Yes.

DR. OSTROW: The linear function?

DR. ANIGSTEIN: Well, let's see. According to the one-dimensional model, yes, it is linear with the crack.

Oh, yes, and the one thing I

forgot to mention is the concrete in between the cracks is not impermeable. There is a diffusion coefficient for concrete. It's about ten times lower than the diffusion coefficient for soil.

But seeing that the concrete barrier is relatively thin, I mean, we're talking about drawing in from a soil depth of, what, three meters. And the concrete would be a few inches, the most, you know, in the tens of centimeters. There would be somewhat of 90 percent of the uncracked concrete would still be conductive. So that's another issue with the model.

Plus, the movement, the movement around the soil, around the concrete pillars, let's call them, to get into the cracks would also be. So yes, I don't and we just don't feel that this model is a bounding, impact to bounding model.

Any other --

CHAIR ROESSLER: Does anyone have

any questions of Bob before we continue?

MEMBER LOCKEY: Yes. Bob, I have a couple of questions. I'm interested in the silo. The silos at Fernald are underground?

DR. ANIGSTEIN: No. They're above ground.

MEMBER LOCKEY: They're above ground. All right. So these tunnels are underground?

DR. ANIGSTEIN: Yes.

MEMBER LOCKEY: All right. And how would you have -- I just need to understand how you would have temperature fluctuation to allow the tunnels underground to breathe.

DR. ANIGSTEIN: Just in the soil. There might be temperature fluctuations in the soil more than in the tunnels. I don't really have a mechanism for that.

MEMBER LOCKEY: I can't imagine how underground how the temperature differentiates from the soil/tunnel, may

differ unless the tunnel is heated for comfort.

DR. ANIGSTEIN: Well, the air -- no. But the fact that there is a fan pulling air through the tunnel, that means outside air is coming through, not coming through the soil. So there would be some possible reason for temperature difference. And just the movement of the air itself would cause some pressure gradient.

I'm just throwing these out as possibilities, not as the hard fact. But yes, your point is well-taken. There is a difference.

CHAIR ROESSLER: It seems the bottom line to your report, Bob, is that SC&A has no problem with the equations nor the parameters for doing the radon doses from the surface contamination, right?

DR. ANIGSTEIN: That is correct.

CHAIR ROESSLER: Your problems all lie with the diffusion model?

DR. ANIGSTEIN: Yes.

CHAIR ROESSLER: And you have brought up a number. You said the map is okay, but you brought up a number of questions about the parameters there. Some of them seem rather large, and some of them seem quite questionable.

I guess the question for the Work Group and the people assembled is, where do we go from here with regard to those questions? Obviously SC&A has not accepted NIOSH's bounding on this. So if anyone has any suggestions, I would be --

MR. KATZ: It seems like DCAS should respond in a report as a first step.

MR. ALLEN: I was just going to say I would like to point out a couple of things. You know, one, it seemed like one of the biggest factors there in the difference between the numbers Bob was talking about what we got in the report was that factor of eight difference in the area, probably the largest

difference, I would guess, but I'm not positive on that.

That is assuming the same radium concentration all around the tunnel. The reason we used the top three feet or one meter was that was where the bulk of the contamination was. And we used samples that were in the top three meters or top one meter.

If you were to assume a uniform distribution, you're going to have to use samples that include those below that. And that does lower the concentration that you would use if you do any kind of statistical analysis on the samples.

I did do that. I ended up with a lower number. That's why I decided to keep the top one meter. And that cuts down to, what, about two, maybe three times, instead of eight.

Also I've mentioned before that some of the higher soil concentrations come from areas well away from the tunnels. And

they really shouldn't be used in a more robust type of analysis.

Neither Bob nor I accounted for diffusion into the air, which is also going to lower the soil concentrations considerably -- the radon concentrations in the soil.

And the thing that neither one of us accounted for because it is a more complicated model to do would be the rate of diffusion into the tunnel is proportional to the difference in concentrations, the radon concentration in the soil versus the radon concentration in the tunnel.

There is radon in the tunnel from surface contamination of radium. And that slows the diffusion rate down. That is not accounted for in the models.

DR. ANIGSTEIN: Correct.

MR. ALLEN: And if you simply multiply by the area that's around the tunnel, it is not a simple addition, even though that's what I did in here. In reality, the

higher the concentration in the tunnel, the slower the diffusion rate into it. You reach a maximum point. It will increase it, but it won't double it if you double the area.

All those things kind of go together to -- you know, if you get closer to reality, brings us to the numbers we got and the numbers Bob got closer to each other. And I think there's a number of things to indicate that we are conservative with a number of the assumptions, including not accounting for the emanation into the air, not accounting for the radon that's already in the tunnel.

The ten percent crack side, I agree that there's no basis for it other than I think we could probably get a structural engineer to say that's not going to be a -- you know, that tunnel is not going to stand for 20 years, if it has that much of an open area.

I think that's the bulk of what I wanted to say.

CHAIR ROESSLER: What you've done, if I understand it right, is you have taken all the things he discussed and kind of rolled them into one. You talked about his factor A that he said should be a great deal higher. Then you talked about a lot of other things. I think what you're saying is it all sort of evens out.

MR. ALLEN: I believe it would. If you account for everything in the most robust way, I think your numbers are going to be considerably closer. And it's going to be closer to what we have.

It's not a simple times eight the area. And the concentrations, you can't use the top three feet of the radium concentration. You'll assume it goes all the way down that level.

Like I said, we don't account for the emanation into the air, which is another big radon sink. And, again, the concentrations that are the largest are well

away from the tunnel, at least spot checked in some of the higher concentrations.

CHAIR ROESSLER: I think we need to get to ask SC&A whether they want to go through this one item at a time or how you want to handle it.

DR. MAURO: I just wanted to put out something that has been in my head. Really, from the very beginning -- and the thing which we didn't do but I have been thinking about, I wanted to play out the sophisticated model.

In my world, I deal with simpler models. And whenever I run into radon in soil, I ask myself a very simple question. I would like to hear from everyone around the table, certainly Bill on the phone, a different way to come at the problem. And it may not be a good way to do it, but it's how I think about it, which is a lot different. And there may be some value to discussing it, maybe not.

You know, I am just picturing that you've got the tunnels and you've got the soil to varying degrees from painting radium-226 around it. And we have a fan that air is being drawn out.

The air that is being drawn out is sucking out, sucking on, creating a negative pressure between inside and outside. The air that is coming out, some of it is going to be because it's drawing air in through cracks, openings, diffusion through the concrete or whatever. And certainly there are probably other openings to the atmosphere where air is coming in.

So what you have is you have radon coming in because there's a fan sucking this thing out. And you have clean air coming in, too. We don't know how much.

But I ask myself the question, okay. A very simple problem. We know from the diffusion coefficients -- tell me if I'm wrong about this -- the diffusion coefficients

and placing sort of an upper bound, doesn't that tell you about how far away from the outside wall of the tunnel, of the tunnel, where any radon that is produced can possibly reach the tunnel before it decays? Okay?

DR. ANIGSTEIN: And the base model actually shows and I confirmed that the center of the symmetrical contamination is three meters away.

And then you have -- that is the most you get. If you go beyond three meters, it levels off.

DR. MAURO: Okay. So let's say this is three meters. Okay? By the way --

DR. ANIGSTEIN: The center, the maximum concentration is at three meters.

DR. MAURO: Well, I'm asking a different question. I'm picturing a radon --

DR. ANIGSTEIN: It's comparable to what you're asking.

DR. MAURO: I want to -- it's the essence of how I'm thinking about it. Radium

decays. Pop. A radon atom is produced. And for the time being, let's just make believe it finds its way into the pore space. You know, I would like the one emanation coefficient just so we can talk about it. And now, boom, it's produced.

And now because of the delta P created --

DR. ANIGSTEIN: That's totally different. That's not this model.

DR. MAURO: Yes. Stay with me, though. Because of the -- well, I mean, that's the question I'm putting on the table.

Now, I had mentioned that I worked with Vern Rogers and Associates 15 years ago, where he was looking at this class of problems for homes. And I remember him reporting to you all distinctly -- I had to look through my deep, buried archives to find them.

And he was talking about a distance of about five meters, just bear with me, from the wall of the basement that -- if

it is more than 5 meters, that -- even though you have a delta P in the house, not because you've got a fan, there's just a natural -- especially during the winter, because of the temperature changes, you've created a delta P between inside and outside.

And his work said, well, any radon that's in typical soil -- of course, it varies depending on the kind of soil and a lot of parameters, but as a rule of thumb, he said that, you know, if it's beyond five meters, a radon atom that shows up. And it starts to migrate because of the delta P, not diffusion, because of delta P. It's not going to get there if it's more than five meters away. It's going to decay, turn into the short --

DR. ANIGSTEIN: You're basically saying that the radon moves at about a meter a day.

DR. MAURO: Okay.

DR. ANIGSTEIN: Because its mean life is around four days.

DR. MAURO: Okay. Well, I'm giving you a concept right now. So what that means to me if I was going to come at the problem, is if I know this is correct, whatever that distance is, every radon atom or perhaps 30 percent of the radon atoms, if you want to go with an emanation coefficient of 30 percent, is going to end up in that array.

So I've got picocuries per second -- okay? -- coming into that box. In other words, you know, assuming that, great, simple. It's an easy thing to do.

And, now, I also know that the air turnover rate is some lambda. Okay? That gives me the number of pure picocuries that are in equilibrium in the air in that tunnel. I've got to divide that by the volume of the tunnel. I get picocuries over here. That's how I would have done it if it's doable. That is much easier for me to understand because I --

DR. NETON: You are going to end

up with an extremely large concentration, I think, for some reason.

DR. MAURO: You would get an extremely large concentration. Is that right?

DR. ANIGSTEIN: Sure.

DR. MAURO: And, now, the reason you get -- you're saying that, in reality, this little movie I have in my head -- it doesn't work this way.

Okay? Okay. And the reason it doesn't work this way is because, what, there's a barrier preventing all of that radon? I mean, because in reality, this is what is happening.

You're saying something is preventing this from happening. Is the reason that you don't go out that far or is the reason that there actually is a concrete wall here, so you're not going to get -- it's going to prevent it from entering?

DR. ANIGSTEIN: We've got that. Remember, I did this concept on --

DR. MAURO: You did?

DR. ANIGSTEIN: Concentration over the phone for you.

DR. MAURO: Oh, okay.

DR. ANIGSTEIN: And we come out with taking all of that. Basically what we're doing is, it's the same as we took all of that radium, the five --

DR. MAURO: Right.

DR. ANIGSTEIN: And put it on the surface.

DR. MAURO: Right, lock it inside the box.

DR. ANIGSTEIN: They're saying every bit of it is going on.

DR. MAURO: It's coming in, yes.

DR. ANIGSTEIN: It's the same thing as if it was all inside.

DR. MAURO: Yes, sure. That's true.

DR. ANIGSTEIN: And you'll get in the tens of thousands.

DR. MAURO: Okay. So that just can't happen.

DR. NETON: It's an interesting exercise that came out to be two picocuries per liter, or something.

DR. MAURO: Then it would be okay.

DR. NETON: All of a sudden, it starts out. In a very broad-brush approximation, it's okay. You're okay. But in this case, it's --

DR. MAURO: And when you would argue what belies that is the fact that in this other tunnel where they did that, you're not seeing that. You're seeing something lower.

DR. NETON: Part of it. Part of it, yes.

DR. MAURO: Thanks for bearing with me. I wanted to get it off my chest.

MEMBER LOCKEY: If the movement is going to soil, what did you say, one meter a day?

DR. ANIGSTEIN: I'm just using John's -- I just did derive that quickly. John says that everything within five meters makes it.

And the mean life of radon is around four days. So, therefore, it takes four days to go five meters. So I just said meter a day.

MEMBER LOCKEY: Does it take four days to go through five meters of concrete?

DR. ANIGSTEIN: No, not concrete. Five meters of soil.

DR. MAURO: Once it hits the concrete, I don't know. I don't know. See, what I'm assuming is that there are no cracks and openings and porosity to the concrete. And if not, the concrete isn't there because --

MEMBER LOCKEY: Without it, there is no concrete.

DR. MAURO: Yes. And then why I would think that way is that there is a motive

force, right, like I was talking about before. Okay? It's going to start moving. If the atom comes in, it's going to fall where the delta P is sucking it in.

In other words, even though there is a wall here, if there are a number of cracks, it's going to find its way through the crack because there is a delta P. It's not that it's diffusing. See, if it was diffusing in classic diffusion, it would just be doing a random walk. It would bind into the concrete and keep walking.

But if there's a delta P, maybe it will be moving. It may -- and when it starts to approach the crack, it will bend and go through the crack. It will be sucked in to where the cracks are.

So, for all intents and purposes, if that's the way you think about the problem, there is no concrete there. If there is that delta P, it's going to bring it in.

But, then, Jim, correct me if I'm

wrong, well, Bob just said you came up to numbers that are off the charts.

DR. NETON: Yes.

DR. MAURO: And the fact is that if that were true, you would have seen -- you know, the numbers you actually did measure weren't that high. And in homes, the reality is, typical concentrations in homes are around one picocurie per gram out here.

And what they're seeing -- well, the highest you see is about, like the Watras home. Typically in homes, they're 10, maybe 20 picocuries per liter.

But this is how I was thinking about how I originally would have done it myself, but I bowed to your understanding of the problem.

It just can't be that high. It just can't be.

CHAIR ROESSLER: Chris.

MR. CRAWFORD: Gen, I just wanted to add some historical perspective that is not

talking about the model directly. I found in chapter 4 of the 9026 document --

DR. ANIGSTEIN: Right.

MR. CRAWFORD: Which is chapter 4 of the larger report --

DR. ANIGSTEIN: Right.

MR. CRAWFORD: That the deepest contamination found inside area 4 was 2.7 meters.

DR. ANIGSTEIN: Right, right.

MR. CRAWFORD: However, on a previous page, I found this, which is for a very similar bore hole, it's B29, R38, as opposed to R36.

DR. ANIGSTEIN: Say it again.

MR. CRAWFORD: There's another bore hole nearby.

DR. ANIGSTEIN: Yes, right.

MR. CRAWFORD: And the notation is this, "The bore hole gamma log reading showed that radioactive contamination may extend to a depth of 2.4 meters, as opposed to 8.7 -- 8

feet." Why? "The field log indicates that the radioactive contamination was moved to this depth during installation of the peak PVC pipe prior to gamma logging --"

DR. ANIGSTEIN: I saw that, right. But the other --

MR. CRAWFORD: And other results confirm that radioactive contamination in the area of B29, R38 does not extend to depths greater than 1.2 meters, the depth of the fill material."

DR. ANIGSTEIN: Okay.

MR. CRAWFORD: So is there some reason to think --

DR. ANIGSTEIN: Yes.

MR. CRAWFORD: That since the similar techniques were used at the same time, that, really, the contamination was carried down there in the process of taking the bore hole and lining it?

DR. ANIGSTEIN: Oh, I see. Okay. Okay. I'll accept that.

Again, I have to say I'm not saying I did a definitive analysis and I have the answer. I'm simply saying these are possible examples of where I find problems with the NIOSH report. But I'm not saying use 2.7 meters. I'm saying that there are --

MR. CRAWFORD: Yes. I just wanted to say that there is some perspective on that.

DR. ANIGSTEIN: Yes. I saw both those statements. And I just said, well, the 2.4 had an explanation. The 2.7 didn't. So I said that maybe that is real. But your observation, your point is well taken.

MR. CRAWFORD: Also, I have looked at some of the tunnel cross-sections. And the tunnel near building 14 is actually surface, in other words, the grade is the same as the top of the tunnel.

DR. ANIGSTEIN: I see.

MR. CRAWFORD: In other places, it's up to three feet below grade.

DR. ANIGSTEIN: Okay.

MR. CRAWFORD: So depending on what section of the tunnel --

DR. ANIGSTEIN: Sure. Well, of course, a thorough analysis -- I'm not saying we should make one -- would have to be, cut up the tunnel into pieces, look at the radon concentrations around each side, look at the actual model of the tunnel, look at the surface contamination in that particular region. And it probably would be like, what, a couple of man-years.

DR. MAURO: I've got something. I hear what you said about that, but the reality is there are homes where the concentration of radon in the basement is hundreds of picocuries per square liter, thousands. And so it does happen. And you have to ask yourself the question, what is going on?

You know, they know that the concentration of the radium in the soil and the rock and the soil is not high. You know, it's two to three picocuries per gram.

And all of a sudden, you've got these concentrations in the basement.

Now, I know that there are a lot of reasons for it. I believe in the Watras house, which I think was in the thousands, picocuries per liter, it was some type of the distance over which the radon was being sucked in was very large. In other words, there were cracks, fractures.

So whatever the radon was produced, I don't know how far out. It wasn't that it diffused through clay and somehow made its way to the basement. It was coming pretty far away. It was being sucked in, almost like you have pipelines out there, drawing it into the house.

So the reality is that, in defense of my little model, there are circumstances and they are not that uncommon where just normal levels of radium soil about the basements of homes could result in concentrations of radon inside homes that are

not that low. They can get pretty high.

So you can't just dismiss what I said that easily.

MR. CRAWFORD: Well, I'm glad you brought it up because the hydrology -- and we have good documentation here of hydrological studies in that area and specifically the Linde plant -- is that there's about three feet of fill or topsoil, you might say, on top of the ground. Beneath that is a layer of dense clay. And there's a lot of perched water in clay layers where it gets more impermeable.

So we know we're not in the kind of situation where diffusion is going to be easy. Clay soils are very, very slow.

DR. MAURO: Advective or diffusive, both. I mean, advective transport or diffusive transport.

MR. ALLEN: I would also like to point out that you --

MEMBER LOCKEY: I mean professional

courtesy.

DR. MAURO: I'm sorry? I can't hear you.

MEMBER LOCKEY: I mean professional courtesy.

MR. ALLEN: As a little side note, from what you said there, I mean, do you know the name of the guy's house from, I think it was Pennsylvania?

DR. MAURO: Yes, the Watras case.

MR. ALLEN: Watras? It kind of disagrees with what you said about it being common or not uncommon --

DR. MAURO: The reality is there is an enormous amount of data out there where the concentrations in people's basements are pretty high. Now, they're not up there with the Watras, but they're pretty high. They're in the tens to hundreds.

In other words -- yes, I'll give you a good example.

MR. ALLEN: I don't disagree, but

tens to hundreds is pretty much where we're coming out with a model. It's where the measurements are in conveyor. And those are unusual compared to most homes. I mean, there are thousands and thousands and thousands of homes that have been measured. And those are the outliers. Those are --

DR. MAURO: Yes, granted.

DR. ANIGSTEIN: The interesting -- to me what was interesting looking at the literature, it states that there was essentially no correlation between the radium concentrations in soil and the radon levels in homes because it is a scatter graph.

Obviously, it's logical, but obviously the radon comes from the radium, but the other, the lithography, is overwhelmingly more important.

And because I guess the radium levels in naturally occurring radium can't vary by more than a factor of ten, whereas, the values in the homes varied by --

DR. MAURO: Thousands.

DR. ANIGSTEIN: Many orders of magnitude.

MR. ALLEN: Well, I think that one of the two biggest differences between a home and a tunnel area is a decent amount of the radon can come into a home through the water supply and ends up being, emanating through the house when you take a shower or et cetera, that you're not --

DR. MAURO: Not important. And this is very, very unusual that high levels --

MR. ALLEN: But no. The ventilation that you see --

DR. NETON: The slab foundation of the house or the basement is a pretty huge -- the radium is coming all -- we don't have that situation here. We have the top.

We can argue what the depth is, but a certain finite depth -- and that's all it's going to contribute into this top. I think that's a very different situation.

Houses sort of create their own natural suction with furnaces and heaters and -- I don't know. I don't know how the --

DR. MAURO: The numbers -- I'm exploring. The numbers you came up with, you have ten picocuries per gram of radium in soil.

DR. ANIGSTEIN: 9.5.

DR. MAURO: And you have 30. So there is a very classic number that people use all of the time. It's picocuries per liter indoors in a basement per picocuries per gram of radium-226 in soil. Okay? And there are tens of thousands of these numbers out there. And the national average, that ratio was 1.24.

So, in other words, if you know you've got one picocurie per gram of radium in soil, infinitely around the basement, infinitely around the basement, your best estimate if you were going to randomly pick any house in the country is that the indoor

radon concentration on that base would be 1.25 picocuries per liter. Okay?

Now, there is variability. Variability is very large. What your number comes to -- I can easily say it could be easily 10 or 20, as opposed to 1.25, in some homes, not all homes, some homes, depending on the lithography, the delta P created in the house, and the fracture, the degree of fracture there is in the basement.

Now, what you're basically -- these are reality checks for me, weight of evidence kind of thing. You're using a number that's three, right? You're coming up with ten picocuries per gram. And you're coming up with 30 picocuries per liter.

DR. ANIGSTEIN: Twenty-six.

DR. MAURO: What's that?

DR. ANIGSTEIN: Twenty-six.

DR. MAURO: Twenty-six. Please. A factor of three. So your number is three. The national average for homes -- and I'm not

saying this is a home, but what I do is I try to always look at it from lots of different directions if your numbers ring true.

And I have to say, notwithstanding all the limitations of the model -- and I think that there are some very serious limitations of the model, the ones that Bob pointed out.

Nevertheless, the number you come out with, you know, 30 in relationship to the ten picocuries per gram at -- you know, the other measurement that was actually made in this other place, I have to say it sort of hangs together pretty nicely, notwithstanding a lot of the problems with the models, notwithstanding, you know, this is no robust analysis, but what this comes to is like a compilation of information that some places along the line, you say to yourself does it seem to ring true and make sense?

And I think, unfortunately, that is where we are with this problem now. We

have collected a lot of information, thought about it a lot of different ways. And does your number come into place where it seems to be there?

And I don't know what more you can do. I mean, Bob did a parametric analysis to look at other assumptions. And he's saying that, no. These can be ten times higher.

And you give good reasons. Well, not really. You know, if you did it, you know, if you really wanted to start to sharpen the pencil, maybe it's someplace between Bob's numbers and your number. And everyone --

DR. ANIGSTEIN: I also used a .2 emanation coefficient.

DR. MAURO: Right. So you took --

DR. ANIGSTEIN: Right there, it's lower by a factor of three.

DR. MAURO: Yes.

DR. ANIGSTEIN: And then the other factors overcome it.

DR. MAURO: Right.

CHAIR ROESSLER: So I think what Work Groups, what those of us who are on the Work Group, need to know at this point, we have had DCAS' presentation.

And we have had, John, your people's interpretation. And I think we're looking for -- and you had a lot of time to talk about it. And I think we're looking for SC&A's kind of conclusion.

But we do have a radon expert on the phone. And I think I would like to, if Bill is still with us, to have you give us your interpretation or conclusions from all of this.

MEMBER FIELD: I would be glad to. And I think a lot of points that were brought up have been very accurate.

One thing I just want to get back to is just I think it's -- you say you keep focusing on that this is not a home we're dealing with, this is a tunnel, and the behavior of radon entering tunnels or even

crawlspaces are a lot different than what you'd see in a home.

There are some measurements that I've performed in tunnels and worked with different industrial hygienists throughout the country. And where you see homes that have one or two picocuries per liter, it's not unusual to see several hundred picocuries per liter where the tunnels or wires run or pipes run. And every tunnel has its own character and own behavior depending on the air flow, obviously, and the surrounding soil and makeup there that goes into the tunnel.

The other thing, I agree that I think it's been 20 years since Nazaroff and others have shown that advection is very more important than diffusion. That's something that I think is that -- and we know that that is from the point of advection.

I think this is one of those rare cases where we have a source. And this would be the soil, just looking from the soil

contribution that's static. And radon changes over time. And from the perception of a soil-based source, the concentration of radon should be able to be reconstructed, I would think.

MR. KATZ: Bill? Bill? Bill? Can I just -- I'm sorry to interrupt you, but are you maybe speaking into a speakerphone?

MEMBER FIELD: No, I'm not. But I'll try to change the direction here.

MR. KATZ: Okay. Because your voice sort of comes in waves almost. We can hear it, but it's hard to follow sometimes.

MEMBER FIELD: Okay. I can try -- let me -- is this any better?

MR. KATZ: Yes, I think so.

MEMBER FIELD: I guess I was just saying, given the uncertainty in the radium concentrations in the soil near the tunnel and since we don't have historic information on radon measurements in the tunnel, I mean, from my perspective, it seems like the best way to

move forward, if we could, would be to sample of the radium in the soil around the tunnel and perhaps perform radon testing of the air in the tunnel. I don't think that it would take that much time to do this.

One of the things that is a very important constituent is the degree of soil moisture surrounding the soil surrounding the tunnel. I mean, that's going to, that can change the emanation in the tunnel by a significant amount.

And the other thing that was mentioned about the clay, clay can be -- when you're looking at radon, clay can work different ways. If you have clay and water underlying that, that actually impedes radon movement, but there are many glaciers which have clay soil that under dry conditions, they crack. And you could have movement of radon for tens of meters from the various sources.

If you have karst geology where you have cracks, it would have to be just two

meters. That could move by ten meters scooping the radon through soil under those situations.

So clay can work both ways. It can impede radon. But if you have cracks in it, it could also be a conduit to pump radon through. So I'm not sure we know the local geology around this, but it seems like if you have a constant source and the sources remain the same as the tunnels put in, the only variables are the ventilation rate in the tunnel and the soil moisture.

I would think the testing could be done and we wouldn't have to make so many of the assumptions that we're making right now.

CHAIR ROESSLER: So I gather, Bill, you're suggesting that some method to resolves this, that measurements need to be made?

MEMBER FIELD: Yes. I only say that because it's a static source. It's not like the source strength has changed over time

from the perspective of the soil. I mean, the contamination, it may be much more difficult to go back now and reconstruct what possible contamination there may have been over time.

But I think based on what was said, that this is just a tunnel that was used, not like some of the other tunnels that may have had higher contamination. Maybe that is less of a concern.

I think now, we can make measurements now that would be representative of past concentrations. But, then, you still get back to, no matter what the concentration is in the tunnel, it would be good to get some information on what the occupancy was, to come up with an actual exposure because right now we're just talking about concentrations. I don't think we have a whole lot of information about how much time was spent down in these tunnels.

CHAIR ROESSLER: I think we've brought up occupancy before. And I think

that's pretty questionable.

DR. OSTROW: Well, the occupancy is not really an SEC issue. It's a dose reconstruction issue. You know, after you determine the concentration, you can multiply by any occupancy factor you want to pick.

CHAIR ROESSLER: Good point, Steve.

DR. NETON: Up to one.

CHAIR ROESSLER: I think what we need to talk about here is, the final decision here is, do we delay a decision today and say that we're going to be doing more evaluations for more measurements or do we take what we have and go to the Board when we meet in Santa Fe?

I think some of the questions that come up or at least one question is, what are the implications of what we're doing here today on other time periods at Linde or other facilities? Is this the sort of thing that we need to pursue because there are -- because

other things depend on it?

DR. NETON: This is relevant with the SEC petition for radon for Linde during the covered period, which is actually being presented at this upcoming Board meeting.

And, of course, the tunnels were there during the covered period as well. I think we have incorporated this same model into that Evaluation Report that is being presented. As a matter of fact, it affects that.

MR. KATZ: One concern I have is, it sounded quite uncertain as to whether we could ever go and do measurements. I didn't really --

DR. NETON: Well --

MR. KATZ: What is the take-home message on that question?

DR. NETON: I think we have never been told no. Right now we have been getting sort of the run-around on authority to go in, but no one at this point has said "You can't

do it."

MEMBER BEACH: Well, the other question that comes to mind is the authority is one thing. But also, what is left of the tunnels? I don't think at this point we know what is left of the tunnels, do we?

DR. NETON: No. I think we know that there are some portions of the tunnels left. We don't know what are there.

MEMBER BEACH: And then we would have to agree on whether those are representative of what we're trying --

DR. NETON: I think if you could establish, if you knew what the soil contamination levels were around the tunnels that you were measuring, you could come up with some inferences.

I mean, if you know so many picocuries per gram in the soil around the tunnels that existed and then you go inside and you take a measurement, it's --

DR. ANIGSTEIN: What about

ventilation?

DR. NETON: Well, you would have to figure out something about the ventilation of the tunnels.

DR. MAURO: I think that, clearly, especially what Bill just said is that, you know, modeling this -- and I like models, but in this application, we know, boy, there are an awful lot of variables here that are just not very well-controllable kinds of things you would just describe -- because I was assuming even clay would be a nice barrier, but I think what I just heard was, even clay, if it dries out, creates fractures. And you could start to suck in radon from pretty far.

So, in other words, the application of a model to try to predict what might be inside a basement or a tunnel is a pretty tough nut to crack and to place a plausible upper bound. And measurements certainly would go a long way to bring closure to this.

But I also would point out that, you know, even the measurements I think would be one very important piece in the weight of the evidence, just as is this other measurement that we do have for this other tunnel piece of information that goes --

DR. NETON: Right.

DR. MAURO: Very strongly toward weight of evidence, in my mind even stronger than the model. And if we had some measurements in the tunnels themselves, notwithstanding there might be some problems, you know, how representative is it, are we catching it at a time, at the right time, do we take it up -- I mean, there are always going to be those questions.

So, in the end, we would certainly benefit if we can get some measurements in those tunnels. But I still think that we're still going to be having some discussion. Okay.

DR. NETON: Well, I also think

that it seems like a little more information about these circumstances of the conveyor tunnels that were there -- and I don't think we ever went to try to determine what the soil contamination levels might have been around those tunnels --

DR. MAURO: And whether they had a fan.

DR. NETON: And if they were ventilated.

DR. MAURO: Yes.

DR. NETON: I think we actually have the testimony of one of the claimants who claimed he was in the tunnels doing work. If that person were still available, he might be able to tell us whether there was ventilation.

And then, more importantly, I think to figure out -- or as importantly, what were the potential levels of soil contamination around there? And were the tunnels actually of the same thickness and everything? I don't know, but --

MEMBER BEACH: Jim, just let me ask you, what bearing would that have on the utility tunnels? Would it only substantiate the model or -- because the utility tunnels were not connected to the conveyor belt.

DR. NETON: No, but it would give you an idea of it's sort of a -- geology. Yes. The local circumstances are still there. It's buried in the same type of soil. If you knew the contamination levels and if you know the tunnel wall thickness were the same -- I hate to use the word "surrogate," but it would be a mock-up, essentially, of a potential of what would be in the tunnels.

If you knew the ventilation, is it existent ventilation, nonexistent ventilation, I mean, it's an underground passageway in the same environment as utility tunnels, as close as we could establish, if we could determine that.

And we know that the maximum values are 46 picocuries per liter. And you

could argue: okay, maybe there was no contamination of tunnels. Then that would support the fact that it would be higher. The highest it could possibly have been from diffusion into the tunnels would be 46 picocuries per liter if there were no internal contamination, that would put an upper bound on the diffusion of radon into the tunnel.

CHAIR ROESSLER: Antoinette has suggested that she would like to ask the workers if they used the tunnels. And there might be other information.

DR. NETON: I know there is at least one claimant that had indicated that he had done some work in or about the tunnels.

MS. BONSIGNORE: SC&A interviewed all the workers at the May Board meeting. They have all of this information.

DR. OSTROW: Antoinette, this is Steve. I don't remember anybody mentioning this conveyor tunnel. In fact, this is the first I've heard --

MS. BONSIGNORE: No, they didn't, but they may have a different term of reference for it, though. I have a meeting with the workers today. I will talk with them later this afternoon and ask them about this.

MEMBER LOCKEY: Let me ask you about, then would you go back and look at the core samples that were taken within five meters of the tunnel? Would that be -- you took the core samples and you used those core samples and compare those samples to the samples outside the conveyor belt tunnel? That seems to be very logical to me.

DR. MAURO: I think also, as Bob pointed out, the relationship between picocuries per gram in the soil and the concentration inside, whether it's a tunnel or a basement, is not very reliable. In other words, so it's these other parameters, the geology, the hydrology, the lithography. So if the soil -- in other words, if the place where --

MEMBER LOCKEY: They're the same.

DR. MAURO: If they're both sitting in a place where, for all intents and purposes, they're an awful lot alike, what you have just done is gotten one big variable out of the way.

MEMBER LOCKEY: Right.

DR. MAURO: Then say, "Okay. Listen, we're talking about" -- because if you find out they're very different, let's say you go in and say, "Oh, my goodness. This is sitting all in gravel, and it's a different type of soil, different set of conditions. It's at some distance to where the tunnel is," well, all of a sudden, the weight of evidence goes against this other tunnel as being useful to you.

But if, all of a sudden, you find out, yes, you know, it looks a lot -- even though the concentration of radium might be different, we've got to -- yes, it looks like it was a little bit higher near this tunnel

than that tunnel, then you can deal with that.

But if the lithography is substantially different, I don't know if we could deal with that.

MEMBER LOCKEY: So that's what I was looking at. But if the soil is the same, then you --

DR. MAURO: See, that's the whole thing. That's what is the -- if you wanted to do an -- in fact, I remember reading this -- an analysis of variance, what are the things that caused the variability between these things -- and the least of which was the radium concentration. It was these other parameters that drive the uncertainty in predicting what might be the concentration of radon in a location.

MEMBER GIBSON: I guess from the other side of this, I would say how many times are we going to go back and look for more information to try to refine the model, to try to see if SC&A's model and OCAS' model can get

closer together?

When are we just going to say the exposure data isn't there and make a recommendation that we disagree with NIOSH's?

CHAIR ROESSLER: Mike, that's a good point. I was going to come to you and Josie next because, you know, as a Work Group, we are the ones who are going to make a recommendation to the Board.

And my question to you was going to be -- and I think you have already brought it up -- would doing, delaying this, going forward, and doing more measurements, doing a better resolution, would this change your conclusion?

MEMBER GIBSON: To me, it's still just -- both groups are creating a model because there's a lack of data. They go get more data or more soil samples and stuff to try to get their models closer together. That doesn't tell me that the -- because the workers' exposure data is not available.

You know, I don't know that I would agree with an upper bound, even if we do take more measurements.

CHAIR ROESSLER: That's what I conclude you would probably do. However, I sort of hesitate to go to the Board myself and make a presentation and say that we still have some areas that aren't resolved.

I think from the scientific point of view, particularly since this may impact on other -- certainly on another Linde time period. And I don't think I got an answer, will this type of discussion impact other facilities?

If those things are true, then my feeling is that we have to continue and try to resolve them.

MS. BONSIGNORE: If I could just bring the workers' perspective into this for just a moment? We are very confused as to why it's appropriate to actually go out and gather new radiological data.

If you are making an assessment that the data that you have right now has too many variables or there is too much uncertainty or there are too many assumptions being made, the way to cure that problem is not to go out and find, to actually collect, new data. That to me seems completely contradictory to why the SEC program exists.

If you don't have sufficient data, the answer is not to go out and gather actual new data samples from the site. The answer is to recommend the approval of the SEC.

I really don't understand what is going on here. And the workers are, quite frankly, really distressed as to what is going on within this Working Group.

I think you're working from a perspective of you have to figure out how to create a model. That is not what this program is for.

You're not supposed to be favoring creating models over SEC approval. You're

supposed to be evaluating this petition on its merits based upon the data that you actually have right now.

CHAIR ROESSLER: Antoinette, I have an answer to your question, but I see John Mauro also would like --

DR. MAURO: Well, in the six years, this is the first time I know of where going out and making a measurement now might add some important value.

And it's not -- I don't like the model. Okay? I mean, here's the -- I don't like the application of models to this class of problems. I liked it for Blockson. I don't like it here for the various reasons that became apparent during this discussion.

What I do like is measurements. And here is the one place, one time, where we could actually go make some measurements perhaps. Now, there will be some problems with the measurements because of -- there are things going on.

So I guess, Antoinette, and I usually don't step in at this point, but we're not -- I don't think we should be depending on the model. I think we should look at the measurements made in the one tunnel and convince ourselves the degree to which there is parity between the setting in the tunnel where we do have measurements. And is it reasonable to assume that those measurements made in that tunnel seem to be more or less representative of what we might expect to occur in the tunnels of interest?

But even that, I would say we could do that. And that goes towards weight of evidence. But, boy, would I like to see measurements made in the actual tunnels, now, notwithstanding the fact there may be some limitations. And I'd like to have a full appreciation of what those limitations are.

And then we will have information that will put us in a place where we are not depending on models, we are depending on

measurements.

And the only question becomes, are those measurements sufficiently complete that we could feel comfortable that we could apply them to the exposure that some of the workers might have experienced back in 1954? And that is the question we are going to have to answer.

And we will not be depending on models. We will be depending on whether we think those measurements can be trusted.

MEMBER BEACH: And at this point, we don't --

MS. BONSIGNORE: With all due respect, John, I don't feel and the workers certainly don't feel that the intention here is to figure out how to recommend the approval of this SEC.

Their feeling is that everything that is going on here is a policy that favors the individual dose reconstruction over SEC approval, that that is the policy, that is how

you approach these evaluations, and that if you go to the site next week, next month and collect data, you are only looking for further justification to recommend the denial of this petition.

CHAIR ROESSLER: Antoinette, as I look at this, I think in order to recommend an SEC, we have to be convinced that dose reconstruction cannot be done. From what we know, if we know enough about the source term, if we know enough about description of activities and various other things, and can come up with bounding numbers that we all feel are very conservative, very much in favor of the claimants, then I think we say that dose reconstruction can be done. That is the criteria I am looking for here.

What I think I am hearing is that in order to really resolve this, we need to explore these measurements. And I think Josie's question about timing, though, is really important.

And I think before we even go there, I think we need to look at when can some soil measurements be done? What if you could get into the tunnels?

I think, Jim, you mentioned that if you were to use the electrets -- what is it they're called? -- dosimeters to make these measurements, that that might take weeks.

I don't think that's true. I think there are some electrets which you can use; you can get a result in a couple of days.

DR. NETON: Well, I think it depends on how long you want to integrate the measurement to get a --

CHAIR ROESSLER: But if you're looking for kind of a --

DR. NETON: High point, yes.

CHAIR ROESSLER: Yes.

DR. NETON: You're right. We could --

CHAIR ROESSLER: An upper bound sort of thing, I think that could be done more

quickly. I think we're now looking to NIOSH to give us some advice as to timing. I think timing is what you were going to bring up.

MEMBER BEACH: Well, we had asked for this three months ago. So, so far it's been three months, and we still haven't got a yes, we can go in and do it. So --

DR. NETON: I mean, to our credit, we did send a letter out in August. And we just got a response back.

MEMBER BEACH: I understand that.

DR. NETON: So we've established communication, I guess. So it's started. But I can't predict how much longer it would take, if we could get agreement, and if we could, how long it would take.

MEMBER LOCKEY: Are there really two avenues here? Is the one avenue looking at the core samples that are currently available and putting them on the grid and comparing the conveyor belt core samples to the tunnel core samples?

Is that, in itself, enough data or then is there a second step that you would say, "Well, we're going to use that data, look at a model," then that's a good sample, see if it fits what the model shows based on looking at the core samples that are already obtained?

I'm not saying -- I don't think it's a good idea to go back and redo core samples, but looking at the core samples that are already there, look at the ones that are five meters from the tunnel. Look at the ones that are from building 30 and comparing them to the measurements that are in the conveyor tunnel versus what in 2002, what the model shows for using those samples to come up with what the exposure levels potentially could be within the tunnels.

DR. NETON: I mean, that is doable without any additional measures.

MEMBER LOCKEY: It seems to me that that is doable. And I am going, John, back, John, to what you said. If the soil

sample levels outside the conveyor belt areas are known --

DR. MAURO: Known.

MEMBER LOCKEY: To some degree.

DR. MAURO: I don't care that they're different.

MEMBER LOCKEY: No, no. Then you --

DR. MAURO: And you also know that the characteristics of the soil are similar and this is a judgment call are similar, you have created -- and the two answers to those become yes, we have that. What I have done is I think you have done as many great strides in building the weight of evidence that you can trust the measurements made in the conveyor tunnel.

Now, on top of that, though, I would say still I think that different individuals have different thresholds. How much evidence do you need to convince yourself you have a boundary?

I would say that if you also pulled some air sample measurements enough that you could characterize the radon levels today in the tunnels we are concerned about, well, now you have built the weight of evidence that's becoming pretty weighty.

MEMBER LOCKEY: It's a two-step process.

DR. MAURO: It's two steps.

MEMBER LOCKEY: And I am very supportive of looking -- of course, the core samples are already done -- putting them out in a grid, looking at them, and making that comparison. And while that is being done, there can be a parallel step to see how easy it is going to be to get into the facility.

But I don't think we should delay this for umpteen times in the future because I know the politics of trying to get into a facility.

And people don't want you in. They'll just give it to the legal counsel.

And that will go on forever. I think that's a bad idea.

CHAIR ROESSLER: Ted has a suggestion.

MR. KATZ: Well, go ahead. I mean, go ahead, Josie.

MEMBER BEACH: I was just going to say then you get right back to the model, NIOSH's model. And SC&A has already clearly said they don't agree with it. So what do you do with the model if you're going to put those measurements in? And the basic model we don't agree on are --

MEMBER LOCKEY: We've taken care of -- most of the variabilities that are in the model are going to be taken care of at the soil samples and the soil consistency is the same.

DR. MAURO: I would throw the models away. I mean, I don't like the models.

MEMBER LOCKEY: Yes.

MEMBER BEACH: So that would take

--

DR. MAURO: Yes. So I want data. I want data that says, listen, I --

MEMBER LOCKEY: And so if the contamination outside the tunnels are equivalent to what -- we have actual measurements where there was radium rock being transported. And those are relatively high values. So you could say this is the worst case situation.

CHAIR ROESSLER: Ted?

MR. KATZ: I have some thoughts just for you to consider. I am concerned about the actual feasibility of going in and taking measurements, as to whether that would come about given because, as somebody said here, I know it's true. You can think you're at the doorstep and it can take six months. That happens all of the time when they are doing epi studies and so on. It can take --

MEMBER LOCKEY: Years.

MR. KATZ: And I am concerned also

with Antoinette's point about going on and on and developing data, as opposed to making judgments based on what is on the table.

And I am not saying to you that it's not okay to do that, to go get more. I am just saying that I am concerned about it, though, about given that this has been a lengthy process already as well.

And so I am wondering if one sort of way of possibly satisfying these tensions might be you have until November to do some things that you could do, at least with data in-house and also to inquire, at least, about accessibility. I mean, that would already put you into middle of November but about planning, in any event, to present.

So, in other words, sort of develop your point of view. And it sounds like we're probably going to still have a Work Group that has different perspectives, as opposed to one perspective, on this, but develop your point of views, looking for the

November Board meeting ahead. Plan to present on that and explain.

One thing I think I need to say to Antoinette in this discussion is I know some of the pressure you feel is that you have knocked out so many issues at this site that you have put to bed, in effect, and now you have this one remaining thing. And you sort of hate to leave this one remaining item incompletely addressed when you have knocked out so many. And I understand that pressure, but, then, again, there is still this timeliness matter.

And so you could present to the Board based on whatever information you have at that point in November. You could also explain to the Board, you know, what you have knocked out already as well as this tunnel issue and how this tunnel issue sits at that point. And whatever prospect you have at that point, you could explain that all to the rest of the Board. And they could help you take

into consideration what do you do from here, do you actually go for more or do you actually then establish a Board decision based on the information that is on the table at that point.

I don't know, Antoinette, what your perspective is on that proposal, but --

MS. BONSIGNORE: Well, we want this over with. We want --

CHAIR ROESSLER: So do we, Antoinette.

MS. BONSIGNORE: We don't want any more surveys. We don't want any more delays. We don't want to be told that you're still searching for documents. This is absolutely insane at this point.

MR. KATZ: Right. So that's what I thought you felt. In this way, I mean, at least, then, the judgment as to whether you go and get more information at that point in November is a judgment of the whole Board. It doesn't just rest on your shoulders.

And if the judgment of the whole Board is we want more information, then you have the debate based on what is already accomplished by November.

DR. NETON: I have a brief update from Stu. He just sent me an email. He just spoke to the site manager at Praxair. And she's asking the Corps to see if they can dig up any radon data they have from the tunnels.

Unfortunately, the Corps had changed contractors this spring. And they're not familiar. No one on the project is real familiar with what data had been collected. So they're going back to the previous contractor.

So that's ongoing. It may be. And it would seem likely to me that someone would have taken measurements in the tunnel at some point. So that is ongoing right now. Stu has got that put in motion.

She has also indicated that the building 30 and the tunnel that runs beside it

have been demolished. They are no longer there. Some of the other pieces after what's called junction 4, which is sort of right by building 30, are still there, but they are undergoing active remediation. And some pieces may have been removed for decontamination.

The situation is changing rapidly there. It may be that there might not be enough representative stuff left there to survey. But I think this directive that she put to the current contractor to go dig up radon information I think is important.

CHAIR ROESSLER: And I think what Ted has just said is really important, that we probably should just take this to the Board for the decision. I think that is going to happen anyway because the way I have seen this Work Group work and the way we have voted before, it will probably be two to two. I am assuming that, which means that, in any event, we would probably go to the Board with a

report and maybe a minority report is what I had thought we would do. And this has happened in other situations. And then the Board makes the decision.

The thing I would like, though, that is a little different here -- I will wait until I have John's attention.

DR. MAURO: I'm sorry.

CHAIR ROESSLER: I think what Work Groups depend on a lot is this whole interaction between DCAS and SC&A. And I think Work Groups put a lot of weight on SC&A's final decision.

I think if you were to say, if SC&A were to say, at this point, yes, I think NIOSH can bound the doses, then I would feel comfortable going ahead with the report that I would make. And then I think we would have a minority report.

But at this point I don't think I see that quite from SC&A. And I guess I would want to have just a little more time, like Ted

suggests, between now and the Board meeting in November to see what NIOSH can find out and what SC&A can weigh-in on that and at least give us some sort of, give the Work Group some sort of, SC&A yes or no or yes if, decision by that time. And I would feel comfortable.

MR. KATZ: Well, just to be clear, though, there's very little opportunity for another Work Group meeting.

CHAIR ROESSLER: I know.

MEMBER BEACH: That was my question. Would we do this via email or would we --

MR. KATZ: I mean, it would not be via email. This is really too important for this to be something that is not handled in a Work Group meeting if it's going to be -- I mean, it's one thing if you're just saying to SC&A, you know, "If you're saying to DCAS, you know, see what you can get done between now and then and then report to the Work Group and SC&A and SC&A cogitate over what results from

that and make up your mind in time for the Board meeting," that's fine. And that could be a technical call for technical issues.

But if there's going to be dialogue, discussion that is sort of substantive on what judgment SC&A is coming to before the Board meeting, that really needs to be done in a Work Group setting.

MEMBER LOCKEY: You know, I am going to go back to what I suggested before is that the core samples are available. All right? Why not map them out and have the two groups look it? And then we'll go with the weight of the evidence based on those.

And we can handle that just by hearing the results by a conference call. There won't be a discussion. It's not really much change other than, this is what is outside the tunnel in the conveyor belt. This is what is outside the tunnels in the rest of the facility.

DR. MAURO: But that goes not only

to the radiological concentrations but also the characteristics of the soil.

MEMBER LOCKEY: That's correct.

DR. MAURO: Yes.

MEMBER LOCKEY: That's correct.

DR. MAURO: Absolutely.

MEMBER LOCKEY: And I think that is doable if that information is available. And that is doable in the time frame we're looking at before the Board. I think we don't have to delay to have --

MR. KATZ: We could do that through a conference call.

MEMBER LOCKEY: Yes. And that could be handled through a conference call. It may be that we come up with the same conclusions that some people think that's not adequate for dose reconstruction. Other people can say the weight of the evidence is such that under most scientific conditions it is adequate. But then let the Board decide.

MEMBER GIBSON: One of the

frustrations I have though, if that data is available and we're sitting here in this process well over a year now, why has it not been used yet?

I mean, I don't care whether in our recommendation to the Board on this or whether it comes out of the Worker Outreach Group, there is the issue of timeliness as far as dose reconstructions and data.

DR. NETON: We just found this radon measurement like two weeks ago. We had no knowledge of this radon measurement until a couple of weeks ago.

MEMBER GIBSON: I was under the impression you had it longer than that.

DR. NETON: The measurement came about after the model was developed, Dave's model.

MEMBER GIBSON: How did you come across it?

DR. NETON: ORAU found it in a survey for another site. They were reviewing

some data for I forget which -- ElectroMet.

MEMBER GIBSON: So it was in a government database, but it had not been sought out before?

DR. NETON: It was in an ElectroMet report. And they said, well, there's no tunnel in ElectroMet. What is this all about? And it turned out they had done an ElectroMet survey and a Linde survey sort of in one path. And it was embedded in that. That's how we found it.

MEMBER GIBSON: When all of the data gathering things went on for this particular site, it had not been ever up in any searches or --

DR. NETON: No, no.

MR. KATZ: This happens all of the time. I mean, people are constantly stumbling into data for other sites in unexpected places. It's sort of part of the problem with disposition of records in this whole program.

CHAIR ROESSLER: And I don't think

we should totally -- that's just my view -- drop this modeling. I mean, this has been a very well constructed effort to come up with some bounding. And the way I see it -- and I don't think we have enough time to really discuss the details of it, that there may be more agreement on this modeling than we really realized.

Bob brought up some things. And Dave responded. And my conclusion from what Dave said is that some of the things may be higher, some are lower, and that it probably all comes out to the same value.

And so I don't think that we really should throw that out.

DR. MAURO: The only reason why I said I bound is that advective transport, which is not treated, is the single most important factor that drives the buildup of radon inside basements and in tunnels.

Now, that being said and, plus what we heard from Bill, advective transport

is driven by some very, very subtle differences in the characteristics of the soil, the fracture, particle size, water content.

And you can't get -- in other words, my experience in reading radon literature for many, many years is that one thing you really can't do is model the buildup of radon in someone's basement.

In other words, people measure radon in my basement. And they can measure it in another development. It's going to be completely different because the variables are, you know -- so modeling radon buildup doesn't work for the reasons we -- I don't think it was a bad thing that we went through this exercise. I think it revealed the difficulties in trying to model radon.

Others may feel differently, but I mean, this is what I walk away with.

CHAIR ROESSLER: Well, I think we should hear from Dr. Field on this particular

aspect.

MEMBER FIELD: You're talking as far as modeling radon?

MR. KATZ: Right.

MEMBER FIELD: I think it's very difficult to do myself. As mentioned, there are just so many factors to model. And what we're working with now, we're working with on the radium concentrations.

But I think what was stated before, that what is important is what kind of ventilation there is within the structure, what is the soil porosity, what is the underlying geological characteristics. And these things are very difficult to model in my opinion.

MEMBER LOCKEY: Bill, it's Jim Lockey. If we go back, as I suggested, and look at the core samples that have already been done along the conveyor belt in building 30 and along the tunnels within five meters, looking at those core samples and looking at

the concentration in the soil type, is that worthwhile doing?

MEMBER FIELD: Well, I guess you're asking me personally. I don't know if it would be enough for some Board Members, but if you have that information, I guess my own personal opinion, I am still somewhat skeptical that you may be able to do a reasonable modeling with that information.

DR. MAURO: Could I add one point? I wouldn't be doing collecting the data so that I could model. I would be collecting the data to see if the characteristics of the soil in the vicinity of the tunnel that we do have a measurement for, some measurements for, is similar.

So measurements made in the tunnel where we have data can be assumed to be bound, bound, to concentrations you might expect in the other tunnel where we don't have data.

MR. KATZ: Could I ask a simple

question? Is there someone who knows about geology, but is it likely -- is it that geology would be highly heterogeneous within 100 yards? I mean, we're talking about the same site all the same.

I mean, it's like a couple of baseball fields we're talking about here. Is it reasonable to expect that you would have very different geology all in the same ballpark?

MEMBER LOCKEY: If they use backfill and use gravel against the tunnel walls, that's going to be different than if they used clay.

MR. KATZ: Right. But in terms of what Bill was talking about, clay fracturing and then conducting, you know, air under the soil and so on at assumedly the whole site, had the clay bedding and so on, I am just sort of curious that it just seems a little odd here that the tunnel and the building are basically cheek by jowl.

MEMBER LOCKEY: Are what?

MR. KATZ: Cheek by jowl. They're approximate to each other.

DR. ANIGSTEIN: I would have a question for Bill. And that is in terms of the clay, would there be seasonal or annual differences depending on rainfall? Wet clay if it's optimally wet is an excellent barrier to diffusion. And dry clay is not.

MEMBER FIELD: I think you described that accurately.

MEMBER LOCKEY: And maybe the important thing about that is that the core sample that is taken under building 30 is going to be in a dry area. So that really is going to be a worst case situation.

MS. BONSIGNORE: May I ask a question from someone in DCAS about the other Linde petition that you are planning to present at the November meeting?

There isn't an ER yet for that. Are these discussions about the residual

radiation petition going to affect the conclusions you reach for the ER for the other petition?

DR. NETON: Yes, yes, because the tunnels existed during the covered period as well.

MS. BONSIGNORE: Yes, I know. So you say you're going forward with the other petition in November, but there is no ER yet.

DR. NETON: Well, maybe I spoke prematurely. The ER is being worked on. I think it's our intent to have that ER presented at the upcoming Board meeting.

MS. BONSIGNORE: But in order to do that, don't we have to resolve this here and now for this petition?

DR. NETON: Well, they're going on in parallel.

MS. BONSIGNORE: I mean, they're inextricably connected here. So you can't go ahead with one without making decisions about the other.

DR. NETON: Well, it could be presented. The same issue would exist under both ERs, yes.

MR. KATZ: Antoinette, yes. The bottom line is DCAS can make up its mind and put out a report. It doesn't mean that it has the support of the Work Group or anybody else, but --

MS. BONSIGNORE: I understand that. This is becoming increasingly difficult for me to understand what is going on technically. And when I speak to the workers this afternoon, they are going to have a lot of questions, questions that I can't answer because this process has become so incredibly opaque it's, quite frankly, becoming -- you know, it's bordering on absurd because they don't understand what is going on. They don't understand why decisions are being made.

You know, it's really very unfair to them because they have a right to understand why you are making recommendations

or decisions based upon models or core samples or whatever. And, you know, there is really no avenue for them to understand what is going on.

MEMBER LOCKEY: I think what I am struggling with is that we have some sampling data from perhaps a situation in the conveyor tunnel that may be a bounding sample for this particular exposure. But I'm not sure until I know what the soil sample and the soil consistency is around the tunnels versus comparisons around a conveyor belt.

MS. BONSIGNORE: I'm sorry. Who is speaking?

MEMBER LOCKEY: Jim Lockey.

MS. BONSIGNORE: Okay.

MEMBER LOCKEY: So those samples are -- if the soil samples are similar and the radon concentration around the conveyor belt is equal to or greater than what is around the tunnels, then the actual measurements that are taken within the conveyor tunnel probably do

bound the upper limit in relationship to radon exposure.

MS. BONSIGNORE: Dr. Field has been saying that, from what my understanding was, that he doesn't believe that it can be bound.

CHAIR ROESSLER: No. He is questioning the modeling. These would be actual --

MEMBER LOCKEY: Yes. This is not -- these won't be used in a model. These are just verifying that the actual sampling data from the site is truly an upper bound limit for tunnel exposure. It doesn't have anything to do with modeling.

MS. BONSIGNORE: Okay.

CHAIR ROESSLER: Would there then be questions, though, about the construction of the two different types of tunnels? Have we resolved that?

DR. NETON: I don't know that we know the exact construction of the tunnels

themselves.

CHAIR ROESSLER: I'm just trying to anticipate what might come up to give us further delay.

DR. NETON: Yes.

DR. MAURO: And I would say that is one of the reasons you really would like some measurements in the tunnels of concern, especially if there is some historical data that is available. And in the end, they are going to have that problem, yes.

Let's say there are walls in the tunnel. And, of course, one of the very -- for example, my neighbor's house, my house, we're sitting in the same hill. Okay?

Now, I have different kinds of fractures and cracks in my basement and a different delta P because of his ventilation system. In other words, that's another variable, you see. So this is not a walk-away.

MR. ALLEN: Unless one of those

basements had a bunch of uranium ore in it, it is going to be the higher one.

DR. MAURO: Oh, I agree. Ore. I agree with that, even though we both have the same geological and radiological characteristics in the soil. That's why people go in and seal their basement. They go in. And they seal it. They put a sub-slab ventilation system in and boom. The radon problem goes away.

MR. ALLEN: To keep from getting --

DR. MAURO: So yes, walls will be important. And that's why that -- you know, so yes, if we had more information, the weight of the evidence ought to build nicely and say, "Well, maybe those measurements made in the other tunnel could be helpful, but there will be questions. You know, there still will be questions of the nature regarding the structure of the tunnel and the ventilation in the tunnel."

So in the end, you know, certainly the thing that might get us to where we might be able to make some judgments, the historical measurements that were made, maybe not the ones that we made now, that might be off the table.

But if there are some historical data back there, I, for one, if they show up with radon measurements -- I don't know -- some years ago, whenever the previous contractor was in, now we're talking about some really hefty weight that will help us make some judgments.

CHAIR ROESSLER: Well, Ted suggested that perhaps we could have some time for -- I see three things on the table that could be done -- that we pursue that and see if we could have a Work Group teleconference before the Board meeting. Is that feasible? Do we have time to do that?

MR. KATZ: It's difficult because there are actually very few dates open, even

for a teleconference. But I know we have another Work Group that is setting up, two other Work Groups that are planning to have teleconferences.

So those days when they are having teleconferences, they won't be whole days. It will be a couple of hours. And there may be four days when this can happen between now and the Board meeting. There's not a lot of free days, but especially if you are considering doing it close to the Board meeting, because otherwise how much time is there to get any more work done or look at any other data?

So there are a few dates, a couple, maybe three days in November when we could set up a teleconference, depending on when those other ones are set up. I could probably tell you the days now if --

CHAIR ROESSLER: Is there another option --

MR. KATZ: If you want to aim for that.

CHAIR ROESSLER: That we could meet when we all get to Santa Fe before the Board meeting? We have had Work Group meetings --

MR. KATZ: Well, there is actually -- the day before the Board meeting, there is a tour planned of Los Alamos, but nobody has to go on that tour. And we could certainly have a Work Group meeting there at the hotel, certainly that afternoon, I would say. Actually, I can't say for certain because we would have to find a room. But I think we probably can get a room and get the equipment for the telephone connection to do it the afternoon before the Board meeting, which would be, I think, the 15th of November.

CHAIR ROESSLER: But what about the tour? What time is the tour scheduled?

MR. KATZ: Well, the tour isn't set in -- it's not set in place yet. There are two elements of it. And DOE hasn't gotten back to me with anything definite about how

that will work. The only commitment, that there will be either or both a museum overview and possibly a tour. They haven't committed to the tour even yet.

So that is the 15th. The other dates, I believe, are something like November 7th or 8th.

MEMBER BEACH: There was the 1st, the 2nd, and the 4th, I thought.

MR. KATZ: First, 2nd.

MEMBER BEACH: And the 5th I --

MR. KATZ: First, 2nd, 10th. Well, I could look it up, but I guess we need to --

DR. NETON: I guess we need to know how difficult it is going to be to do these analyses and how quickly.

MR. KATZ: I mean, all we would be doing in this case is having that as an option, not necessarily that it would come through. I mean, that's the thing. You can have uncertainty about whether there is any

more information to bring to the table is going to be uncertain. I mean, we're only talking about less than a month away, right? And then there is the Board meeting.

So we can try to set up. We can try to find a date for a possible Work Group meeting before the Board meeting. That is one alternative.

Another alternative is to just plan to have this, resolve this during the Board meeting, during your presentation. In other words, it would be whatever supplemental information would be brought to the table at that time. And the other alternative is to take this off of the agenda for the Board meeting.

CHAIR ROESSLER: I will see what the rest of the Work Group thinks. I would like to have one more chance to see what DCAS can find out, schedule a teleconference, come to a decision then, and then go to the Board. I don't want to delay it another time. I

think we're --

MR. KATZ: I would really prefer not to, too, but --

CHAIR ROESSLER: Yes. I think we just need to go to the Board and say, "Here is where we are."

MEMBER BEACH: In addition to what DCAS comes up with, SC&A has to have time to look at that and also get back to us.

CHAIR ROESSLER: Well, I'm thinking if we have a teleconference, then as a Work Group, we will be able to come up with what we want to present to the Board.

MEMBER BEACH: Sure.

MR. KATZ: Why don't we look at calendars to see if we can find a date? I mean, if nothing else, that teleconference can be used to present depending on what the situation is. There may be no new information, but you may be --

CHAIR ROESSLER: Then we decide what we're going to --

MR. KATZ: Organize, at least what you are going to present for the Board meeting --

CHAIR ROESSLER: That is our job as a Work Group to say --

MR. KATZ: Because you are going to have to do that.

CHAIR ROESSLER: What to present to the Board.

MEMBER BEACH: Right, right.

MR. KATZ: So let me tell you about dates now. So November 1 is a possibility. I mean, I have a conflict on that date, but this is more important than my conflict.

CHAIR ROESSLER: I have a conflict, too, but if it comes down to it --

MR. KATZ: So November 1 is one option.

MEMBER LOCKEY: What day is that?

MR. KATZ: That is a Monday. November 2, which is Election Day, is another

option right now. Again, that's --

MEMBER BEACH: I'm actually traveling for --

MR. KATZ: Okay. November 2 is not an option.

CHAIR ROESSLER: I'm traveling on November 2 also.

MR. KATZ: Well, let's just figure out what the days are. So November 1 you say is an option for you?

MEMBER LOCKEY: Not for me.

MEMBER BEACH: But the other thing is it might be better to go towards the second week, the end of the second week.

MR. KATZ: Yes. I'm just trying to come up with all of the options --

MEMBER BEACH: I understand.

MR. KATZ: At this point. Okay. So there is also -- Mound was canceled. That was going to be on November 5th. So that right now is open.

MEMBER LOCKEY: What day is this?

CHAIR ROESSLER: Melius is working on a Work Group --

MEMBER LOCKEY: That day, Friday --

MR. KATZ: I know, but his is a teleconference too. So, he is talking about a couple of hours.

CHAIR ROESSLER: Okay.

MR. KATZ: No. Maybe three hours most for --

CHAIR ROESSLER: November 5th is good for me.

MR. KATZ: Does November 5th work for -- how about you, Mike? So is that -- and how about for --

CHAIR ROESSLER: We need somebody from --

MR. KATZ: Where is Chris and Jim? Does that work for you, November 5th?

DR. NETON: That's okay for me.

DR. MAURO: November 5th should be okay.

MR. KATZ: SC&A, everything's good for SC&A. So November 5th. November 5th, we will at this point set up a teleconference on November --

MEMBER BEACH: Can you look at the 12th also just to give that extra week?

MR. KATZ: Yes, we can look at that.

CHAIR ROESSLER: I like that. That would be better. That would give DCAS more time.

MR. KATZ: November 12th right now is open. It also could be -- again, they could both happen.

MEMBER LOCKEY: November 12th.

MR. KATZ: November 12th is fine for everybody here? Okay. Let's do the latest. Antoinette, you can hear this. November 12th is going to be a Work Group teleconference. And, even if there is no more information, there will be some discussion about how to present to the Board --

CHAIR ROESSLER: Right. That will be the --

MR. KATZ: Which will be useful to you, too, Antoinette.

CHAIR ROESSLER: Whatever information we have at that point in time. And we are going to identify the things that we think are going to happen.

MS. BONSIGNORE: Okay. So can I be confident to tell the workers later today that both petitions will go before the Board in Santa Fe?

MR. KATZ: Yes. That's not my choice. That's Gen's choice here.

CHAIR ROESSLER: As far as the one that we're working on right here, our intent is for the Work Group to come to a decision as to what we are going to recommend to the Board at the meeting in Santa Fe. And then the Board will make a decision. That is our intent at this point.

MR. KATZ: Okay. So that covers

it for the petition we are currently discussing. I am not sure that that is necessarily at what point will you decide, Jim, about the other petition or Chris.

DR. NETON: I think we are moving forward with the other --

MR. KATZ: Are you going to present, no matter what, the other one, 154?

MR. CRAWFORD: That is the current plan. Unless the Board tells us not to, we will present 154.

MR. KATZ: Okay.

DR. NETON: That's the plan. So any discussion about this would be relevant.

MR. KATZ: It is going to impact it. Okay, Antoinette?

MS. BONSIGNORE: Thanks.

MR. KATZ: Then both of them would be presented. The Work Group and DCAS presentation of the new one, newer one.

MS. BONSIGNORE: Okay. And am I safe in saying that this idea of actually

going out to the Linde site is now off the table?

MR. KATZ: Unless they go out to the Linde site before that happens, that seems incredibly unlikely.

MR. CRAWFORD: Very unlikely.

MS. BONSIGNORE: Okay.

MR. KATZ: Okay?

MR. CRAWFORD: Take measurements and analyze --

MR. KATZ: So that seems incredibly unlikely.

CHAIR ROESSLER: So the things that are on the table that I see that DCAS is going to look at between now and then is that you are going to look at the existing core samples and -- so that the soil characteristics near the conveyor tunnel can be evaluated so that they can be compared to the ones near the utility tunnel so that we can have a better handle on the actual measurement that was made, measurements made,

near the conveyor tunnel.

The other thing I have on the list -- I had two other things. One was see if you could do measurements in the existing tunnels. I think that's quite questionable, but let's just leave it there and receive that.

And the third thing was to continue the search for the historical data in the utility tunnels. And whatever you have at that point we are going to have to sit and evaluate.

And I think the Work Group, at least as one Member of the Work Group, I would say that I will base my decision heavily on those of you who are experts on it and what SC&A concludes from that.

MR. KATZ: And given the timeliness, I would just suggest that all of the Work Group Members sort of start thinking about developing your positions as if there will be no new information just to get yourself prepared because it's not leaving

yourself a lot of time.

We're talking about meeting, teleconference, the Friday before. So I think, for example, a presentation, Gen, if you're going to do a PowerPoint presentation, that only leaves you the weekend. If I were you, I would be preparing something, a placeholder.

DR. OSTROW: I think you have all the background in the slides and all of that.

CHAIR ROESSLER: Yes. I have some background slides I can use. But the other thing that I think I would like to talk about today, maybe after we break up, is I see, no matter what happens, I think what we are going to do is have a presentation.

I will make a presentation. And then I expect that Mike or Josie will want to make a -- whatever we want to call it -- another presentation, a minority presentation.

MR. KATZ: Yes.

CHAIR ROESSLER: I think we need

to do it that way.

MR. KATZ: Yes. I wouldn't even call it a minority if it's a two and two --

CHAIR ROESSLER: Yes, because it really isn't minority.

MR. KATZ: No.

CHAIR ROESSLER: We'll call it two presentations.

MEMBER GIBSON: But we've got five Members on the Work Group.

CHAIR ROESSLER: No. There are four of us.

MR. KATZ: Four.

MEMBER GIBSON: Four.

MR. KATZ: Bill's not -- Bill just asked to listen in.

CHAIR ROESSLER: And he'll weigh in with his input at the Board meeting as a Board Member.

MR. KATZ: Right.

CHAIR ROESSLER: So there are just four of us.

MEMBER GIBSON: I thought maybe Jim had appointed him as a new Member.

CHAIR ROESSLER: No, no. I just asked him to listen in because he is the radon expert.

MEMBER GIBSON: Okay.

CHAIR ROESSLER: I would expect that perhaps Jim and I -- and I'm looking at Jim to see if this is true -- would prepare a report. And in that will be background as to what we have resolved, certainly, and then what we haven't resolved. And then the two of you would follow with a report. Does that sound like a reasonable approach?

MEMBER LOCKEY: I am still --

MS. BONSIGNORE: Would I be able to get copies of these presentations in advance of the meeting?

MR. KATZ: No. I mean, the presentations are never available in advance of the meetings as far as I know, never, but they will be available at the meeting. And

they will be put online as well. Are you going to be at the meeting, I assume?

MS. BONSIGNORE: I don't think I am going to be able to travel, no.

MR. KATZ: We will get them to you. Okay? As soon as we have them, we will. I will make sure that those are sent to you, --

MS. BONSIGNORE: Okay.

MR. KATZ: For certain.

MS. BONSIGNORE: Okay. Also, there was a report that SC&A had put together from the May Board meeting that I never got a copy of.

MR. KATZ: A report on the --

MEMBER LOCKEY: Yes. There is a May report.

CHAIR ROESSLER: While they're looking at that, did you get the report this morning?

MR. KATZ: Yes. Well, I sent, I asked someone to send it to Antoinette. So

I'm --

CHAIR ROESSLER: I'm just wondering if she had gotten it.

MR. KATZ: Assuming that it had been sent.

MEMBER LOCKEY: Yes. It's a May 19th-21st report?

MR. KATZ: The interview notes?

MS. BONSIGNORE: It's from the interviews and from an evaluation of the documentation that we had provided to SC&A at that time?

MEMBER LOCKEY: It's the interview. I have the interview. This is Jim Lockey. I have interview notes from that date. Is that what you are talking about?

MS. BONSIGNORE: Yes, yes.

MR. KATZ: So, John, there was no PA-cleared version?

DR. MAURO: I'm going to have to look at Steve whether that was PA-cleared and distributed. I remember the report.

DR. OSTROW: Hang on one minute.

MEMBER LOCKEY: It has been cleared by DOE --

DR. MAURO: Yes. That --

MEMBER LOCKEY: Does contain privacy-protected information, not to be provided to any third party.

DR. OSTROW: I don't have a copy in front of me of the actual report. I don't think it was PA-cleared, the final thing.

MR. KATZ: Okay. Okay. Well, Antoinette, we will work to -- as soon as we get that PA-cleared with whatever redactions it has to have.

MS. BONSIGNORE: Okay. Thank you.

CHAIR ROESSLER: So I think we are about ready to conclude, but we are planning on a teleconference on November 12th and the time to be determined.

MR. KATZ: Time to be determined because we need to work that out with Melius, if he is going to set up a Work Group, too.

CHAIR ROESSLER: Those of us involved should keep that --

MR. KATZ: Keep that day open.

CHAIR ROESSLER: That day open.

MR. KATZ: For a teleconference.

CHAIR ROESSLER: Okay. Is there anything else that we need to do here? Mike, do you have any comments, suggestions, or anybody on the phone have any advice for us?

DR. MAURO: I would like to confirm SC&A has no action items except to be prepared to review material as it comes in.

CHAIR ROESSLER: And I think we have listed DCAS stuff, actually.

MR. KATZ: Right.

DR. ANIGSTEIN: Did you want to explain, you know, this was like an initial memo, did you want a more formal report on the model?

CHAIR ROESSLER: I don't think that's necessary because I think that we're going in a little different direction.

DR. NETON: We're moving away from --

CHAIR ROESSLER: Yes.

DR. NETON: We're not using the model. The model is not being used.

CHAIR ROESSLER: Yes. Anything else?

(No response.)

CHAIR ROESSLER: Then I think we're ready to adjourn.

MR. KATZ: Okay. Well, thank you, everyone, on the phone for bearing with us.

(Whereupon, the above-entitled matter went off the record at 12:23 p.m.)

1

2