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 TBD-6000

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THURSDAY
MARCH 15, 2012

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The Work Group convened in the Brussels Room of the Cincinnati Airport Marriott, 2395 Progress Drive, Hebron, Kentucky, at 8:30 a.m., Paul L. Ziemer, Chairman, presiding.

PRESENT:

PAUL L. ZIEMER, Chairman
JOSIE BEACH, Member
WANDA I. MUNN, Member

ALSO PRESENT:

TED KATZ, Designated Federal Official
DAVE ALLEN, DCAS
ROBERT ANIGSTEIN, SC&A
DAN CHUROVICH*
LEROY DELL*
JOHN DUTKO*
JENNY LIN, HHS
JOHN MAURO, SC&A*
DAN McKEEL
JIM NETON, DCAS
JOHN RAMSPOTT

*Participating via telephone

C-O-N-T-E-N-T-S

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

(8:42 a.m.)

CHAIRMAN ZIEMER: I'll officially call the meeting to order. I'd like to have everyone take a quick look at your agenda. The agenda was distributed by email. I have some hard copies here, if anyone at the table needs a hard copy and, folks on the phone, if you didn't get it by the email distribution, it also is on the website.

The focus today -- well, let me before I talk about the focus today just point out that when we initially set the time for this meeting, we did that with a projected assumption that we would have all the materials that we needed in time for all of us to digest them in a timely way. That only partially occurred, at least for the Chair, who was not able to, because of other commitments, even look at the SC&A piece until yesterday as well as the petitioner's piece.

But knowing that that was going to

be the case, I initially talked to Ted about whether or not we might schedule a follow-up meeting very rapidly within the next couple of weeks, and we have been able to do that.

So my idea today would be that we look at this as an information-gathering meeting where we look -- first of all look at the proposed models for the betatron work as well as, we can go back to the earlier model, source -- radiographic sources if we need to.

But, go through that carefully, make sure that the Work Group understands that model or that little -- portions of the modeling, have an opportunity to hear from SC&A and the issues that they have raised or are raising about the betatron model, as well as related matters, as well as hear from the petitioner and the site expert on the issues they have with -- and concerns that they have with the NIOSH models as well.

So this will give us an opportunity to get all of the information out there. Then we'll have a couple of weeks so that we can individually digest it in more detail and I'm very hopeful that two weeks from now, it'll come together and be in a position to make a final judgment up or down, which -- whatever we decide to recommend, to come up with a recommendation for the full Board so that that can be acted upon after the next full Board meeting.

So I think we'll have time to go through these all in detail. I want to proceed in the fashion that we would go through the NIOSH White Paper, have Dave go through some detail on that and explain their thinking and approach for the modeling there, have SC&A present the analysis that they have done, what concerns that that they are raising and why, and then have the petitioner go through their materials. We have extensive comments from the petitioner and we want to make sure we understand the petitioner's concerns and issues, so we have all the points of view on the table.

And I did commit to Dr. McKeel at the front end that I would make sure that we didn't end up, you know, at the last minute, with just petitioner stuff at 2:59 or something.

So wherever we are, if we're not there right after lunch, we are going to jump to that. The intent is to give them a chance to go through their materials, both Dr. McKeel and Mr. Ramspott, to go through their materials in whatever area of detail they want. No 10-minute limits, Dan.

DR. McKEEL: Thank you very much.

CHAIRMAN ZIEMER: But I'm planning to leave at 3:00, so --

DR. McKEEL: I'm planning on starting at 1:00.

CHAIRMAN ZIEMER: In any event, that's my intent today and I hope everybody is okay with that so that you don't feel pressured today to say, okay, I've got to come to a final decision on it. Because there's a lot of issues here, number one, and we have some conflicting points of view, and we want to make sure that everybody has a chance to put their information on the table and if Board Members have questions, they have the opportunity to ask, and so on.

So I will proceed in that manner. We all know that at the Work Groups, we can be very flexible, in terms of you are free to raise questions, for example, during Dave's presentation. He's not the only one that can talk and, in fact, petitioners can also raise questions as the Board Members do.

So we'll look at this as just a discourse and you know, I don't want -- I don't want SC&A and the petitioners to make their case particularly when Dave's making his, and I don't want them to make their case when you're making yours.

But I think it's fair to raise questions, what do you mean by this, why did you do this? So we'll proceed on that basis.

So we'll begin with the NIOSH White Paper and, just for the record, there are three main documents that we have before us. There's other -- a whole plethora of documents that we have from seeing this, but we have the January White Paper from DCAS called Dose Estimates for Betatron Operations.

We have the SC&A document of March -- it doesn't have a date. It just says March 2012.

DR. ANIGSTEIN: March 12th.

CHAIRMAN ZIEMER: Okay, officially March 12th. "Response to Battelle TBD-6000 Appendix BB General Steel Industries: dose estimates for betatron operations."

And then we have Dr. McKeel's document which, at the top is called Docket 140 General Steel Industries Addendum 1 to 2-28-12 submission and I think there's another one. Yes. Let me get the right one out here. Critique of NIOSH January 2012 White Paper dose estimates for betatron operations.

So actually there's actually two papers from the petitioner, make sure we have both of those. And then each of you also has perhaps some PowerPoint materials that you may wish to use.

So let's begin with the NIOSH White Paper and there's a section at the very beginning and I'm going to sort of ask -- I'm going to sort of lead you off with a question, because the first thing that you have in here is the section called "new betatron building." I mean, you have your introductory remarks, but --

On new betatron building, there is a section about the cobalt survey and how you have utilized that in terms of evaluating radiation levels, and I know there are a number of questions that have been raised about that.

But I want to make sure that I understand and that others here understand why this was done, and so let me precede your comments by simply stating that as far as shielding -- we are talking about, in a sense, evaluation of shielding capabilities and how they relate to distances of locations in that building, as I understand it.

And I just want to point out, just sort of for the record, because one of the questions I think that arises is: why are you even doing this? What does this source have to do with the period in question? And I just want to point out, from a basic point of view, aside from the issues that are being raised, that -- because I have done a lot of shielding design and I've taught a lot of shielding design and others have here, that if I know something about how a particular source at a particular location delivers exposure through a shield, I can then use that information and say what would I would get if I change the shielding material, what will I get if I change the source term, the energy, or its location?

In fact, I have done that in the past all the time with students, that, okay, here's a source, a known source in a known facility and we put it here, we point it in this direction and here's what you get on the other side of the wall. What happens if I change the source, change the direction, change the distance, even change the wall material, what am I going to get? It's a standard procedure, based on physics.

Now, that only works, of course, if nothing else changes and the petitioner is going to raise that question, so I understand that. But do I understand the reason you are doing this to be something like what I described? Or, now that I have sort of said what I thought you said, tell us why you did this.

MR. ALLEN: Yes, you're right. I was looking at it as essentially calibrating the model or verifying the model or calibration, but it's essentially verifying the model of the building itself, the betatron building, because that was the one place where we had a known source and known radiation levels at various locations.

We have some drawings of the building, we have some dimensions. There's a little bit of conflict from one drawing to the next on dimensions et cetera, so I revised the model that SC&A put together some time ago to update it for the new information that we have been obtaining from the NRC and used that survey to make sure that that was a realistic model of the betatron. We weren't missing some other big unknown. So like I said, essentially it was used to validate an MCNP model of the betatron building, to put it short and sweet.

CHAIRMAN ZIEMER: Okay, so you are basically taking the cobalt readings and saying, okay, this tells me something about the nature of the shield walls, at least at the time the cobalt was used --

MR. ALLEN: Yes.

CHAIRMAN ZIEMER: for that purpose, and it helps you refine distances, or confirm distances.

MR. ALLEN: Distances, thicknesses, densities et cetera.

CHAIRMAN ZIEMER: Yes, yes, okay. So that's the basic use of that. Now --

MR. ALLEN: At that point that gives me what we can verify as a good model of the new betatron buildings, then I can start putting different sources that have the betatron in there and see what kind of -- have some confidence in the radiation levels that has given me outside of the betatron building, or in various locations within.

CHAIRMAN ZIEMER: Now, let me ask the Work Group Members, there were some questions on why they would use that methodology --

MEMBER MUNN: No, that's clear --

CHAIRMAN ZIEMER: Bob, do you have a question on that? It looked like, from a methodology point of view you are okay with that. Now there is -- there are some questions -- what's the starting activity of the source and I think you registered that --

DR. ANIGSTEIN: Yes.

CHAIRMAN ZIEMER: You can raise that later.

DR. ANIGSTEIN: Yes. Yes.

CHAIRMAN ZIEMER: Methodology-wise. Dr. McKeel, I know you have some other questions on it, but you understand why they did it, even though the source itself was outside the time value?

DR. McKEEL: Yes, let's come back to that other point later. My concern is with you're modeling a betatron facility using a cobalt source that wasn't even used in that building until after the covered period.

So my question is, MCNP is perfectly capable of modeling the betatron itself. So you know, you are modeling the cobalt source with MCNPx, why not model the betatron, which is really the function of that building during the covered period?

So I guess I would have to be -- to be frank, it seems like a bizarre thing to do. It's modeling something that is not the source that was used there at all during the covered period.

And I understand what you are saying, but my view, as a fellow scientist from another field, is: why don't you use the most direct evidence that you can get rather than some indirect measure that you have to extrapolate back to, and as I did point out, those two sources are really quite different on many different levels, a betatron and a cobalt source, the radiation pattern, the collimation of the beam, the energy spectrum, all sorts of things are different about that other thing. So I would say to choose -- choose the model is still odd. That's all I would say.

CHAIRMAN ZIEMER: Okay, that's your concern. Okay.

MR. ALLEN: And just to come back to that, we did model the betatron and put it inside that modeling and yes, you're right, we could have started with the model of the building and used the betatron, but the information we had was some radiation -- actual radiation survey with the cobalt source, and that goes one step beyond simply modeling it and actually allows you to validate that model of the building --

DR. McKEEL: I understand.

MR. ALLEN: -- so the extra step to try to validate that --

CHAIRMAN ZIEMER: And the program will take into consideration the difference in energies under the spectrum because the cobalt is a monoenergetic. You've got two gammas but they basically have the same energy. You have more of a -- you have what looks more like a bremsstrahlung spectrum from the -- but in normal shielding calculations, you can take care of that in any event, and you also have some other factors that come into play, the buildup changes with energy sources.

In any event, it's just a sort of independent way to cross-check.

MR. ALLEN: Yes, I mean those numbers were not --

(Simultaneous speaking.)

CHAIRMAN ZIEMER: Yes, you didn't use --

MR. ALLEN: -- dose estimates --

CHAIRMAN ZIEMER: Okay. Comment.

DR. ANIGSTEIN: Yes, I'll make a comment. To cut to the chase, the reason they did this, the cobalt source, is that was the only one on which they had actual, real world measurements.

They did not -- to our knowledge, to the record, they did not do a radiation survey of the -- with the betatron on. So only with the cobalt source do we have radiation survey measurements and therefore, they used that to validate not the betatron radiation, but the model of the physical model of the building. Does it make sense? Can MCNP predict? I think it was an excellent exercise to say: can MCNP predict the measured dose rate, given the information that we have about the building?

And the answer was, we both did it. Dave did it. I did it. We came up with -- there were some differences in the approach. We came up with somewhat different answers.

But the basic answer was: yes, we are comfortable with the model. It comes close enough, I think within a factor of two is considered pretty good for radiation release theoretical modeling with all the uncertainties there.

CHAIRMAN ZIEMER: Dan, you had a comment.

DR. McKEEL: Yes, my comment was I wanted to make that clear for the record. The problem here with this site, particularly related to dose reconstruction, but particularly with related to the SEC, is there is no real actual data on either betatron facility, old or new, at any time during the covered period or thereafter.

So with all due respect, I understand everything that has been said. I accept that -- and I have been saying for a long time, years, that in order to validate a computer model -- and I have papers that we did this -- you know, you have to have real data to compare it against.

So when you then turn around and use a validation which there's even some dispute on how close to the real and the actual -- and the computed data have to come to be validated, I would say twofold is very generous, and lots of times you can do better than that.

So, you know, but that -- I don't think that means that it validates it for betatron model, where you don't have any real data to compare against. So you can't actually validate the betatron.

CHAIRMAN ZIEMER: And John, you have a comment too?

MR. RAMSPOTT: Yes, this is John Ramspott. My main concern is: it is totally out of the AEC window. Any information being used is totally out of the AEC window.

The contract period of General Steel was 1955 to `66. The survey that they are referring to is in 1971.

And I want to go back to a comment, on the record, that's actually from Dr. Anigstein's meeting with the workers at General Steel -- Dave was in attendance -- in Collinsville, 2007.

And the quote -- I'm sure you remember it -- the workers and staff were looking at a drawing from 1991, from the cleanup, and Dave cautioned the workers at that time -- I have the quote -- that, "Don't work with that kind of drawing because things change over the years. That's actually out of the window."

Now if that that's out of the window and that caution was given then, it seems pretty apparent it would be given now.

CHAIRMAN ZIEMER: John, I think it's a good point and that would be always be the caution, and I think it works at both ends. We don't want to say that we shouldn't use any drawings before that period or any after, or information from before or after. The question always is: okay, we have this information, how well does it apply to the period we are looking at? Were there changes?

So that's a caution that would take place here as well. You know, the basic principle of doing it conceptually, good principle, the cautions that you all raise are valid cautions.

Is the facility as it was when they did the survey? And that's the main point, not that we shouldn't look at it because we look at other things that -- we look at stuff that's way earlier. We look at stuff that's later. But we always have to say: Does that even apply?

We don't always know, and that's -- your point's well taken.

MR. RAMSPOTT: A follow-up to that if I could. I mean, for the record, that survey that you're referring to was not done by a licensed health physicist, physicist. ‘ identifying information redacted’'s always referenced later -- or actually early in the program. That survey was actually conducted by two General Steel employee management individuals --

MR. DELL: That's right.

MR. RAMSPOTT: -- with no credentials to really do that testing and I think that should be noted too. If you're going to have data, have valid data, you know, from experts.

MR. DELL: I can validate that.

DR. ANIGSTEIN: I'd like to disagree with a couple of points, or I have a comment, shouldn't say "disagree." First of all, the earliest drawings were from -- I'm going to show it in my talk -- January `68.

Yes, it's outside the window but it's a year and a half. Just a second. Your earlier charge -- there is no reason, there is no basis for saying that the building was rebuilt during this period of time.

I'm not talking about the lead door now. I'm just talking about the structure of the building. The building -- we have the drawings from January 1968 and then a couple of later ones during that couple of years. They are entirely consistent.

It did change to `91. By this time, the building had been out of use for its original purpose for almost 20 years and there may very well have been some walls torn down because the sketch -- the drawings from 1989, `91 are different.

There's a wall missing. So they may have -- and from what I understand from you, John, was that later on, by the time they were using it like for office space.

So there may very well have been a difference and we recognize that. That's why there's a change. That's why we did this, or NIOSH did that.

There was a change and this was acknowledged, but to say we can't use any information just because it came a few months later, then this whole program can't do its work because everything is based on information gathered usually in a later period or an earlier period, and my experience with this whole program, which SC&A developed about eight years, and I have been involved more in GSI than any other site, we probably have more information on GSI, wouldn't you say that

Paul, than on any other site, or at least one of the best. It's one of the best documented --

CHAIRMAN ZIEMER: Well, we have a lot of information. Like any other site the issue, though, is: how good is the information and do we apply it properly?

But let's not have that debate today.

DR. ANIGSTEIN: Okay, and the other comment about the person making the survey, the person making the survey -- I guess I'm not supposed to say his name even though it's in the open record, it's in the --

CHAIRMAN ZIEMER: It doesn't matter what his name is.

DR. ANIGSTEIN: Pardon?

MS. LIN: Well, I mean, the point is made --

CHAIRMAN ZIEMER: It doesn't matter what his name is.

DR. ANIGSTEIN: But anyway, the

gentleman who did the survey, was the radiation supervisor there for a period of, call it 10 years, and his resume is very well-documented.

No, he was not a certified health physicist. There were very few of them in those days. But he was well trained. He had courses in radiation safety. He had courses in radiography. He had courses in handling of radioisotopes, and his resume is very well documented in the AEC application.

In several places his training is -- he's probably, from what I could see, the best-trained person there, with the exception of Dr. ‘ identifying information redacted’, who is a Ph.D. physicist and a CHP. Again, there were very few of those, of people of that qualification, and he was the one who made the original radiation surveys of the facility in building -- the 6 Building.

But at that time, he was no longer employed -- I guess GSI figured they can handle it themselves and they were using the -- stopped using his survey -- that's why they went to the historical -- I'm going a little ahead -- historical reasons.

They terminated the contract with him for whatever reason and they refused to supply -- he did three things for them. He did a radiation survey for them, he supplied the film badges under his own name -- he probably bought that from someone else but he distributed them under the name of his own company -- and he calibrated their instruments.

So after that, they turned to St. Louis Testing to calibrate their instruments, they got their own film badge contract with Landauer directly, and they used this gentleman for the radiation supervisor, and their film badges were -- at the beginning the film badge reports were addressed to him and then later they were addressed to the new supervisor of the betatron facility.

CHAIRMAN ZIEMER: Okay, let's move on then. You made the point. Let's go ahead with the shot scenarios, and I guess, as a starting point, I want to make sure that I'm understanding these scenarios, and I think there's maybe some debate about whether they could or did actually occur.

But you have all of these -- you have like the straight-on, you have the 45 each way, you have some up and downs and you have the railroad location, you have pointed at the wall, you have pointed at building -- yes.

But were you trying to get a spectrum of what the --

MR. ALLEN: That was the intent, was to get a whole variety of possible angles that the betatron could be pointed at, keeping in mind that it's always going to be pointed at some kind of casting.

CHAIRMAN ZIEMER: Right. Right. But once you generate the numbers in Tables 3 and 4, for example, then what?

MR. ALLEN: The whole first part of the White Paper was essentially the pieces. This was -- this piece was essentially to point the betatron at a casting in a wide variety of locations for -- several locations for the casting in a variety of orientations of the betatron pointed at the casting, and to determine the dose rate in various areas from all those orientations.

That was then later all put together primarily for the -- essentially the non-betatron -- well, I wouldn't even say the non-betatron workers, but the people not in the control room, people who were layout men and anybody else outside of there, such as on the roof or outside of the betatron building, in an attempt to -- I mean, when you put the whole model together you can come up with a dose rate outside of the building, but to try to reconcile this with all the other information you've got, you need to know the various orientations and what kind of an effect that has on these values.

So like I said, it was essentially a spectrum of orientations, a whole variety of them that are explored to see what the effect would be.

CHAIRMAN ZIEMER: So if you take the railroad position, and my understanding, and I'm coupling what you said with, I think, with what John said, that in reality, they probably would move the sample along the railroad and keep the thing perpendicular, did I understand that right, that they probably wouldn't actually do angle shots, sidewise?

MR. RAMSPOTT: They would try to keep the betatron heading directly at it, rather than at an angle.

CHAIRMAN ZIEMER: Right, because it wouldn't make sense to --

(Simultaneous speaking.)

MR. ALLEN: It would throw off --

CHAIRMAN ZIEMER: -- in terms of an

image it would --

MR. RAMSPOTT: It doesn't make any sense, no.

CHAIRMAN ZIEMER: But you're only doing that to get the effect of what happens if you're off center or up or down a little bit, what does that do?

MR. ALLEN: Well, keep in mind it's not -- this was this big axle model that we are shooting at, but that's not the only thing that got shot. There were various different sizes and shapes --

CHAIRMAN ZIEMER: Right, so the orientation might have changed somewhat.

MR. ALLEN: Sure, I mean you can easily angle it to shoot straight at one piece of a casting that has a different shape, where you are kind of glancing off of a different side of it. Not everything was a flat, straight piece of steel that they were shooting at.

So essentially this was primarily

just to get the various angles where you -- that you could angle the betatron at.

MEMBER MUNN: At certain angles you could not because of the limit switches. Right.

CHAIRMAN ZIEMER: And as you modeled this, you're modeling with the beam in an orientation, but without a specified sample in place. It's unshielded? Not unshielded, but -- no sample barrier, in other words, the value you are reading in the model, outside the wall, say in the 10 Building from railroad straight on --

MEMBER MUNN: That's without the target.

CHAIRMAN ZIEMER: Is that without a sample target in place?

MR. ALLEN: No. There is a steel casting in front of that.

CHAIRMAN ZIEMER: Okay.

MR. ALLEN: In front of the beam.

CHAIRMAN ZIEMER: Of a specified

size?

MR. ALLEN: Yes.

CHAIRMAN ZIEMER: Okay, and these all have the same specified --

MR. ALLEN: Yes, the same target, coordinated, different places. Actually, they are targeted in, I think, three different places, and then, like I said, it moved ahead to where yes, it was a -- for that particular type of thing, it wouldn't make a lot of sense if it was at a glancing angle.

But essentially, if you had a piece of steel there that you were trying to shoot like that, oriented to head that direction, then you've got the numbers there, like I said, basically trying to get a whole variety of possibilities.

CHAIRMAN ZIEMER: Right, okay. This, so my simple mind can get around this, suppose that the only possibility is railroad, straight, up and down. Three numbers. Forget the others at the moment.

MR. ALLEN: Okay.

CHAIRMAN ZIEMER: What do you do with those three numbers? Let's say at the number 10 Building. What are you going to do with those three numbers?

MR. ALLEN: Well, that's towards the end of the paper. What I ended up doing with those --

CHAIRMAN ZIEMER: Yes, but just conceptually, you've got these three numbers, what are you doing to do with them?

MR. ALLEN: What I did was -- and I know there's some debate on this -- in the White Paper it'll say that I was maximizing it as 10 millirem in the control room and didn't do one particular shot forever, there was various orientations in the -- it wasn't just --

CHAIRMAN ZIEMER: Yes, I know what you -- you parsed that out --

MR. ALLEN: I put -- of the 15 scenarios here, I used Excel Solver to say what's the conditions that we come up with, which were the 41 percent utilization, the 10 millirem in a control room, and trying to maximize the dose in different locations such as the number 10 Building, what would be the number of hours used and these various orientations to combine to meet all these criteria.

CHAIRMAN ZIEMER: Okay. And I know you're going to address that in a general or more specific way, and I sort of knew the answer to the question, but I want to make sure that we're understanding that you're not using these individual numbers per se, you're gaining the spectrum of readings and then you're parsing things out in a way to maximize -- the way you do it conceptually, to maximize what would be the exposure to a person, and you have them in there a certain percent of the time of their work day at that location?

MR. ALLEN: I think so. I did use these numbers in combination. I didn't use all these numbers, it was a maximizing analysis.

CHAIRMAN ZIEMER: Right. Questions?

MEMBER BEACH: I guess the only question I would have is why would you use 15 models instead of limiting it to maybe 7 models of more -- so it's more applicable?

It seems confusing that you have put so many in there when, in reality, you're not going to use that many.

MR. ALLEN: Well, when I did them, I didn't know which ones I would use. That was the whole idea, was to -- any time I've tried to do any kind of a model before, it was: "But what about?" Okay?

So I tried to --

MEMBER BEACH: So you were covering all bases.

MR. ALLEN: -- cover the whole spectrum because honestly, I didn't know, if somebody said, what if they angled it up, what if they angled it down, you get a lot of scatter off the concrete floor, and in all honesty, unless I did it, I wouldn't know for sure. So I tried to get all the spectrum. I didn't know which one was going to end up being the maximizing, because once you put that criteria of not exceeding what the film badges read, it can change. It's not necessarily the highest dose rate. It might be a little more than the highest ratio of the number 10 Building to the control room, and it's not intuitive which one will give you the higher ratio.

MR. RAMSPOTT: John Ramspott again. One of the other concerns we have is the charters are constantly changing. And it could be HY80 steel which you referenced, could be a uranium ingot.

I mean, there's a variety of different items going through there, shapes, sizes, there are no shot records. They don't exist. No one knows what was on there. What did you use in your model?

MR. ALLEN: What we used is -- I think it was HY80 steel.

MR. RAMSPOTT: I mean, what size, how big, how --

MR. ALLEN: It was the same thing in the SC&A report from a few years ago, was a large axle as I recall. Bob, you can correct me if I'm wrong.

DR. ANIGSTEIN: Yes. No, it was a hollow axle for the power shuttle which I believe --

MR. RAMSPOTT: So that you used one item --

(Simultaneous speaking.)

MR. ALLEN: But I did do some scoping on a few different -- not 15 different shots; each of them takes some time to do. But I did a little bit of scoping that's not written in there, just to satisfy myself.

But the truth of the matter is with photon radiation, which is what X-rays are, it's honestly the electron density that makes much of the difference. It's not so much the type of material as far as scatter radiation that comes off of that. As far as any kind of build-up or activation of the material, yes, that makes a difference. But as far as the scatter -- it's kind of the density that makes the most difference and I shot some uranium, I shot some steel, different thicknesses, and as long as you're not into a thin steel, it doesn't make as much difference on the scatter, and there would definitely be no reason to shoot a quarter inch steel with a betatron or an eighth of an inch steel -- so basically, a thick, massive piece of steel or almost any other kind of metal could give you a similar answer.

MR. RAMSPOTT: So you did shoot at the uranium?

MR. ALLEN: I did. It's not in there. I didn't put -- didn't make it part of the analysis.

MR. RAMSPOTT: Because that would be interesting to see. Did you take into account that 15 percent of the -- I think it's called the photon beam coming out of the betatron?

MR. ALLEN: I believe it's neutrons. I think it's a smaller number. I think it was like 0.15 on that chart, percent. But I could be wrong. But in any case what we did was --

MR. RAMSPOTT: Aren't there documents that say it's 15 percent --

DR. McKEEL: There are documents that say that 15 percent of the axial beam --

MR. RAMSPOTT: -- the axial beam --

DR. McKEEL: of old and new betatron donut tubes is neutrons.

CHAIRMAN ZIEMER: It may be that when you do the quality factor, to change it to dose, as opposed to the flux value. We can double check that.

DR. ANIGSTEIN: Dose being 15

percent sounds within reason.

MR. ALLEN: Yes, that might be the -- I might have been thinking the flux.

CHAIRMAN ZIEMER: You can check on that.

(Simultaneous speaking.)

MR. ALLEN: But in any case, the model itself, its first principle, does essentially shot the 25 MeV electrons at the platinum target and the model will produce essentially whatever is going to be produced, including the neutrons and you can't -- you can tally them together. I did do these and tally the neutrons in separate runs, just because there are limitations to the program and you can only do so much in one run.

It was considerably easier to tally the neutrons separately in other runs, so I didn't run out of computer time.

DR. McKEEL: Paul, I have a question for Dave Allen. One of the pieces of information we will present is that the new betatron tunnel exit door was not enclosed by a lead-lined double door in the covered period.

So my question is: when you were modeling those 15 scenarios, one route for the betatron -- new betatron being to get into Building 10 is through the tunnel down the railroad track, directly into Building 10, was the double-leaf, lead-lined door in your model?

MR. ALLEN: The lead-lined is the bottom seven feet and yes, that was in my model and I have seen the question raised about that. The White Paper --

DR. McKEEL: I am going to stick to exactly what Paul asked and not get into that right now. But --

CHAIRMAN ZIEMER: Yes, I understand that is a question.

DR. McKEEL: -- it's important for the record that that was not accurate. That didn't exist in 1966 --

CHAIRMAN ZIEMER: And I would also --

DR. McKEEL: That's a fallacy.

CHAIRMAN ZIEMER: When I talked to Bob last week to see where he was on the report, I asked him if he had seen your comments on that and whether, when he was checking out Dave's stuff, whether he was doing it with or without the shielding, and you can speak to that later. But in any event, we are aware that that could be an issue in terms of how it puts at certain location --

DR. McKEEL: I think that's important to get on the record. That would actually affect all 15 scenarios. Whatever you are measuring, the final count --

CHAIRMAN ZIEMER: Right. Right. Right.

(Simultaneous speaking.)

DR. McKEEL: -- into Building 10.

CHAIRMAN ZIEMER: Right now, the

NIOSH model assumes the lead is in there. So if at some point it was either confirmed or NIOSH said, well, we're not sure but we'll accept maybe that it wasn't there for claimant-favorability, from a conceptual point of view, it would -- you would rerun some numbers as far as --

MR. ALLEN: Yes, it would take about two minutes to change the input --

CHAIRMAN ZIEMER: But right now, it's assuming the shielding is there and affects the final numbers, yes. You're quite right.

DR. ANIGSTEIN: I had a question. This Excel Solver, now my -- perhaps I misunderstood. You had another condition that it maximizes the dose rate in the 10 Building, you had a condition in there?

MR. ALLEN: Yes. Yes.

DR. ANIGSTEIN: I somehow didn't catch that or I didn't realize that you didn't -- because I thought it was --

MR. ALLEN: When I saw your report I went back and looked and I realized I had two things bulletized and that wasn't one of them, but essentially it was in the text above that I said I used Solver to maximize the dose rate using these conditions and then bulletized --

DR. ANIGSTEIN: I see, okay. Because otherwise it didn't make very much sense. Now I withdraw my -- would have been, you know -- so in other words, it sampled all possible combinations --

MR. ALLEN: And gave you the max.

DR. ANIGSTEIN: -- and then gave you the -- okay. That makes sense, because there's about 100 combinations that you could have. Okay.

CHAIRMAN ZIEMER: Just for my own understanding of the term "flipping," Dave, you referred to certain positions as flipped positions and, John, I think you said that's not how they used the term. Could one of you explain to me what the operators understood flipping to be? And you may be using it in a different way.

MR. ALLEN: We could be wrong on this, because I kept getting different impressions and stories on exactly what is called that. So --

MR. RAMSPOTT: John Ramspott again --

CHAIRMAN ZIEMER: I mean, it doesn't affect your model. You called it something but --

MR. ALLEN: Yes.

CHAIRMAN ZIEMER: But in any event what's --

MR. RAMSPOTT: Actually, the term is wrong in your report. You actually referred to swinging the head 45 degrees as "flipping" in your paper, and that's definitely not flipping.

What they did, and a gentleman deceased, ‘ identifying information redacted’from Allis-Chalmers, Los Alamos as well, taught the workers when he came to the site how to flip the head of the betatron. The betatron, as built by Allis-Chalmers, was designed to shoot straight out away from a control room, using that wall as the example, to shoot straight out but have the ability to rotate and turn 45 degrees without any flipping, that was standard. That was safe and then that whole --

CHAIRMAN ZIEMER: Rotate 45 degrees in any direction. Top down --

MR. RAMSPOTT: Absolutely. They could have -- well, actually no, they could go 180 degrees down. They could shoot straight at the floor or straight at the ceiling if they wanted.

CHAIRMAN ZIEMER: Okay.

MR. RAMSPOTT: They didn't do that very often, but I actually have photographs of a site with a betatron actually doing it.

CHAIRMAN ZIEMER: So 90 degrees

from --

MR. RAMSPOTT: So, flipping --

MR. DELL: I've seen it done.

CHAIRMAN ZIEMER: Who is this? Who is speaking?

MR. DELL: My name is Leroy Dell, and I was the supervisor for the betatron in the late end of `60s and up to `70s. Yes, they could turn the head around and shoot right, I mean directly, at the control room.

CHAIRMAN ZIEMER: Okay, good. Thank you.

MR. RAMSPOTT: And the gentleman taught the guys how to do that, and that essentially lets that machine shoot about anywhere in that building, because the betatron is on a tripod -- actually a crane, telescoping crane, comes down, can go down to the railroad tracks. When you flip it you lose all barriers. Now it can go as far as it wants down the tracks, as far as the head sticks out, and we actually have some good photographs of the normal betatron right at the tracks, from Allis-Chalmers, shooting into that L area that everybody says is the dead area.

So flipping the head is not turning it 45 degrees. It's actually turning it upside down and in reverse. That's what Mr. Dell says.

MR. ALLEN: I mean, the scenarios I have, have it going, what would that be, you 270 degrees --

MR. RAMSPOTT: You actually turned it back at the control room, I think, in your paper?

MR. ALLEN: Well, what you were just saying about shooting down that L area, shooting -- the one that I called flipping the head was shooting the 45 degree angle down that --

MR. RAMSPOTT: And that didn't have to be flipped to do that.

MR. ALLEN: Okay. I thought that

was --

MR. RAMSPOTT: No.

MR. ALLEN: -- outside the limits of what was supposed to be done --

MR. RAMSPOTT: No, that -- that betatron will go down to the edge. We've got photographs of it. It'll actually go down to the tracks and you still are allowed your 45 degrees, so your angle -- you are not totally down it, but --

CHAIRMAN ZIEMER: Now they had to defeat some limit switches or some interlocks to do the flipping?

MR. RAMSPOTT: They were actually taught -- no, all they had to do was move the hoses out, move the wires out of the way --

CHAIRMAN ZIEMER: Okay.

MR. RAMSPOTT: -- so they wouldn't get hung up in the flip.

CHAIRMAN ZIEMER: Okay.

MR. RAMSPOTT: And you see that from the photographs. And then the other method that one of the workers shared with me, if you took the betatron down -- there's two -- there's actually two cranes in the building, one to pick up castings to put it on a car, whatever, or take it off a car, the other one is for the betatron.

If you ran a betatron crane into the lifting crane while it was stationary, that jolt would actually allow the head to turn more than 45 degrees.

So they figured out how -- yes, those guys figured out how to do it when you are in a hurry and it's the end of the month, they said, okay, this is how we're going to do it, they just changed the rules. They did what they had to do and told to do, that supervisor in particular brought that bit of knowledge.

CHAIRMAN ZIEMER: Okay, that's helpful.

MR. RAMSPOTT: And 45 degrees is important because that sounds like they didn't flip it as much as they did the other --

DR. ANIGSTEIN: Perhaps I can clarify this. This is a diagram that was drawn by one of the workers during the meeting. Let me just reproduce it here.

CHAIRMAN ZIEMER: Okay, for those on the phone, Bob is going to -- is drawing on the magic white board which is actually a piece of paper. Or are you? Are you drawing on the paper?

MR. RAMSPOTT: We have some workers on the line that could describe this too.

CHAIRMAN ZIEMER: Yes. He's got a diagram that was provided to him, I guess, by someone there, but in any event --

MEMBER BEACH: Bob, what report are you getting that diagram out of?

CHAIRMAN ZIEMER: Yes, is this a report that we have, Bob, or --

DR. ANIGSTEIN: This is something that was hand-drawn at the meeting. So I don't have --

CHAIRMAN ZIEMER: It was hand-drawn at the workers' meeting?

DR. ANIGSTEIN: Yes.

CHAIRMAN ZIEMER: Okay, but your marker is not working there.

DR. ANIGSTEIN: I see that. Not my marker. I think it's meant for the Board.

CHAIRMAN ZIEMER: So, but does it differ from what -- I mean, does it differ from what John Ramspott has described or what Mr. Dell has described? I think I understand what they're saying. I just, I don't -- do we need a diagram?

DR. ANIGSTEIN: Pardon?

CHAIRMAN ZIEMER: Do we need a diagram?

DR. ANIGSTEIN: Well, I don't think they would -- I don't think it was -- what they were saying does not agree with what I was told by the workers at that meeting. So I want to show --

CHAIRMAN ZIEMER: Oh, okay, well, I'm not sure how critical it is other than you have the ability to get the beam down that corridor that you're talking about --

MR. ALLEN: Whether legally or illegally.

CHAIRMAN ZIEMER: Yes, either way.

DR. ANIGSTEIN: This is what I was told. Here is the building. Here are the railroad tracks.

CHAIRMAN ZIEMER: Okay.

DR. ANIGSTEIN: This is -- the betatron is here. And the normal limit switches were 110 degrees -- I spoke to someone just recently. So this is the straight-ahead position. They could go 110 degrees in either direction. So this was the normal arc that was limited to.

However if they, from my understanding, if they take the head and flip it this way, then you can get the other part of that arc.

CHAIRMAN ZIEMER: Yes, the rest of the way round. Right.

DR. ANIGSTEIN: So the 45 degrees was just an example. It wasn't that it was 45 degrees, that normally it couldn't shoot over the control room. It could shoot at the railroad track but it couldn't shoot down.

CHAIRMAN ZIEMER: Unless you moved it way on down.

DR. ANIGSTEIN: However, we were also told by one of the radiographers at the meeting -- no, they never actually aimed it at, you know, they never actually aimed it at the door. That was completely unlikely. But it did go -- this is getting a bit technical.

CHAIRMAN ZIEMER: Well, they are obviously going to be aiming at a sample. You're not going to sit there and say, let's aim at the door. You're aiming at a sample and depending on where the sample is, and the orientation --

DR. ANIGSTEIN: Right. In this

instance, in Dave's model, and actually our model, the SC&A model, the thing where the axle was mounted here, and Dave's model has it pointing straight, just like in our model, and he also has it pointing 45 degrees this way, 45 degrees this way and 45 degrees, if you look at it now in a vertical cross-section near the axle, you always had it centered but you also had it pointing this way and this way, and these are realistic because they would have to do -- they will have the film inside, so they would have to have different angles to get different parts of it.

So the up and down is realistic. The left and the right probably does not represent actual practices.

CHAIRMAN ZIEMER: Well, I guess the bottom line is: do the scenarios -- are the scenarios such that they would take into account whatever could scatter down that corridor, and that's the issue I guess that you are addressing.

Okay. Anything else on the shot scenarios that we need to clarify for us today? The flipping, the terminology doesn't affect your numbers per se, as to whether you call it flipping or not, it's where you had that point and whether that's flipping or not flipping, you get the point there. John, you have --

MR. RAMSPOTT: There is one last comment.

CHAIRMAN ZIEMER: Yes.

MR. RAMSPOTT: Regarding that model that the management at GSI did, we have worker testimony again, probably at Dr. Anigstein's meeting, if not it's definitely on the record from a Mr. George Luber, and they did use cobalt on the railroad car on the tracks. So it wasn't just the betatron that was aimed at the tracks in the L.

CHAIRMAN ZIEMER: Thank you.

MR. DUTKO: Dr. Ziemer? John Dutko, sir.

CHAIRMAN ZIEMER: Yes. Oh, hi, John Dutko.

MR. DUTKO: I was one of the fellows that was ordered to flip the head. Leroy Dell was telling you the truth, the exact truth. Anywhere in the chute itself, anywhere in the chute itself, if that head was flipped, limits, normal limits, would be violated. The machine would be pointed toward the control room, or the hallway, as you would call it, would violate all normal limits.

And there were times when we were ordered to do so and shoot toward the control room, sir, at a casting that had routed in, but we couldn't reach with normal limits.

The same if the casting moved, they would order that casting -- or the flipping of the head to pick up the needed shots to save a moved casting.

MR. DELL: That's exactly right.

MR. DUTKO: Thank you, sir.

MR. KATZ: Who's the other person

who just said, "that's exactly right?" Is that Leroy Dell?

MR. DELL: Yes, it is.

MR. KATZ: Okay, thank you. I think everyone in the room acknowledges, realizes that this is -- and doesn't dispute this information. But thank you.

CHAIRMAN ZIEMER: Okay, thank you. Anything else on the shots right at the moment? Yes, Dan?

DR. McKEEL: I hate to make a point too many times but I think we can't. What Mr. Dell and what Mr. Dutko said is in fact they did point the betatron directly at the control room.

MEMBER BEACH: Can I just ask what -- can you give us a percentage of time that happened? Was it 5 percent, 10 percent? Just an estimate.

MR. RAMSPOTT: Maybe the workers could answer that better. Mr. Dell or Mr. Dutko?

CHAIRMAN ZIEMER: I mean, it was --

MR. DELL: Probably wasn't over five percent.

CHAIRMAN ZIEMER: But it was done, it's not like --

MR. DELL: The major reason was to save time. You didn't have to take -- if you're going to turn the casting around, you had to take it out to 10 Building and have them turn it around and bring it back in.

That way you could go ahead and shoot it and you didn't have to move the casting.

CHAIRMAN ZIEMER: Thank you.

MEMBER BEACH: Thank you.

MR. KATZ: Thank you, Mr. Dell.

CHAIRMAN ZIEMER: Anything else on shots? Everybody think they have a feel for the issues on that?

MEMBER BEACH: The only other question I would ask: is there any contention between NIOSH and -- the wall, how thick the walls were, between where you shot and the control room? Was that a contention -- I read some differences on two block walls, one block wall, filled, not filled, is there a contention on that or not?

MR. RAMSPOTT: I think the workers could answer that, but yes, there are definitely disagreements on that.

DR. McKEEL: I can answer that. I think the issue is that different drawings from different time periods show different thicknesses and even quantitative -- qualitative differences, which is -- there is a drawing which we'll show you a little bit later on that says that the concrete blocks and the walls had mortar in them and mortar has a different density, et cetera.

I think the point that's not emphasized enough is that one wall of that tunnel with the railroad tracks, where the control room was, and the thin metal control room door, was just a very thin wall. It wasn't a 10-foot thick wall.

So I think there are certainly those kinds of differences.

CHAIRMAN ZIEMER: For clarity, on your model, Dave, on the new betatron, your walls were -- you assumed the concrete blocks were filled with -- was it with sand or with mortar?

MR. ALLEN: The 10-foot thick or the --

CHAIRMAN ZIEMER: The big walls --

MR. ALLEN: -- was two, I think, one-foot concrete walls with sand --

CHAIRMAN ZIEMER: Sand-filled --

MR. ALLEN: between them.

CHAIRMAN ZIEMER: Yes. And what about the other --

MR. ALLEN: The dimensions are in the paperwork, but I think it's 16-inch, if I remember right, that wall that Dr. McKeel's talking about.

CHAIRMAN ZIEMER: Okay, thanks.

DR. ANIGSTEIN: Actually David's model was based on the early SC&A model and we had -- we made a minimum thickness to the control room. We had the hollow walls, hollow concrete block, and I looked up commercial concrete block and I picked the one that would give you the lowest overall average density, which was like less than one, that's the density of water.

But I ran the -- first of all when I saw that it was mortar-filled so that immediately mean, no, it wasn't hollow, it wasn't empty.

And second of all, I ran the model to get the dose on the outside. I ran the cobalt-60 and to get the dose on the outside, and I have extremely high doses, assuming that those outside walls, not the 10-foot thick wall but the thinner ones, were also of this light weight. I said no, this is not consistent with their survey information.

So what is consistent with the survey information is all the walls, all those smaller walls would be solid -- the equivalent of solid concrete. Mortar is about the same as concrete, they're about the same density, comparable materials.

So that's much more consistent with the survey -- the cobalt survey and as a matter of fact our number -- my numbers actually came out higher than the ones that were actually measured, but not by that much, so I consider that to be consistent.

So there's no evidence and there's no logic why they would be -- I mean the building would not be built.

CHAIRMAN ZIEMER: Thanks. Okay. Does that answer your question? Let's go to residual radiation from uranium, and, Dave, do you want to just give us a quick overview of the concepts here that you followed and --

MR. ALLEN: Yes, in that particular one, I'm trying to remember the exact page, hold on a second --

CHAIRMAN ZIEMER: Well, you had a certain amount of exposure time per shot. These are --

MR. ALLEN: Yes, the --

CHAIRMAN ZIEMER: Uranium --

MR. ALLEN: -- was 60 minutes per shot.

CHAIRMAN ZIEMER: Uranium ingots and so on --

MR. ALLEN: The report was 60 minutes per shot. We had earlier done one of trying to shoot through an entire ingot and found out that there was no way you were going to get an X-ray exposure, it's all scattered so you couldn't really do that and that went along with what the operators had said at one point about shooting it obliquely, basically through the corners, and if they had to shoot it four times obliquely to the top of -- there was some debate on what they were calling an ingot and what they were calling a beta slice and some had seen one and not the other, so there were various types of uranium that were X-rayed.

But essentially, the model had one that's thick enough to essentially absorb all the useful X-ray and betatron and shot it four times to get a full coverage on -- I don't recall the dimensions, but a circular piece of uranium metal.

And what we did here was to shoot for 60 minutes, give it 15 minutes to take the film down, reorient the betatron and put some new film on and then shoot it again at a different angle, and we accounted for the activation that would occur within the uranium as well as the decay from that first shot until you are done with all four shots, that you are actually exposing different pieces of this uranium for different timeframes, plus some of the shorter-lived activation products would build up almost to an equilibrium pretty quickly and then they wouldn't go any higher during the shot.

So trying to account for all that, taking four shots, 15 minutes in between, so they ended up being 4 times 75, 300 minutes for this process, and accounting for the dose rate you would be getting from these shots to the operators that were taking down the film, they were in the betatron et cetera, and we put all that together into an average dose rate while you were X-raying uranium, and then that later on in the White Paper is used as part of the dose estimate based on how much uranium -- they were doing for various times.

CHAIRMAN ZIEMER: And you included neutron in this one, I think, right?

MEMBER MUNN: Approximately 90 percent of the neutron dose is received first --

MR. ALLEN: Okay.

MEMBER MUNN: -- following irradiation.

MR. ALLEN: There's a lot of

numbers going through my head right now --

CHAIRMAN ZIEMER: Well, what I'm trying to get a feel for, so -- there's no prompt neutrons that you worry about because those are only occurring when the thing's being irradiated. It's only the activation products --

MR. ALLEN: Right, prompt neutrons are dealt with, with the shot scenarios.

CHAIRMAN ZIEMER: Right, separately.

MR. ALLEN: Yes.

CHAIRMAN ZIEMER: So this is residual so --

MR. ALLEN: It's essentially delayed neutrons.

CHAIRMAN ZIEMER: Well, that's why I was having a little trouble with these neutron ones. Jim, can you help me out on this too? Why are we seeing this much neutron after the shot?

DR. NETON: I can't help you;

Dave's been doing all the work.

(Simultaneous speaking.)

DR. ANIGSTEIN: I can speak to that. Neutrons from the uranium?

MEMBER MUNN: Yes.

DR. ANIGSTEIN: And you have the delayed, you have some very short-lived radionuclides that are neutron emitters. I mean there are neutron emitters, they are just very short-lived.

So this is the facility of MCNPx to do -- it's still at a -- even though now it's at a mature state, it's still -- they still call it developmental.

But what they do is they have a data file which they sample, which gives you -- after the photoactivation, you get -- rather than trying to trace each radionuclide and that is now, it's just -- so the answer is to have a separate database that they simply sample and they said these will be the delayed gammas and the delayed neutrons. Delayed neutrons go to zero very quickly, delayed gammas persist.

CHAIRMAN ZIEMER: Right.

DR. ANIGSTEIN: So your question was why are the delayed --

CHAIRMAN ZIEMER: Well, okay. Your delays are short enough, I guess, that you're still seeing some of the neutrons. Just intuitively, those neutron values look high to me. That's why I raised the question. I'm not necessarily disputing it, it was more intuitive.

MR. ALLEN: I can't say as I have a feel for what their intuitive value would be. I'm not -- as Bob said, I mean, you know in a nuclear reactor, some of the fission products are called delayed neutron precursors.

CHAIRMAN ZIEMER: Right.

MR. ALLEN: And they have difference -- some of them are a little bit longer half life, they decay to something that then emits those neutrons and you get this delay.

CHAIRMAN ZIEMER: Yes.

MR. ALLEN: And you know that helps control a nuclear reactor.

CHAIRMAN ZIEMER: But they're really pretty short and --

MR. ALLEN: Yes, and you're going to get --

CHAIRMAN ZIEMER: We're out here at -- I guess most of this -- see, you're assuming that, okay, they have a brief delay and then they are going in and handling it, so they are getting that early in that scenario.

MR. ALLEN: Yes, this starts five seconds --

CHAIRMAN ZIEMER: Five seconds in, so yes, okay. That -- all right. I'll just --

MR. ALLEN: It's my intuitive -- if I had to guess at what the number would be before I ran these, it wouldn't have been that high.

CHAIRMAN ZIEMER: No.

MR. ALLEN: But --

CHAIRMAN ZIEMER: And it's taking into consideration all those photoactivation products that are neutron emitters.

DR. ANIGSTEIN: Essentially photofission that you would get.

CHAIRMAN ZIEMER: Photofission.

DR. ANIGSTEIN: I mean you get both.

CHAIRMAN ZIEMER: Yes.

DR. ANIGSTEIN: You get both. But the neutron emitters are from the fission.

CHAIRMAN ZIEMER: But I guess it's because we only had the five second delay that we are still getting some of that and -- okay.

MEMBER BEACH: Might be break time if we wanted to catch that.

CHAIRMAN ZIEMER: Okay. Just a couple more seconds here and then okay. So that answered my question. Let me see if, Dan, you have a question --

DR. McKEEL: I had a short comment. We brought this up many times about -- this goes back to the fundamental purpose of why General Steel Industries had a contract with the Atomic Energy Commission and with Mallinckrodt Chemical Works to X-ray their uranium.

And what we have put on the record is, in many different ways as we know, is it is quite clear from the purchase orders and from Technical Bulletins that Mallinckrodt Chemical Works uranium division offered, that they sent to GSI the betatron slices which were modeled. They also sent both two-step uranium ingots, you know, made from derbies, remelted and then cast in the bomb, and dingots, which were a patented form of one-step uranium from Mallinckrodt.

The dingots, I think most of them, actually came in the later years probably from the Weldon Spring plant. But the point of the

X-raying certainly may have been to find cracks and flaws and voids, but the main point, which is continually overlooked, and if you understand this, you understand why they shot four corners, they weren't trying to go through the entire ingot or dingot. They couldn't. It was 3,000 pounds. It was 18 inches in diameter and it was two feet tall. You couldn't do that with a betatron.

But what they could do is -- when those uranium, that metal came out of the bomb, it carried along with it crust or slag from the magnesium fluoride, and that crust and slag covered the entire ingot and dingot, and then, when they had the X-ray pictures and they could take it back to Mallinckrodt, then that would guide the way the vertical lathes would shave off the slag and the crust, and what they were after, of course, is that highly valuable, pure uranium, shiny metal lying underneath that crust and slag.

They couldn't really -- they can't

roll an ingot or a dingot until that's done. And what -- the valuable information they got from GSI was where is that interface, all over that ingot.

And so a betatron slice wouldn't do that for them. And if you think about it, or at least the way I think about it, you have a two-foot tall ingot or dingot, and you take off a slice, and you see that there's a void in the bottom, well that's not representative of what's all up and down there. There were gradients in that ingot and dingot, and they talk about that.

And so you really had to look at the whole thing. So they needed to give those X-rays to the machinist and cut off the crust and the slag, revealing the ingot -- the pure uranium underneath, is what they were looking for. Then they could take that and roll it and send it out to Hanford or what have you.

CHAIRMAN ZIEMER: Yes.

DR. McKEEL: That's fundamental.

MR. RAMSPOTT: Dr. Ziemer, this is John Ramspott again. This is an actual document that we did share with people and we'll do it again today, and it states in here, "The amount of metal to be removed by cropping in order to produce sound material for rolling is determined by the use of high energy X-rays."

They had to see through the crust, take off the crust without cutting into the uranium, which was like pure gold, and the cropping was done after GSI did their X-ray, according to this, too.

So that's a pretty important thing. It's pretty nasty stuff in that crust. I thought I'd share this.

CHAIRMAN ZIEMER: I don't think we've disputed that that's what they were doing.

MR. RAMSPOTT: Well, there could be very few slices. A slice on an ingot is probably only four inches thick, at most.

That's right. You couldn't tell from that what your problem was through the whole ingot or even take care of how much crust is everywhere in the ingot for that process.

So -- and the other thing the workers point out, they are going through magnesium. Now they're not going through uranium. So the shot time is nothing. We've got workers on the line that can tell you it's not a two hour shot. It's zing zing. You run a whole lot more uranium through there, and they bill by the hour not by the piece, and that's pretty important.

So the quantity has changed totally as to what could be going there.

CHAIRMAN ZIEMER: Now, does any of that affect -- you have to mull that over a bit.

MR. ALLEN: I was going to say no right up until that last part. I don't think on the crust -- I mean, the crust that I've ever seen at Fernald and stuff, you're not going to get enough to where you are actually shooting much of a crust.

I mean you are going to shoot, it's mostly uranium, you're going to find the interface as Dr. McKeel said, but from what the workers were saying in Collinsville, it was about one hour shots, shot obliquely, which make -- like Dr. McKeel said, makes sense to find that interface.

And they actually drew a picture out for Stu Hinnefeld of what the shots were laid out at, and it took four shots. So I mean it sounds like we're talking about the same thing. There were four, one hour shots on these of, whether it was two-foot thick or a few inches thick, it's going to make little difference in the model because, you know, the bulk of that is going to be absorbed in the first few inches of uranium because it's so dense.

So the White Paper, I probably shouldn't have said defects in there, I could have just said they X-rayed uranium and left it at that, and I don't think anything would change what --

DR. McKEEL: I don't mean to -- you know, they would see surface defects on the surface of the uranium. It will penetrate some in that period of time, and the men did say they had four and -- so David's estimate of 300 minutes for the whole process, that is what -- that's what the worker that I trust the most, that seemed the most credible to me, that's basically what he said. So I --

CHAIRMAN ZIEMER: Final comment, then we're going to take a break.

DR. ANIGSTEIN: Yes, I'd like to set the record straight on this. We have -- I conferred with this at length with Bill Thurber, who is a retired -- who was a metallurgist who worked with uranium for many years with Union Carbide, at Oak Ridge, so we discussed this process.

I think there's a little confusion

here. The -- your betatron slices, which we have, are documented in the Mallinckrodt TBD, and the workers that I interviewed at that meeting agreed that that was the most common, that was the common thing that they did.

So since those were -- those required four shots but that they were 18 -- 18 inches in diameter, the biggest X-ray film was 14 by 17 inches -- I think they were more than 18 inches diameter -- you needed four, four shots to cover that disc, that were done head on.

Those were done to see if there were -- there was a quality control to see if they were coming out with defects in the middle of the uranium.

Now obviously, those were -- I mean that was, that was destructive testing because they would cut up that uranium ingot to get this betatron slice as a QA measure, and then of course they would send it back and remelt them because you can't send those slices to be rolled into rods from Hanford.

The second thing, which all -- from the worker testimony that I've seen, is one worker said he came in in the morning on the regular shift, and the weekend men were telling him what they had done. So it was already second-hand. And what they had done was they took corner shots, so they would have an ingot, and they would take four corners.

They did not go all the way around, and the purpose of those shots were when you do a vacuum casting, you get a lot of poor quality metal at the top or maybe even at the bottom, and they would have to crop that, cut it off with a band saw.

So that was the cropping and they would cut the ends off and then of course they would remelt them and reuse them, but they wanted to know how much and -- as far as skinning it on a vertical lathe, you don't do an X-ray for that. You would have to X-ray every square inch of it. That's nonsense.

The machinist does that by eye. He puts it on, keeps turning it, as soon as he gets done, that is -- that is what my metallurgist colleague told me.

They turn it on the lathe until they can see it, because the coating is not regular, it's irregular, it's thicker in some place than others, and you don't do that with an X-ray, you do it by turning it and doing it by eye.

The ends -- and that's why they said they shot the corner -- the ends, they do for the X-ray, with the X-ray, you see how much to crop off -- there were two different things.

They were cropping off the ends and they were also turning it on a lathe. The end-cropping was what you did the X-rays for, not to get the surface in the middle because you would have to -- it's just not the way it's done.

CHAIRMAN ZIEMER: Well, I think

we've been talking about the cropping --

DR. McKEEL: Paul, I need to say this. This is one of those situations where two people who have excellent intentions, and believing they have excellent data, strongly disagree with each other.

So I accept what Dr. Anigstein just said his expert said, but I'd also like to just mention for the record that John Ramspott in particular and I as well, have talked to those workers repeatedly, many times, and the papers that we've said -- that paper right there is from ‘ identifying information redacted’ who is the head of Mallinckrodt uranium -- who was -- very knowledgeable and that's what he said they did at Mallinckrodt, so I suggest that whoever your expert was and whatever his experience were, and when you say that's, you know, potentially you're saying that our scenario was ridiculous, and I'm saying no, it wasn't ridiculous.

DR. ANIGSTEIN: I didn't say that your -- they did the -- perhaps it's a technicality and it wasn't even important. I agree that they would, that they would shoot the edges, the corner -- that's what they said, that's what they would --

(Simultaneous speaking.)

DR. ANIGSTEIN: They shot the corners but not to get the -- not to see how much to take off with the lathe, to see how much to cut off on the ends.

CHAIRMAN ZIEMER: Well, they were talking about cropping also. You're talking about --

(Simultaneous speaking.)

DR. McKEEL: In you all's -- you just said that --

MR. RAMSPOTT: Cropping was with a saw.

DR. McKEEL: Yes, you all said that cropping was with a saw, and in addition to the cropping of the ends, or the bottom, they cut off the sides.

DR. ANIGSTEIN: I agree with that also, but not -- but the X-ray was not used for that purpose, but that probably doesn't matter.

CHAIRMAN ZIEMER: But where was that done? At Mallinckrodt.

DR. McKEEL: At Mallinckrodt.

CHAIRMAN ZIEMER: Yes, so the X-raying -- we're all agreed the X-raying is the same thing either way. Okay. Let's take a 15-minute break, okay? Comfort break.

(Whereupon, the above-entitled matter went off the record at 10:02 a.m. and resumed at 10:19 a.m.)

MR. KATZ: The Work Group is back and we are getting started again. Let me just remind folks on the phone, please mute your phones except when you are addressing the group. If you don't have a mute button, press * then 6, that will mute your phone, and then press * and 6 to take your phone off of mute.

Thanks.

CHAIRMAN ZIEMER: Okay, I'm going to have us take a look at the skin dose. The NIOSH model has a skin dose component that's based primarily on some short-lived decay products of thorium and -- is it protactinium --

MR. ALLEN: Protactinium-234.

CHAIRMAN ZIEMER: -- 234, yes, there it is. And those materials at the surfaces of the ingots, drive that dose rather than the uranium itself I guess, as I understand the model, those get the biggest contribution.

There's some uranium contribution, but your model includes all of those, right? The --

MR. ALLEN: Yes, and that's already typical with uranium is those two short-lived products --

CHAIRMAN ZIEMER: Right. So that part's -- that part of it is sort of standard but then you have issues of -- a percent of the time you're at, say, a foot versus a meter, and I just wanted to ask for my understanding, what's your basis for that distribution? I mean is it sort of arbitrary or is there a work basis that we know of for saying, you know, part of the time they are away, part of the time they are working close, and then you have the hours per week, is it based on the 90 percent long shots and the 10 percent?

So can you sort of, sort of defend the basis for those distributions and then I'll open it up here for questions?

MR. ALLEN: The half the time one foot, half the time one meter is a standard we've been using in TBD-6000 and it is, it is based on -- I wouldn't say based or somewhat validated by looking at dosimetry records from various places that work with uranium metal, and that assumption seems to be fairly typical for somebody working with uranium metal, I mean it gives addition to the numbers that correspond to badges and TLDs that have both gamma and beta in them, and it does seem to be standard throughout time, throughout different facilities when you are working with normal low-enriched uranium. In high-enriched uranium it might be a little different because you get less of those -- less beta dose.

CHAIRMAN ZIEMER: Right. Right. And then just sort of for the record I want to make sure that we were aware of what NIOSH's basis was for that. Obviously one of the issues that could arise on this sort of thing is well, does that apply here and I understand that, but that's your starting point, and then the 90-10 had to do with what you learned from this site in terms of the long shots versus the --

DR. ANIGSTEIN: That's one of the workers' testimony.

CHAIRMAN ZIEMER: Yes, the short shots. That part I was more comfortable with.

Okay. Let me open this up for questions on the skin dose model. Dr. McKeel or anyone, did you have any questions on it right now?

DR. ANIGSTEIN: On the skin dose model, no. No.

CHAIRMAN ZIEMER: Okay. That was the basis. Okay. That included both -- well that's primarily beta stuff that we are talking about there. Let's go on to film badges.

There -- I know there's some issues on control badges, and maybe we'll discuss a little bit of that in a moment. I wanted to ask about -- basically you're trying to use the film badge data in terms of where it overlaps in terms of normalizing that with some assumptions about control room values, and I understand that part of it.

And then the -- on page 15, you have the statement that 400 previous shots accomplished in the same location while the short shots, assuming there were 500 previous shots and you referenced SC&A, and I was -- just needed a little clarity on that. It's the middle of page 15.

MR. ALLEN: Okay, that's section -- that's dealing with the residual radioactivity in the steel --

CHAIRMAN ZIEMER: No, no, I'm in the wrong place on that one everybody. That was -- wait a minute -- that was still -- that one's still part of the skin dose stuff. Okay, I'm sorry, I'm looking at the wrong page. Let me get the right place. Here it is. Here it is. On the film badges --

MEMBER BEACH: It started on page 20 and that's --

CHAIRMAN ZIEMER: Yes, well, the film badge stuff is on pages 16 and 17. Okay. The question that arose for me on the film badges, and I think arose maybe for the petitioners, was do we have any confirmation that the control badge was in the control room?

Was there -- there was a film badge rack there where they were supposed to leave their badges. Are we assuming that the control badge was there at the rack, or what's the basis for using that --

MR. ALLEN: To clarify, there is a control badge that was always associated with each group and there's also, separately, a betatron control room badge.

CHAIRMAN ZIEMER: Control room badge that's labeled as a control room badge.

MR. ALLEN: Yes.

MR. DUTKO: Dr. Ziemer.

CHAIRMAN ZIEMER: Hang on.

MR. ALLEN: And I realize there's some -- now there's some people saying that that didn't exist or whatever, but he dosimetry reports had that in there, and I'd assume that control room badge meant that it was in the control room and that's how the White Paper was put together.

So are you asking about the

control badge or the control room?

CHAIRMAN ZIEMER: Well, there's two parts of it then. The control room badge, do we know that there was a badge in the control room? There was a badge labeled control room, right?

MR. ALLEN: That in reality is all we know, there was a badge labeled control room badge up through --

DR. ANIGSTEIN: Excuse me, can I --

CHAIRMAN ZIEMER: Hang on Bob, hang on.

MR. ALLEN: Not the full time but up through `65, maybe. I can't recall the date.

CHAIRMAN ZIEMER: And that's as opposed to what you're calling control badges which --

MR. ALLEN: Yes, they had both listed on the Landauer --

CHAIRMAN ZIEMER: On the Landauer

form, which presumably are badges that they used to subtract out a background value from everything else. Is that --

MR. ALLEN: That's normally what a control badge --

CHAIRMAN ZIEMER: Yes, that's normally how it's done. And do we have any knowledge of where those were located?

MR. ALLEN: No. There's been some information come to light since then, but when the White Paper was written, no.

CHAIRMAN ZIEMER: Okay. Bob?

DR. ANIGSTEIN: I just have to correct -- the badge on the film badge record, those five years' worth of film badge records that I looked at, it's not -- does not say control room. It says betatron CTL, which I guess is an abbreviation for control. It does not say control room.

MR. ALLEN: Okay. I believe Bob's right on that.

CHAIRMAN ZIEMER: It's labeled

betatron --

DR. ANIGSTEIN: CTL.

CHAIRMAN ZIEMER: CTL. Control.

DR. ANIGSTEIN: Right. Right.

CHAIRMAN ZIEMER: So we don't know that it is or isn't a control room badge -- that's as far as your record -- there's no -- let me ask Dan or John, what's your take on that one? Or do you have any -- can you shed any light on that?

DR. McKEEL: Yes, I'm going to show you all several slides about that, but the basic understanding that we have reached about that is the -- they are -- unlike in Dr. Anigstein's report, there is actually alive, and we have talked to him and gotten his affidavit, from the first clerk who actually handled the GSI film badges, this is very recent.

And what this gentleman says is that he -- he went -- when he was the clerk, he came in right as the new betatron machine was installed and they were starting up the new badge program, and that he got the badges from Landauer, he collected the badges, and he sent the badges off to Landauer himself.

They didn't go through any intermediaries or anything like that. He said, you'll see, in his affidavit, that there were no control badges that were not worn by a person.

So the workers, no worker that we've ever talked to, has any knowledge about the CTL badges, what they were, where they were, or that they ever existed, that appeared in the Landauer film badge -- apparently.

And as you remember, what happened was I contacted Landauer, I got film badge data on quarterly report from about 30 workers so I've never been able to -- I've never seen the badges that Dr. Anigstein is talking about, but I'm sure he's right if that's what he says, that -- so, but the workers are not aware of any control badges, control room badges, and then I will share you that definitely the racks were not ever in the control room. There were no badges kept in the control room, the console room where you operated the betatron.

They were in two locations.

MEMBER MUNN: According to your report.

DR. McKEEL: Yes, so --

CHAIRMAN ZIEMER: Okay, and John did you have any additional comment on that, or did --

MR. RAMSPOTT: Well, just very briefly, but the badges you have are strictly, I mean I think they're from '64 on essentially. The new betatron was built in `63. So from `53 to `64, there are no badges, no control room badges --

CHAIRMAN ZIEMER: We're aware of that.

MR. RAMSPOTT: No nothing, no racks --

CHAIRMAN ZIEMER: No. No. No. We're just asking about these, and did you have any other comment on that?

DR. ANIGSTEIN: No I was just saying, the betatron -- the new betatron started operation just about the time the film badge records start.

It was either end of `63, beginning of `64. We even have a photograph of it in late `63 so -- so that's, you know, consistent with that.

My comment about nobody being around, I was simply going by the names to whom the reports were addressed. There were two different names on the report over the years and the first one, John Ramspott told me the gentleman is alive but incapacitated, and the other one we know has deceased.

So that may be -- they may have had someone else who actually did the handling but the name on the report -- it was addressed to a certain person at GSI and those names --

that's what I was reporting --

DR. McKEEL: This is Dan McKeel. When I first called Landauer, which was about 13 months before NIOSH ever got their film badge data and gave it to SC&A, they told me that actually the film badge program managers, there were two of them, and one of them was Mr. Norris, who is deceased, and then there was a later one who took over after Mr. Norris left. I don't know --

DR. ANIGSTEIN: That was actually a covered period.

DR. McKEEL: Right. But the person I'm talking about right now was actually the clerk who handled the film badge --

DR. ANIGSTEIN: Okay.

DR. McKEEL: And worked under Mr. Norris. We had heard various things. One thing we had heard was that there was a chain of people with badges, passwords, and this particular person says not when he was there.

And he then went on to name the other people in succession who took over his job as clerk as they kept on -- there was a lot of promotion and changing.

But anyway, the clerk basically handled that. And that was new for me, and that makes it much simpler to track, actually.

CHAIRMAN ZIEMER: I think one of the GSI people on the phone had a comment they wanted to make also. They at least -- did one of you on the phone have a comment on those film badges?

MR. DUTKO: I relinquish my time to Dr. McKeel.

CHAIRMAN ZIEMER: Oh, okay. Thank you.

DR. ANIGSTEIN: I will address the film badge location.

CHAIRMAN ZIEMER: Right, you know, that's fine, I just wanted to see if we had any other questions on at least the methodology that was used for -- by NIOSH on this.

Okay, the next one is the residual radiation from the betatron. And this is basically activation issues. Dave, do you have any comments on that that you want to highlight at this point?

MR. ALLEN: No, not really. All I tried to do in that particular section was to put down in one place everything we had looked at or other people had looked at to try to explain this -- what the Allis-Chalmers individual told about the 15 millirem right after the shot that dropped off to zero within 15 minutes.

CHAIRMAN ZIEMER: Yes.

MR. ALLEN: And so far as I can tell, nobody has come up with anything that will give you that kind of a dose rate. There is some activations --

CHAIRMAN ZIEMER: Well, you looked at it, SC&A had looked at it without all these debates. But bottom line is -- and I think this is a question -- what are you doing with the number?

What are your plans in dose reconstruction to do with the number, wherever -- in other words will it be used or will it not be used? That's the --

MR. ALLEN: From the White Paper, it is -- the White Paper assumes there is no residual, no measurable residual from that. And the reason that it did that was, besides can't come up with a real basis for it, the reason I did that was we were going to normalize everything and make it consistent with the film badge readings, and this particular source of radiation would be purely gamma. Other sources of radiation that could add to the film badge would also include other radiation, such as beta or neutron, whether it's -- whether it's from the betatron shot itself or from the activated materials.

And as long as we're normalizing to the badges to make our estimate consistent with the badge readings, it ends up changing very little on the photon, if any dose on the photon dose, but it will, by ignoring this, it will increase the beta and the neutron dose because the other sources also have those components.

So the decision was made on this one that we can't find any realistic reason for that kind of a rating --

CHAIRMAN ZIEMER: But in essence you are saying that if it's there as a gamma or photon component, it would have been picked up by the film badge of the workers and therefore gets included in their readings in a sense.

MR. ALLEN: Right.

CHAIRMAN ZIEMER: So it's not an additional thing. It's a -- that's the position that -- it's -- you're not necessarily saying we're removing 15 millirem per hour that occurs for a brief time. You're saying that if it's actually there, we don't know how it could be there, but if it is, the film badge would have picked it up. Am I understanding you correctly?

MR. ALLEN: Yes.

MEMBER MUNN: If it's there and the worker was there, then it would definitely be on the film badge.

CHAIRMAN ZIEMER: Right, and let me ask for questions now. Dan.

DR. McKEEL: Well, I have a comment and this -- I guess this is a terrific -- philosophical and scientific issue in my mind, a giant one. What I was always taught and believed is that if, you know, if you're dealing with real physical phenomena, you have to deal with it.

The way I read OCAS-IG-003, it says that for dose reconstruction -- and I'm going to point out this afternoon, these White Papers are supposedly primarily aimed at revising Appendix BB from June 2007.

So if you're really aimed at dose

reconstruction, you have to account for all sources of radiation. And so, ' identifying information redacted', contracted by NIOSH, their expert, said he made these measurements.

The Work Group considered it, NIOSH has considered it, SC&A has considered it, and it can't be explained, everybody says. Personally I think it's easy to explain from the beginning. I think the target gets activated, and I gave Dr. Ziemer several papers which he knows much better than I -- you all know the literature much better than I do. But there are dozens of papers about particle accelerators, many components inside them become activated.

But anyway, so it seemed to me that there were a number of sources within the betatron that could emit radiation after it was turned off.

There's also evidence from the Allis-Chalmers manual that advises people not to go in and use the betatron. I think they mention something like five minutes in time could maybe fill that in.

But also, and let me just summarize what I think it is -- so you know, John Ramspott and I met ‘ identifying information redacted’ long before anybody here knew him.

We talked to him across the table at length for three hours up at West Allis where the Allis-Chalmers factory betatron is. We saw the Allis-Chalmers original betatron, that building, and in operation at that time.

So anyway we knew ‘ identifying information redacted’ real well. And John knows him better than I do. So anyway John called him up again the other day, and so he said that he was concerned about this issue about the residual radiation, and they were curious where it was coming from so they did a second analysis where he and his buddies actually removed a donut tube right away after it had been turned off as fast as they could, and I don't remember how long a period it was but they got it out --

MR. RAMSPOTT: He said a couple of minutes.

DR. McKEEL: A couple of minutes and they --

MR. RAMSPOTT: They had four guys helping or three guys helping.

DR. McKEEL: He did their measurement and they found -- I don't think he gave a number to it this time, but that there was residual radiation, and then I'll show you this afternoon we have yet another affidavit from another source completely, somebody at GSI, who said he was well aware. He had measured residual radiation after the beam was off.

So my feeling is I think we are all good solid scientists sitting around the thing. There probably was a residual radiation dose. I think it has to be considered. I think it has to be considered definitely for dose reconstruction and should be considered for the SEC analysis because of another factor that you'll see in the slides, and that is a point that Mr. Dutko has made for a long time and that is, I think in the calculations of how much radiation a worker might receive, if there were residual betatron beam or betatron residual activity after the beam was off, the assumption is made that, you know, they were taking shots at like six feet. But the workers were interposed between the target and the betatron and so this affidavit, which I'll show you, that worker writes it out in detail and reasons that his back was probably one to two feet away from the betatron.

Now then we have a scientific dilemma. We have film badges that say they didn't get a very high dose. We have workers that say they were in front of this machine.

I think for both situations, dose reconstruction, SEC, you have to be claimant-favorable, so number one, I think you have to admit there was residual radiation. So I think to discount that in a model like I understood David Allen just said was done, I think that's wrong, scientifically. I think that's a mistake, an error that shouldn't be done.

Now if you want to say it's a small dose, then you can put a number on it. That's what you guys do that I really can't do. I don't know how to do that, except if I have a real measurement.

But, so I think you need to deal with it, and then I think, you know, I would just say that one reason that I, John, and a lot of the workers are highly doubtful about the film badge data is, yes, it does reason that if were all these exposures, you know, that it ought to show up on film badges, and we have this limited data set which says it doesn't.

Now I'll also show you this

afternoon a fact that Dr. Anigstein I think had in his report a long time ago, that the film badges belong to betatron employees, the people who worked in the betatron building, not all of whom were betatron operators or isotope operators, you know, the people who were photographers, the people who were clerks -- that's mentioned in the affidavit, I'll show you that this afternoon.

So anyway I just think it's a small but needs to be accounted for dose, and to that extent, I would say the model should account for it.

CHAIRMAN ZIEMER: Okay, thanks. Yes, John.

MR. RAMSPOTT: One quick, if I could. I did talk to ‘ identifying information redacted’ two days ago. He said, yes, I know that, I've talked to people and I've told them what I did, and I don't think they believed me. I think they, you know, don't know what I'm talking about, but it is in the -- it's actually in the Allis-Chalmers operation manual that that tube is hot.

He also said there's something else you might be missing. Now that 15 milliroentgen that's at six feet. It's actually 60 millirem at three feet, and I think everybody's reports pretty much acknowledge workers are within two feet of the tube, or of the cone, and his testing was uncollimated, so there is no aluminum -- or -- or is that the filter they had on there, the compensator -- he had one on his machine. So that's definitely not what's getting activated.

It's the tube. When they took it out, they set the tube on a table, they let it sit, it dissipated over 15 minutes, and it was gone. He'll be glad to talk to anybody, verify that, and then he goes, you know, it's not a whole lot. Well, I understand. That's what we're talking about.

And I said well, yes, and then we

talked about one more thing, just because I'm talking about him, about the door. He goes well, you know it was pretty safe, John, in those days, we thought it would be okay.

And you know, that's standard, standard practice was a steel ribbon door, from this man. No ifs, ands or buts. And then I said well we had a little problem over there though, I think. They used cobalt.

He was dead silent, and he goes oh my God. Totally different ball game. Cobalt and betatron -- you don't use cobalt in a betatron building. Roofs aren't shielded. Walls go up 20 feet in the old betatron, 25 feet in the new betatron, and the rest is tin.

Built up wooden tar roofs. You don't use cobalt in a betatron building. He -- he was flabbergasted to hear there was cobalt in that building. As far as any modeling, big cobalt, little bit of cobalt, any isotopes, betatron building is not a non-destructive cobalt building according to this guy. So that's all. Thank you.

CHAIRMAN ZIEMER: On the residual activity, I don't think any of us is disputing that there's residual activity after the operation. There's activated stuff.

This 15 value, the problem on it was that the person reported that it dropped to zero, and that's what -- that's what we were having trouble with.

We felt that it should -- if it's normal decay it would not drop to zero. I mean, it would exponentially come down. So we were trying to find why would you have a 15 reading go to zero in whatever that time --

DR. ANIGSTEIN: Fifteen minutes.

CHAIRMAN ZIEMER: Fifteen minutes. That was what the puzzling thing was about that. I think what NIOSH is saying, all right, so that doesn't make sense from a sort of physics point of view, but if it was there, we'll assume that -- you're saying we're going to assume it's there, that if there is some ionizing radiation, it's got to be residual photon radiation. So the film badges should be picking that up. That's what they're saying, that they're not ignoring it.

Now, and there's other activation stuff which you have done a construction for because a lot of these workers are working with stuff that's activated in the layouts and so on, I mean, that's a part of your separate --

DR. McKEEL: I have one more comment to make. This is another big philosophical thing. David Allen said something in his analysis that really bothers me as a scientist.

I mean, not only does it bother me, but it goes against everything that I was ever taught or believe. And that is he really was saying that you fit the model because you want to, quote, "normalize it", to the film badge readings.

So that means that you have

already a priori, before you do your modeling, you have already established the result that you want to occur.

And to me, that's not the purpose of modeling at all. The purpose of modeling -- and I'll show you this in my last slide today -- to me the modeling results don't match the film badges at all. They're really way apart.

So -- but the idea that from the beginning you try to make the model fit the film badges, is just a really bad approach. So I think you should do the modeling and let's see where it goes. So I must say the logic of what you're telling me escapes me.

CHAIRMAN ZIEMER: Well, let me say something about models and then you can come in, Dave, because models are attempts to make sense of our world. We model a lot of things.

DR. McKEEL: I understand.

CHAIRMAN ZIEMER: And we use real numbers whenever possible to validate models.

I liked the quote of your colleague at Hanford who said all models are poor, but some are useful, because they are -- in a sense they are substitutes for the real world. I mean, we are trying to describe things and simplify things and so on.

But where we do have data, we do try to say okay, how -- the data is real, real stuff. We can debate is it good data and so on, but that's the reason we do that is in a sense to try to validate a model and say does it make sense with whatever real world data that we have.

I mean, if -- and there's errors and so on. But that's the -- so models, you know, and we do, we do modeling all the time in this program and it's, you know, that's the nature of how we have to do these things.

Dose reconstruction, a lot of it is modeling, but you know, it's always this thing, if we had the real data we'd all be more comfortable. We're trying to put them together, and that's really what's happening --

DR. McKEEL: I understand that but I -- this is Dan McKeel again -- but I want to just take that on one step further and say that, you know, if you looked in my CV there, there are three papers that have to do with modeling the size and shape of the plaques that accumulate in the Alzheimer brain.

My colleague wrote a Fortran program to do that. But the validation for that was me sitting down in front of a microscope and counting 94,000 plaques to validate that, you know, the correlation coefficient was like 0.86.

But I would say -- and I've read a lot of papers by now in the field of radiation modeling, so I understand everything you said. It seems to me however if you want to present your new model to a highly-respected, refereed physics journal, that you're going to be in big trouble if you send them a model without any real data as the validation for that model.

In fact, you probably won't get it published. Now, I think you would say, yes, that's academics and scholarly research and so forth, but that's not the real world.

So I understand why some model, it's better to make sense out of things than no model at all. That's fine. But if you recall as well as I do -- and I'm sure you recall it better and I'm sure Wanda can even better -- is what happened about Blockson and the radon model.

There was a model first developed by SC&A, then adopted by NIOSH, and it didn't fly with the Board. It didn't fly with the Work Group. It didn't fly with the Board. There was a deadlock on opinions on that.

And so basically the model didn't fly, and the model didn't fly at Texas City, which was awarded an SEC. So all I'm saying is I think there's standards that you have to hold models to, and I'm just saying I think we should be rigorous in this program.

I don't think we should be overly rigid, but I guess that's -- that's where I'm coming from.

CHAIRMAN ZIEMER: Well, and I understand that, and you know, in -- the reality is we don't have a standard by which to measure models. To some extent we vote on those models and it's -- some subjectivity -- I happened to like the one model that was turned down, but that's, you know, that's fine.

DR. McKEEL: I understand.

CHAIRMAN ZIEMER: That's fine. That's how this process works. And this process is not wholly scientific. It's public policy and science.

DR. McKEEL: Right, I understand.

CHAIRMAN ZIEMER: And so, there's -- well, I'm preaching to the choir -- you guys all know this stuff. So I'm just --

DR. McKEEL: Can I say --

CHAIRMAN ZIEMER: I'm just wanting to make sure that we understand how NIOSH did this and they used the film badges to normalize their model as a sort of reality check, whether or not we agree to that, but that's I think what was done.

And my understanding is, from NIOSH's point of view, the 15 mR per hour part of that, you're not saying we're therefore -- we're ignoring that, that the model captures that through this normalization process where you use the film badge. That's where, I think is, am I describing that? Dave, you -- I don't want to be defending NIOSH. You guys defend yourself, and you may be wrong.

MR. ALLEN: Because we are -- making sure the model is consistent with the measured data, which is the film badge data, it was favorable to not account for the residual --

CHAIRMAN ZIEMER: And that was

favorable because?

MR. ALLEN: Because that means the sources we are accounting for, some of the sources we are accounting for also include a neutron component or a beta component and an increase in those, whereas the photon component is set with the film badges so this doesn't actually increase that.

DR. McKEEL: Well, I've just got to comment. That's exactly what I said. I think that's dead wrong.

MR. ALLEN: That is a bounding approach which is more policy than hard core accurate --

CHAIRMAN ZIEMER: He's saying that's more claimant-favorable. That's all you're saying. Okay.

DR. ANIGSTEIN: I think we're losing the point of one thing here. You know, and that is, the measurement is only as good as the instrument that's used to measure, and the ionization chambers that were used are notorious for being susceptible to stray electromagnetic fields, and there was certainly a lot of that around the betatron when it was turned off.

We did this study, we hired this accelerator physicist to do the study of the betatron circuitry, and he said yes, there was a possibility that there would be some remaining -- some remaining fields there that were not enough to accelerate the beam and produce any significant dose.

So he did the electrical engineering analysis. I did the radiological health analysis. I came up with, you know, if you take the worst possible case, you might get a few micro-R per hour, not milli-R. It's a thousand fold difference.

However, those same electrical fields, radiofrequency fields, are notorious -- I talked to a Mr. Zlotnicki, who is a health physicist, CHP, a lot of experience in this field, and he said we're always having trouble making measurements, radiation measurements, in the presence of electrical fields.

And Dave Allen, in his report, did point out that if there was a change in -- he had a static -- a, what do you call it, a DC field or a static field, but changing gradually, that will cause a meter reading. You have a magnetic field that is declining, that will cause a meter reading, also if you have a radiofrequency field, it's simply means the magnetic field is very rapidly oscillating, thousands of times per second, it will also cause a faulty meter reading.

So the -- you believe that reading, this instrument read that number, but the question is, what did that number mean? And in the absence of any --

CHAIRMAN ZIEMER: We've sort of passed through all this before, so I think it is what it is, and they have told us how they are going to handle it, so maybe we should move on here.

MR. RAMSPOTT: One fast comment. John Ramspott, if I may. There's photographs in just about everybody's report. That's just one of them over there. And those guys aren't wearing those badges on their backs.

Two out of the three have them on their chests, the machine's to their back. You guys are the experts. Will that amount the radiation that's coming out of there go through a human body and hit that badge?

Did the badge pick it up?

CHAIRMAN ZIEMER: Well, you have the method of treating that --

DR. ANIGSTEIN: I will get to that.

CHAIRMAN ZIEMER: Okay. Okay. Are we ready to talk about beta operator dose estimates? I guess the bottom line is your Table 9, right, Dave?

MR. ALLEN: Yes.

CHAIRMAN ZIEMER: And there's some assumptions which sort of normalize this all to a 19 millirem per week control room upper value. That's the basis for the NIOSH estimate.

MR. ALLEN: Yes.

CHAIRMAN ZIEMER: And then there's some information on hours per week that an operator would work with uranium in the steel and so on. Any questions on those assumptions and how they're used? If I may ask, and Dan, again, you'll have your points, but do you have questions right now on what their assumptions were?

DR. McKEEL: I don't think I have.

CHAIRMAN ZIEMER: SC&A. Okay. So basically what you would do for a given year for the operator, would be to assign them this many hours working with the uranium, that many hours with the steel, and then use the --

MR. ALLEN: The Table 9, we misspoke, that's the hours, that's the uranium work --

CHAIRMAN ZIEMER: Those are the

hours of uranium work and then the fractions, okay.

MR. ALLEN: Yes, the bottom line comes down at the, I believe it's the end of the paper.

CHAIRMAN ZIEMER: Yes, at the end of Table 11. Okay, right, that's your time distribution.

MR. ALLEN: But it simply just takes the shot scenarios for the steel, and the shot scenarios for the uranium, as far as how often the betatron will actually be operating and what kind of dose they would get in the control room, and it was being combined with how often they would be out changing film, reorienting the betatron et cetera, how close they would be to the metal and what kind of dose they would get, and essentially you come up with an average dose that they're getting while they're shooting uranium and the dose they get while they're shooting steel, and then basically the hours in Table 9 as far as the uranium, or combine the two to come up with an overall annual dose. That's in Table 11. And it varies from year to year based on Table 9 uranium work.

CHAIRMAN ZIEMER: On the betatron operators, speak a little bit to the contribution from the front to back, back to front issue. John has raised that a bit and clarify how that is being addressed.

MR. ALLEN: With the -- well, with the assumption that there was no residual on the machine then it's not much of an issue. We're assuming that you're facing the work with the casting and the uranium.

I think that really comes up a little later. Bob kind of raised that question too. But from what we looked at, the issue with that is essentially the energy of the photon. If the machine were activated what would be the energies, how much of that would make it through the body to the film badge, also the orientation of a person, would he always have his back to it or would he be turning around and moving some?

As far as -- there are very few isotopes that are -- that you could get from the materials in a betatron that would give you a half life that will decay away in 15 minutes.

Most of them are hours, some millions of years, you know. Most of those that you could get end up giving you either a -- a number of them would give you a 511 keV photon, the bulk of which will get through the body and will be measured on the film badge, even if it's always at the PA geometry and it's always behind him and shielded.

But again, you know the person is going to be moving around some. They are going to be oriented at the betatron some, and not have their back directly to it the entire time they are reorienting.

MEMBER BEACH: My guess is their back would be to it most of the time, though, and they would be facing their shot. That's what I would think.

MR. ALLEN: It would be back -- their back would be to it while they were handling the film and from what we -- from the information we get, it's a lot of shots on the casting that they are laying that out ahead of time in the number 10 Building, making marks on the casting et cetera, so they don't have to do that while they are in the betatron.

So a lot of the time is, in theory at least, is moving the film, putting a new piece of film on there. But they also have to reorient the betatron itself, which would be very difficult to do with your back to it.

MEMBER BEACH: Right.

MR. ALLEN: So it's going to be a mixture.

MEMBER BEACH: Still thinking the 90-10 --

MR. ALLEN: Yes. The 90-10 -- I mean, it's going to -- a lot of it is going to

-- 511 keV, a lot of it is going to make it through the body and show up on the film badge. Some of it is going to be directly to the film badge or you know, at an angle to the film badge.

There may be some reduction if there was a lot of dose coming from that, but there's still, the bulk of that would show up.

CHAIRMAN ZIEMER: John.

MR. RAMSPOTT: Actually, in the photograph too. It's a three-man crew normally, if I understand the workers correctly. Two of these guys had their backs to it. The guy up on the top is the film guy. The guy in the middle here was the marking guy. And it's already marked up but he actually, in this case here, he's putting like lead corners, markers, so when they focus this thing, they're aiming right at it.

Two out of these three guys, pretty typical, their back -- you're right, Josie, their backs are to the betatron a whole lot of the time. But they are working on the target. They are working on the casting.

MEMBER MUNN: But they're also quite a ways away from it. It's the two-foot limitation that you --

MR. RAMSPOTT: Well, this is an exception here too, Wanda.

MEMBER MUNN: Yes.

MR. RAMSPOTT: This guy -- that six foot and nine foot shooting, it -- that's really a misnomer. It's six foot, but if the casting is two foot thick, that means the machine's got to be four foot.

MEMBER MUNN: Yes.

MR. RAMSPOTT: And that's -- that gets the -- you know, a human body, if it's a foot thick, I mean, they're getting pretty close to that, and this happens to be a massive casting here.

That camera's up kind of high.

MEMBER MUNN: Yes.

MR. RAMSPOTT: Normally, it would

be down a little bit lower to get on there -- they set them on three, four foot shooting platforms or a rail car. They told me that. A transfer car, about three feet high.

MEMBER MUNN: Yes.

MR. RAMSPOTT: This one's exceptionally high because it's sitting on a truck, framed to be shot, so that's a little bit out of proportion there, for the height of the machine.

This is a lot closer than the -- we have other pictures of these -- I mean, it's almost hitting him in the head.

MEMBER MUNN: Oh well, it has to be when you are working in that kind of an environment. But by the same token, there's -- it's one of the things that you can't -- you can't make a statement that all of these people were in close proximity to the betatron head that we are concerned about here.

MR. RAMSPOTT: Correct.

MEMBER MUNN: Au contraire; they

are moving around a lot. They have to be moving around a lot. If the assumption that we are making here is the reason they had their backs to it is because they are working so hard and so fast, then, ergo, they are moving around a lot, so they are not going to be that close. That's the only point I was trying to make.

MR. DUTKO: Dr. Ziemer.

CHAIRMAN ZIEMER: Yes. Go ahead.

MR. DUTKO: The operator for the betatron -- it must be remembered that if they were five inches and shot at six foot, anything over five inches.

And simply, the operator is standing, sitting, placing Xs on the casting, penetrometers, numbers, arrows, he was very close to the casting, he has not touched it. You're shooting at six feet. The machine directly impacts him.

I cannot figure out how, if we've got a leaky machine at three feet that's putting out 60 millirem -- excuse me, yes -- three feet, 60 millirem, and it's six feet, 15 millirem, how in the world would casting activation, a leaking machine and a hot control room which Los Alamos says it is, how in the world we can wind up with 1.35 roentgens? Thank you, sir.

COURT REPORTER: Is that John Dutko?

MR. KATZ: Yes.

CHAIRMAN ZIEMER: Thank you. Okay. Any other questions on the operators? I'm going to go to the layout workers here.

Okay. Layout workers -- let me start with a question here, again on the basis for the one foot 50 percent of the time and the one meter 50 percent of the time, I guess the answer there is the same as we had before then, it's sort of based on experience at other sites where they're handling similar kinds of things. Is that correct?

MR. ALLEN: Yes.

CHAIRMAN ZIEMER: Okay. And the use of the 10 Building, is that pretty much, everybody agree on that, that's where that was always done, and the 10 Building was layouts? Is there any --

MR. ALLEN: I think that was the closest place --

CHAIRMAN ZIEMER: It's just the closest one. There might have been others that this will maximize any bounding?

MR. ALLEN: I mean, some of it could have been done in the betatron, but the betatron wouldn't be on.

CHAIRMAN ZIEMER: Wouldn't be on.

MR. ALLEN: So the maximizing would assume that they were near that door in the -- in the number 10 Building while the betatron was operating.

CHAIRMAN ZIEMER: And the betatron might have been operating, so they have the exposure that they get from handling plus scatter --

MR. ALLEN: Right.

CHAIRMAN ZIEMER: -- coming in. That's the basis of your --

MR. ALLEN: Yes. It was intended to be a maximizing but it was also pretty credible, it seemed to be often that it was somewhere in that vicinity.

MR. RAMSPOTT: Question.

CHAIRMAN ZIEMER: Yes, John.

MR. RAMSPOTT: John Ramspott. Is that assuming the lead door?

MR. ALLEN: Yes, this White Paper is assuming the lead door.

CHAIRMAN ZIEMER: Okay, thanks. Wanda or Josie, questions on those assumptions?

MEMBER MUNN: I don't believe so. Seemed reasonable.

CHAIRMAN ZIEMER: And as I understand it, Dave, that you would take your layout workers' values, whatever your final numbers, which are the Table 10 values, and you are proposing to apply those to all workers at the site who were not betatron operators, is that correct?

MR. ALLEN: Actually, right below Table 11 there's a short paragraph and the last sentence says: "the dose reconstruction will choose the most favorable of the sets."

CHAIRMAN ZIEMER: So even if they were not known to be a betatron operator, if somehow their dose reconstruction got -- using both of these sets of things ended up, you mean that -- or how are you deciding?

MR. ALLEN: Well, basically whichever one's favorable for that particular person --

CHAIRMAN ZIEMER: For that person.

MR. ALLEN: -- which could depend on whether they have a skin cancer or --

CHAIRMAN ZIEMER: -- which cancer they have.

MR. ALLEN: Right. So it could depend on the years too, but I don't think it would make a difference.

CHAIRMAN ZIEMER: So if they had a skin cancer and the skin dose was higher from -- if you call them a betatron operator you would give them that value?

MR. ALLEN: Yes.

CHAIRMAN ZIEMER: If the skin dose was higher if they were a layout worker, you would give them that value?

MR. ALLEN: Right.

CHAIRMAN ZIEMER: Gotcha.

MR. ALLEN: And it seems credible because -- as I understand it, the betatron operators and some of them would be doing the layout --

CHAIRMAN ZIEMER: Right, I understand that.

MR. ALLEN: And you also have people --

CHAIRMAN ZIEMER: But there's people doing layout who were not badged and --

MR. ALLEN: Yes, as I understand

it, they were not badged while they were doing layout.

DR. ANIGSTEIN: Even the betatron operators would be not badged.

CHAIRMAN ZIEMER: Right. But there could be other people who were not -- didn't have a badge in the system even, wouldn't be considered a betatron operator.

MR. ALLEN: Right, because I mean, I called it layout, but the truth is that could be, you know, a quick repair job too --

CHAIRMAN ZIEMER: Yes.

MR. ALLEN: -- which could be, you know, any type of job. It could be also, you've got the chainmen et cetera that are moving the castings in and out of the betatron.

MEMBER BEACH: I just have a quick question, Paul.

CHAIRMAN ZIEMER: Yes.

MEMBER BEACH: On your tables you've got `53 through 1960 and then `53 through `65. Is that the total for those seven years or five years or --

MR. ALLEN: No, those are annual.

MEMBER BEACH: It is annual. I just wanted to make sure that that was clear.

MR. ALLEN: Yes, the reason I separated `66 for the Table 10 for layout guy, was because of the half a year --

MEMBER BEACH: That six month -- yes, I got that. I just wasn't sure on the others.

DR. McKEEL: Paul, I have a comment.

CHAIRMAN ZIEMER: Yes, Dan.

DR. McKEEL: My comment is a general one about layout workers being representative of the rest of the workers in the plant. So you'll see that what I tried to do at the end of this, my presentation, is to summarize the agreement in 2007 and `08 between the models that SC&A and NIOSH generated and compare those to what they came up with with new models, or reworking the old models in 2012.

And so in doing that, what kept me up too many hours late at night was it was very hard to trace the direction of how doses were assigned to the non-badged non-betatron operators.

And in Appendix B and the SC&A review, you know, there are places where the betatron doses, which were very much higher due to the earlier models, were said to bound everybody's doses, so there weren't any calculations done for those other people, so you can't get a direct comparison.

But what is clear is this time around, you know, the SC&A models for the layout workers are very high compared to the betatron operators and so it flip-flops.

We have always said in the past that the betatron operators got the highest dose, and 94 percent of the dose reconstructions at GSI have been done based on that premise, that the other people got less than a rem per year, whereas the betatron operators got a higher amount.

Well, if you go with what's now been done, you are going to have a vastly different result with that. So I guess, I guess what I would like to hear from David that I don't understand is: why have we finalized on layout workers representing the rest of the people?

My own opinion is there are other people that, you know, haven't had a dose calculated for them because you can't do it, you don't know who they were, where they were, what doses they received, and in particular the chainmen who had to handle the uranium and the grinders and the chippers, the people that actually got exposed to those hot particles from those activated castings.

So I'd just like to hear David talk about other non-badged workers and why layout workers were suddenly fixed on now.

MR. ALLEN: Well, the layout workers are because the doses that they are getting -- the two primary doses they are getting are from scatter while the betatron is operating down that tunnel, or down the equipment hallway or whatever you want to call that, into the number 10 Building, but also from working in close proximity to recently irradiated steel castings.

CHAIRMAN ZIEMER: And you didn't have that before in your, in your early --

DR. McKEEL: Well, layout men are -- I'm sorry, excuse me.

MR. ALLEN: We had people outside -- Appendix BB, that one? We had --

CHAIRMAN ZIEMER: Well, you were asking why the thing suddenly went so much higher, I guess.

DR. McKEEL: No, no, no, I was saying in Appendix BB, NIOSH mentions layout workers among other workers.

MR. ALLEN: Well, in any case the

reason that we are saying it's representative of other workers is that these are the sources of radiation.

You have the isotopic sources. You have the irradiated steel. And you have shine from the betatrons. The layout worker scenario here maximizes those last two.

I can't come up with any scenario where somebody is going to be closer, longer, to the freshly irradiated steel and get the scatter from the betatron itself.

And as far as the sources, as I mentioned before, that's in the other White Paper, and the intent -- this particular White Paper deals only with the betatron components, but a revised appendix would include both of those components, and just like the last sentence in this thing says, pick the highest of one for that particular, it's going to be pick the highest of sources versus layout men versus betatron operator et cetera and any of them that are -- obviously if one is always higher than the other, then it will be not even included in that particular one, but the basis would be there and say it'd default to layout man or default to near radium radiography, or whatever ends up being the highest, and I didn't actually --

DR. McKEEL: My point there -- yes, I understand that real well, and I understand why that would be an operational way to treat the non-badged, other workers.

I guess my point was though, if I thought about jobs and what people did, actually the people I would think that would be the most highly exposed would not be the layout men, who after all are fixing -- laying out on that activated casting, but it would be the grinders and the chippers and those people who actually take a tool and cut into those activated castings, and everybody who's worked around a, you know, a steel plant or a commercial power plant, or anything, and has seen that stuff, those hot particles can have intense radioactivity.

I would think that -- I mean, much more concentrated just in bare castings, so a priori I wouldn't pick the layout men at all as being the most, the highest of doses.

I would say that it would be a grinder or chipper or somebody like that in Building 10 that just got one of those X-ray castings.

And as I understood it from the workers, you know, they would -- if they found a structural defect that was significant, they might have to haul that casting back out, fill it in, send it -- put it back on the truck, send it back on the railroad car, send it back into the betatron and have it re-X-rayed.

I guess I'm saying that this highlights the -- Dr. Anigstein said it well about the scenarios. The 15 scenarios with exposures are, I understand them on a theoretical basis, but only about five of them relate to the real world.

And I would say that, you know, what this really recognizes is there is no badge data for -- at any time, for 97 percent of the people that worked at GSI. No film badge data at all.

So you are picking, you are modeling now, and trying to apply that to these non-badged workers, and I just don't think you can reliably do that. That, that's my point.

So I kind of understand you've got to pick somebody, but you know, it has not been a consistent approach and I do agree with David that those two basic routes of exposure, of people working the 10 Building for instance, you know, sky shining right down the tunnel, that does apply.

I have to comment, though, again this is a model predicated -- coming down the tunnel through a lead-lined steel door that I'm going to try to convince you all, persuade you, was not there.

So there's a problem with the model just from that point of view. Okay?

MR. ALLEN: I've got to say one thing there, and I don't disagree with you that somebody grinding on that is going to get more exposure, but you have to realize that we're trying to -- at least I have been trying to eat the elephant one bite at a time, essentially.

This White Paper -- you're right. We've been saying this is for betatron exposure et cetera. The truth is this is for external exposures from the betatron.

DR. McKEEL: I understand that.

MR. ALLEN: And what you're talking about is inhalation of radioactive dust from grinding on those. That was already in Appendix BB and that will be included in the overall index.

DR. McKEEL: Well, as I have understood it from painters and grinders who worked in reactor vessels, when they are cleaning and painting them in a commercial nuclear power plant, the tremendous doses that they worry about is, people who actually have to grind off the "crud," is the technical term for it, and they get those hot particles and the real enormous doses are the hot particles landing on your skin.

So it's really beta dose. I'm not talking about exclusively inhalation dose at all.

MR. ALLEN: You won't get those outside of a reactor. You won't get those from betatron irradiation of a metal casting. The hot particles are pieces of corroded metal that actually flow through and get caught in a reactor, get highly radioactive, and then end up breaking loose and flowing --

DR. McKEEL: I understand. They are radioactive pieces of metal that have broken off. But I'm saying when they bring out a recently irradiated casting into Building 10 and start grinding and chipping it and those things are flying off it, they are radioactive hot particles.

MR. ALLEN: Yes, but they're not -- they're not going to give you much of an external dose above what that casting is. In fact, it's negligible compared to the casting that they are coming off of.

DR. McKEEL: You mean the beta skin dose?

MR. ALLEN: Yes.

DR. McKEEL: Why?

MR. ALLEN: Because they are not hot particles like what you're talking about from a power plant. You don't get that highly intense radioactive particle from a casting. You will get the, you know, a large piece of the casting will be evenly irradiated.

Those hot particles come from small corrosion products going into a reactor and getting a neutron flux out of a power reactor type of --

CHAIRMAN ZIEMER: Probably ten to

the tenth or ten to the twelfth, probably eight orders of magnitude --

MR. ALLEN: Hundreds of R.

CHAIRMAN ZIEMER: These would not be defined in the field as hot particles.

DR. McKEEL: I know. I understand. I understand what you're saying.

CHAIRMAN ZIEMER: They're radioactive particles and I mean, you could go through the exercise but you will not be able to deliver much --

DR. McKEEL: Would you then agree with David that there's no increase in dose from those activated metal particles --

CHAIRMAN ZIEMER: There would be a theoretical increase but it would -- and you could do the calculation -- it's going to be in the micro-R region. It's, I mean it's -- it will nowhere compare with what you get in a nuclear reactor where you have the crud going in --

DR. McKEEL: Paul, I'm not talking

about Rs and magnitude. I understand that.

CHAIRMAN ZIEMER: Yes.

DR. McKEEL: The beginning point is so much higher in a nuclear --

CHAIRMAN ZIEMER: Right, right, right.

DR. McKEEL: -- reactor. I do understand that. I do.

CHAIRMAN ZIEMER: Yes.

DR. McKEEL: I'm not a novice in that area at all. I understand that.

CHAIRMAN ZIEMER: Okay. Yes.

DR. McKEEL: I'm just trying to make a point that, a priori, I would think that that could add to the dose. But you all say it's negligible. So --

CHAIRMAN ZIEMER: Well, and maybe someone would need to demonstrate that --

DR. McKEEL: I think that's the key point. You do need to demonstrate it.

CHAIRMAN ZIEMER: Because you are talking about a neutron flux in terms of the neutrons produced in this process, that's got to be at least 8 to 10 orders of magnitude lower so that -- but you know, I'm just talking sort of broad terms here. I --

DR. McKEEL: Okay. Understand what I'm saying. I'm not trying to compare the -- I'm not trying to compare a particle from this --

CHAIRMAN ZIEMER: You're basically saying had you already taken that into account --

DR. McKEEL: I'm trying to say there's an increase -- that those particles increase the beta skin dose above what you would calculate --

CHAIRMAN ZIEMER: Yes, I mean if it's --

DR. McKEEL: -- a layout man, just from his hands --

CHAIRMAN ZIEMER: But if it's six decimal points further from the number they're using, it's a --

MR. ALLEN: I was going to say it's not going to show up on the significant figures, for sure.

CHAIRMAN ZIEMER: No, okay. The point's been made.

DR. ANIGSTEIN: Can I comment on this?

CHAIRMAN ZIEMER: Yes.

DR. ANIGSTEIN: First of all, if you are talking about a particle of metal going on the skin, we have, NIOSH and we have both now, have both modeled the entire hand being on the steel, so how can a particle give you a greater dose than the entire surface of the steel?

We are having the maximum dose, the maximum reactivity is on the surface and it goes down as you go deeper into the metal. So we already get it. We've done that in great detail and we -- and there is a skin dose, and it's accounted for.

And the reason the layout man has

a higher dose than the grinders and chippers, he has -- he gets it first. Then by the time the grinders and chippers get it, there's already been some additional decay time. These are short-lived isotopes. We saw them.

And so the first person that gets the steel coming out of there is a layout man. We look -- this SC&A has looked at all of these things. We have looked at the chippers and grinders. We have looked at the layout men. We looked at the chainmen.

The chainmen don't make the grade because they get to it sooner, but they're not in contact with the metal, in contact with the metal as long.

The layout man is the one that gets the highest dose of these categories and all of them we can examine. As far as the inhalation and ingestion, that was looked at also, and even with a minor decay, there is negligible dose to the inside.

Giving the maximum amount that

anyone is going to inhale over the period of their eight-hour work day, starting with the, oh, after the irradiation steel, over the course of a year, they get less than a millirem, and that's a completely negligible dose.

DR. McKEEL: I'd just like to make one final comment. I accept what Dr. Anigstein just said --

DR. ANIGSTEIN: I mean, you said "a priori," well, we did it a posteriori. We did it after the modeling and we looked at each one. We did not jump to any conclusion. We looked at each one, and each, each of these exposure pathways has been fully accounted for.

DR. McKEEL: Okay. Then I've got to make a comment about that, and this is another huge issue with me and this Work Group and the way it's operating.

Dr. Anigstein just said, and we've heard many instances this morning, where David

Allen and NIOSH took SC&A models and revised them and reworked them.

Bob Anigstein is now sitting and claiming that he and SC&A have done all the original fundamental work to do what, in my opinion, this program pays NIOSH to do, and I have said it many times and I'll keep on saying it until the very end of the program, that I think the roles are improper and they have been reversed.

It is not SC&A's job to construct the dose reconstruction data for these folks. So that's over and above whether the modeling you have done is accurate.

So I think that this Work Group should be considering what NIOSH has done, what NIOSH is able to do on its own. The SEC basis is: can NIOSH accurately bound, you know, with sufficient accuracy, bound the doses? Can NIOSH with sufficient accuracy calculate the doses for these workers?

And I think that -- I just think

that's wrong. The other thing that I think is wrong is: from the petitioner's point of view, I think that SC&A's proper role is to evaluate what NIOSH has done, and, you know, in many instances I think that the two roles have been switched.

So all I can say is, you know, I don't consider the Board's contractor's modeling work on all the other workers in the plant to be definitive.

And where's the comparable data from NIOSH that was done independently? How did those numbers agree? So I just think a big part of the necessary picture is missing.

CHAIRMAN ZIEMER: One comment.

MEMBER MUNN: I'd like to address Dr. McKeel's concerns in a slightly different perspective.

DR. McKEEL: Okay.

MEMBER MUNN: From at least this Board Member's perspective, we hired SC&A. I, as a Board Member, hired SC&A. SC&A was instructed to obtain a wide variety of expertise because we had many different kinds of structures to look at, and there were very few Members of the Board who had the personal background and expertise to be able to evaluate these things well ourselves.

So we wanted our contractor to have -- and I am one of those people who is not always happy with the people who were chosen for that contract role. But it was our desire, I believe I can speak for the Board in this single instance, it was our desire to have the broadest possible expertise.

Now, when we do this, we -- again, as an individual Board Member I'm very, very sensitive to the issue that you just raised, which is first, the chicken or the egg, who's doing our work?

When we have NIOSH bringing us the work that they have done and we have outstanding experts in our contract field who is working with the Board and with NIOSH to resolve some of these really, really deep technical issues, then, if we have expertise in the Board's technical contractor, which is helpful to both the Board and NIOSH in moving some of these things forward, then, from my point of view, SC&A is not providing this information. They are working with the agency to achieve what we want done, which is the best possible product that gives us the best technical solution to the issue that's up in front of us, at that given time.

Now, the sensitivity varies, I suspect, from member to member around the Board. But certainly some of us are extremely sensitive to whether the issue is one that needs to be NIOSH work or whether it is one which SC&A can bring additional expertise to help resolve single technical points.

So whether your concern in this particular instance is seen in exactly the same way by others, of course no one can judge except the individual.

But we, I think most of the Members of the Board are very concerned to see that we -- we understand we want NIOSH to do the work, and for -- in almost all instances, from my perspective, I see NIOSH doing the work.

I see another perspective occasionally brought by our contractor, but the Board is aware of that when this is going on, and isn't -- we are concerned also that the right, the right agency, the right group of people is doing the right -- what we are expected to do both by law and by the process that we've developed here.

MR. KATZ: Wanda?

MEMBER MUNN: Yes.

MR. KATZ: Let me interject now, because I don't think we should spend a lot of time, precious time on this process question.

MEMBER MUNN: No, we shouldn't.

MR. KATZ: But the Board tasks SC&A to do evaluative work. That's what we do. And they do it. And sometimes when they do evaluative work, they produce products that end up being sort of -- leading the path in another direction and those get taken up and made use of. Why would you ignore it when good technical work has been done?

But the charge to SC&A is always to do evaluative work and that's what they do. They don't do -- they're not, they're not intending to break ground in the first place or intending to evaluate how well NIOSH did its job. Often, in trying to validate a model or contest it, whatever, they do their own modeling and so on, that gets brought into play. That's fine. It's evaluative work.

And then if, at that point, NIOSH finds that that information is useful, is a better path, I think it's perfectly fine for NIOSH to take up that information and improve their dose reconstruction process, because the one thing that is certainly true, is that the Board is concerned that at the end of the day, however it comes about, the best methods are used for dose reconstruction and the right answers are reached finally about SEC petitioners, in other words that feasibility -- whether feasibility is there or is not.

So, I mean I think I don't want to continue this discussion.

CHAIRMAN ZIEMER: No, and I just want to point out, and Dan, conceptually, you are quite right, and you've heard me say it many times, that I don't want NIOSH to do -- or SC&A to do NIOSH's work.

But what Ted has described is exactly true, I mean, we have many instances, I think of high-fired plutonium which is originally raised as a question by SC&A, have you considered high-fired plutonium?

And now that has permeated all of our sites because it was raised as part of the evaluation process. But I think we understand your point and we are always trying to find the right balance to make sure that, you know, NIOSH has the legal responsibility to do certain things and we're evaluating, we are trying to reach a point of best science.

DR. McKEEL: I respect everybody's opinion and I hear what you're saying. But I'd like to summarize what my point is, and I certainly respect particularly what Wanda just said, the point I was trying to make is slightly different.

And it is that as far as I can see, from the law and the spirit and the whole thing of this process -- and I respect you, Ted, too -- I just want to make a summary -- it's NIOSH's job to come up with the dose reconstruction methods that SC&A evaluates.

It's their job to come up with information. If there is a gap, in other words if NIOSH does not do something, like for instance model all the different worker jobs, their exposure rates from the betatron, which I think they did not do in the first place, then I don't think evaluation means fill in the blanks, and I actually disagree with Ted.

The way I see it, as a citizen, I see the Board as overseeing NIOSH's activities -- evaluating that for the Secretary of Health and Human Services, that is fine and valid. But I do not see this law saying that the Board is charged, or its contractor is charged with filling in the blanks for dose reconstruction methods and new information that would change an SEC evaluation from deny to approve or something like that.

So that's just --

MR. KATZ: I didn't say that, I didn't say it's the Board's job -- I said it rises out of their evaluation work that they do this kind of -- that they, for example, looking at all the different occupations and what the -- you know, DCAS didn't do that, but they did that. That's fine. They were doing that for an evaluative purpose.

That was the hat they were

wearing. They were evaluating, saying: how well does this model function? So they looked at more than perhaps DCAS did in that. That's fine. It's still fine.

CHAIRMAN ZIEMER: Okay, the point's on the table. What I want to do now, let's take our lunch break. I'd like to see if we can get it done in 45 minutes, the lunch, let's streamline it a little bit.

Dan, I'm going to give you the table right after lunch, so we are going to try to come back here at 12:30, okay?

MR. DUTKO: Dr. Ziemer?

CHAIRMAN ZIEMER: Yes.

MR. DUTKO: Quick comment, please.

CHAIRMAN ZIEMER: Yes.

MR. DUTKO: What Dr. McKeel was talking about was absolutely true. The casting is not limited to the layout person, as you know. You've got bag crews, you've got grinders and chippers. Once that casting is marked up, a magnaflux crew, grinders and chippers go to work. They work with each other.

Also, who might be called in is burners and welders. There's a lot more people involved with the repair of a casting, and it might be -- the layout might be done a lot quicker, in a half hour, depending on what stage or amount of defects the casting gets. Thank you, sir.

CHAIRMAN ZIEMER: Okay, thanks, yes, we understand that.

MEMBER BEACH: Paul, one quick question.

CHAIRMAN ZIEMER: Yes.

MR. CHUROVICH: And I have a thing to say here. My name is Dan Churovich.

CHAIRMAN ZIEMER: Dan, you're going to have to hold off. We're taking a break now. You are welcome to join us at 12:30 when we will reconvene. Thank you.

MEMBER BEACH: Are we skipping over SC&A's review or --

CHAIRMAN ZIEMER: We're going to just -- I committed to Dan we'd let him go after lunch.

MEMBER BEACH: Okay.

CHAIRMAN ZIEMER: We'll still hear from Bob, Dan -- Dan, you're not going to go till 3:00.

(Laughter.)

MEMBER BEACH: Okay.

CHAIRMAN ZIEMER: But I made that commitment that we would --

DR. McKEEL: I appreciate that.

CHAIRMAN ZIEMER: Now, we've got to be careful on that because that's sleep time, you know, right after lunch.

You're going to have to keep us awake. So see if we can get done by 12:30 and that'll give us a little more time this afternoon, okay?

MEMBER BEACH: Okay.

MR. KATZ: Okay, so I'm ending the call and we'll be back on at 12:30.

(Whereupon, the above-entitled matter went off the record at 11:43 a.m. and resumed at 12:32 p.m.)

A-F-T-E-R-N-O-O-N S-E-S-S-I-O-N

(12:32 p.m.)

MR. KATZ: Good afternoon. Folks on the phone, this is the Advisory Board on Radiation and Worker Health, TBD-6000 Work Group, and we are just reconvening, having finished the lunch break.

CHAIRMAN ZIEMER: Okay, thank you. As we begin the afternoon session, we are going to begin with the presentation by the GSI petitioner, who is Dr. Dan McKeel.

And, Dan, do you want folks to ask questions as you proceed or do you want to go through everything and then wait until the end? Do you have a preference on that?

DR. McKEEL: Dr. Ziemer, I think it might be better to just let me go on through the slides.

CHAIRMAN ZIEMER: Okay.

DR. McKEEL: I will try to pause maybe in between the big sections --

CHAIRMAN ZIEMER: Okay.

DR. McKEEL: -- if somebody has a burning question.

CHAIRMAN ZIEMER: All right. Appreciate it.

DR. McKEEL: But we can go back to a slide if we need to bring it up.

CHAIRMAN ZIEMER: Sure.

DR. McKEEL: But I think the flow --

CHAIRMAN ZIEMER: That'll be fine.

DR. McKEEL: -- will be better just to finish with it.

CHAIRMAN ZIEMER: Thank you.

DR. McKEEL: Well, anyway, the first thing I'd like to say is to thank Dr. Ziemer and to thank the Work Group for accommodating John and I even being here, but in particular for participating fully in this meeting.

And I hope to make this presentation in the spirit in which Dr. Ziemer started the meeting by saying it's really to convey information, new information, go over a few points from the past that needed to be clarified, but particularly to concentrate on a few big picture issues that we really have not been over this morning about what was the intended purpose of the path forward for GSI and have those goals been realized.

And then finally, to kind of sum up where we are, I believe, is to give you an overview of the doses that have been calculated from several years ago and updated here more recently by both NIOSH and SC&A, and that sort of indicates what the work of this Work Group might be, particularly at the next meeting in bringing things to a closure, at least on the SEC portion of things.

So, the first thing I wanted to concentrate on is this basic information about the path forward for GSI, and to remind us that on October 20th of 2010, David Allen came forth with his White Paper entitled "A Path Forward for GSI."

And in that paper he mentioned the large 80-curie Co-60 non-destructive testing source and said that the law itself, EEOICPA, disallowed the use of that source.

In that path forward he proposed new exposure models based on GSI information from outside sources including workers and advocates, site experts and myself, and the intended purpose of the path forward, one of the main ones, was to revise Appendix BB Rev 0, which was first put out in June of 2007.

But also, at that point in time, there were outstanding findings from SC&A's review of Appendix BB and SC&A's findings on the SEC 105 for GSI that needed to be addressed, and Dave Allen outlined that they would be addressed in the path forward.

So as the path forward began to be analyzed, Dr. Ziemer sent out an email which I received in May of 2011, May 16^{th}, 2011, and in that email Dr. Ziemer outlined the 10 new exposure models that NIOSH was going to produce.

The first four models were going to be supplied by David Allen, and he did produce that document as a White Paper in August of 2011 and that dealt with GSI portable sources.

And then this last paper, the one we are focusing on today, was by David Allen and NIOSH and that was dated January of 2012, and that was a White Paper on betatron operations.

Now the big picture on the path forward as far as I can see is those outstanding five SEC issues that were outlined in the original path forward document of October 2010, they've really not been addressed and they certainly -- they were not addressed in this latest White Paper.

So as we come here today, the petitioners do have a large number of concerns and I've tried to hit the highlights here, and now I'm focusing on this latest White Paper dated January 2012.

First was that among the six methods that were supposed to be covered, was a new exposure model for the old betatron, and basically that was really left out of this paper.

There is, I think, one sentence that mentions that the doses for the new betatron, which has been recalculated, would be bounding for the old betatron, but there really isn't any new model for the old betatron.

And my comment is that you can't equate them as identical facilities because they really are quite different, and we don't have the time to go into all the differences, but they are not the same.

Second point here is that the new betatron model uses 1971 data for an 80 curies cobalt source where we said that that same source is really not allowed under EEOICPA, and the purpose of that was to validate film badge hearings from 1964 to `66.

So I understand the discussion this morning, but I still would like that comment to be entered in the record. The other comment I'd like to make is that OCAS-IG-003 guidance says that all radiation sources during the covered period must be -- dose must be determined with sufficient accuracy, and with the second path forward document that's now been delivered, I would say that what is not covered is the old betatron doses, the fact that GSI did own a 10- to 20-curie iridium-192 source that's different from the St. Louis Testing source, and I'm going to show you some new information about that.

And although the 250 kVp portable industrial X-ray units were discussed in the previous White Paper, the doses for both those units were not really defined.

The other thing I'd like to just point out is that this site is one of the ones that really had an extensive array of underground tunnels that we've not talked about very much, and they were really designed to be a housing for the conveyor belts, which ran all throughout the GSI building complex.

And we also have tunnels for the railroad tracks that go into the betatron buildings. So it seems to me that one of the things that's really not been addressed at all at this site is radon exposure.

I want to turn to our -- to recap for you the information we have about GSI owning and using an iridium-192 source, and this first affidavit was really presented in 2006 and I want to read it again, the relevant parts.

It says, "The large castings were processed only in the old betatron except for the pipes, which were X-rayed using iridium anywhere necessary, but not routine, except primarily in the end of 10 Building and sometimes in Building number 9."

He also notes that the only cobalt-60 source that he knew about was the small pill in 6 Building west end up against the foundry and the core truck aisle on the west.

The second affidavit is more recent, and that has to do with the same GSI iridium-192 source, and this gentleman says as follows, and this is a report from John Terry Dutko, who had just spoken with this person.

"Dr. Dan, just a reminder that the iridium info about the GSI 10- to 20-curie iridium source and one quarter curie cobalt-60 sources came from -- and I'll omit his name.

"This gentleman started in the fall of 1963 at GSI, worked in magnaflux then moved up to isotopes. He periodically worked in 6 Building with iridium and cobalt, shooting corner shots on rail truck frames."

And that's an interesting comment because the majority of the work that had been ongoing in Building 6, and this inner radiography structure, was to look at railroad truck frames.

He also worked steady midnights, et cetera, in the old betatron while he and his friend were going to school. This gentleman stated that comparing iridium and the cobalt source that he worked with in Building 6, iridium was the weaker source, penetration-wise, and it would take two to four hours using cobalt to penetrate two inches of steel, and so forth.

The third affidavit about there being a GSI iridium-192 source comes from the attorney son of a GSI radiographer who is now deceased, and the son filed this formal affidavit on November 25th, 2006, really in the terminal stages of life of his dad, but he wanted to get this information on the record.

And this is a quote from that affidavit, number 8, "My job duty was to X-ray castings with the betatron. I used 250 kVp industrial radiography equipment and also X-rayed castings using cobalt-60 and iridium-192." He said, "The latter unit was in the betatron room, was mobile and sat on the floor."

We have, I didn't put it here today for time reasons, but we have a fourth affidavit from a gentleman that you all know well, we've talked to before, JP, who worked at GSI during 1957 and the late `50s, and he also attested to the fact that GSI owned and used an iridium-192 source during that time period.

This is from that same dying man's declaration, but a different point that I thought was relevant to what we discussed this morning about the residual radiation from the betatron when it was off.

He said --

MR. RAMSPOTT: Oh, Dan?

DR. McKEEL: Yes.

MR. RAMSPOTT: Excuse me. You added that slide. That's not in their handout right now.

DR. McKEEL: I understand that, John.

MR. RAMSPOTT: They didn't know that.

DR. McKEEL: Oh, I'm sorry. There are three slides, I think, that are not in your handout.

CHAIRMAN ZIEMER: Okay, mine was -- I can just --

DR. McKEEL: I apologize. They will be -- I'm leaving this PowerPoint --

CHAIRMAN ZIEMER: You can just email it to Ted.

DR. McKEEL: And a copy for Ted.

CHAIRMAN ZIEMER: Okay, great. Thanks.

DR. McKEEL: Okay, so you'll have the full, what I have on here. So yes, I apologize for not explaining.

So, in -- so RW says as follows -- I'm quoting, "Before I'd ever heard of the concept of activation, I explained to my son that after the betatron was turned off after a shot, I could still get a radioactive meter reading at the site of the shot.

"The reading was most apparent from the cone of the betatron itself. This was a concern because in setting up the shot, my back was between the cone and the casting, one to two feet from the cone."

And I'd just like to point out that this was an independent affidavit about that effect of their residual activity, made in 2006, long before anybody had contacted ‘ identifying information redacted’ or any of that information was known. And this gentleman has since expired.

Okay. I next want to turn to the subject that we talked about extensively this morning, and this is just our factual basis for believing that in 1966, the new betatron building and the old betatron building were not -- the tunnel with the railroad tracks was not closed off by a lead-shielded double-leaf door that was used in all of David Allen's modeling that he discussed this morning.

But instead, in 1964-66, we have very strong evidence that there was a roll-up steel ribbon door and I'm going to show you a picture of that door in a few minutes.

I'd also comment that in the Department of Energy Oak Ridge National Laboratory 1991/2 cleanup report, and in pictures that John Ramspott and I took in 2006, when we're looking at the new betatron area and the old betatron area, there was a double-leaf door there, but there was no lead shield, and what we did find was a door which was a ribbon roll-up door at the entry of the tunnel break area into Building 6.

So I'll show you why we believe that that door was probably moved from the end of the tunnel in either the old or the new betatron buildings.

This is the drawing that Dr.

Anigstein has in his report and I can't remember, I think Dave Allen may have his -- but what I want to focus on is, I'm going to get away from the microphone for a second.

I'm going to take this with me. Here on the left you can see there's an annotation, there's an opening in the new betatron tunnel wall, and there's a bracket across it.

There's no door actually drawn in there but it says, double-leaf door, bottom leaf seven feet, zero inches high, lead shield. And it has an arrow drawn into that opening.

And then, apropos the discussion we had this morning about the walls of the tunnel and the control room and so forth, you can see on this drawing that the big, thick sand-filled walls bound, you know, three and a half sides of the betatron shooting area, but the tunnel walls are thinner and an annotation at the bottom with two arrows, says, concrete block walls, mortar-filled, 25 inches high, which is -- that part is correct.

So this is the drawing showing the cobalt-60 source and target being used in the new betatron building, and it says, Rev 11-4-68, so that's the date of this drawing.

Now, this is the picture that I took of the old betatron building looking down the tunnel from the shooting room out the front door, towards the new betatron building.

And you can see at the top up here, there are vertical ribs, metal ribs in this door. It was a double-leaf door and this bottom leaf, which was supposed to have the lead shield, at least in 2006, there was no lead shield there.

And to sum up a lot of data, none of the workers who worked at this facility ever saw a lead shield and all of them unanimously say that in 1966, this door was not present. What was present, was a red steel roll-up, ribbon door.

Now, when John and I went to the GSI site in 2006, I took this photo, which I took from the inside of 10 Building and it was quite clear to me that I was standing in 10 Building, looking back towards the new betatron building, at the entrance to the tunnel or what would be now called the break area, so where the railroad tracks ran into the new betatron building to carry the big castings and uranium as a matter of fact.

And what you see here is a door that's exactly what the workers described for all these years: it's red, it's ribbon steel and you can see the roll clearly at the top of the frame and there's a little sign attached, E 22, which identifies the location within that building, and then you can see -- above you can see part of the metal wall, you can see that on either side of the door, and you can see a window in the 10 Building and the construction of the wall above that.

And it's this door, or this type

of door, this exact type of door, that we believe closed off the tunnel to both the old and new betatron buildings in the covered period, 1964-66.

To further the idea that a rolled-up steel door was the norm for betatron buildings, this is taken from the Allis-Chalmers manual and remember that Allis-Chalmers built both of the GSI betatrons.

And this is -- this relates to their facility, and you can see this is the laboratory that they built at Allis-Chalmers in West Allis, Wisconsin. John and I visited there, he twice, me once.

We saw this facility. They had the same old original betatron working and so forth, but the point was that in the Allis-Chalmers manual, they say that a steel roll-up door closes the rail tunnel, and that's what was their recommendation.

‘ identifying information redacted’, again, said that the ribbon steel door was standard fare for Allis-Chalmers betatron installations, and John has further testimony from a worker at the company that took over this facility, called NDT, and this gentleman I met, John has interviewed several times, and that man said that this ribbon door that was in the West Allis facility was just removed a short while ago this year.

So you know, they felt it was adequate and it was there and I think that ought to really put to rest the idea that during the period that's being modeled by Dave Allen, the covered period at GSI, those last years, that it was the ribbon steel door which I've shown you that should be included in the model, and not a double-leaf, lead-shielded door.

CHAIRMAN ZIEMER: There was a date for this replacement. Did you find an exact date on the adding of the shielding later, on the ribbon steel door, or did anybody find the date for that?

DR. McKEEL: Not really -- we would --

CHAIRMAN ZIEMER: Okay, when you said it was recently replaced --

DR. McKEEL: Oh, I'm sorry. No.

CHAIRMAN ZIEMER: That's at their place?

DR. McKEEL: That's at the West Allis facility. As far as GSI, we can do a bounding date.

CHAIRMAN ZIEMER: Okay.

DR. McKEEL: You know that --

CHAIRMAN ZIEMER: I know what bounding is, roughly.

DR. McKEEL: Yes, so --

CHAIRMAN ZIEMER: Sorry to interrupt, but --

DR. McKEEL: We can bracket the date as some time after 1966 --

CHAIRMAN ZIEMER: Gotcha.

DR. McKEEL: and between that and 1991 when DOE came.

MR. RAMSPOTT: The drawing of `68 would be the first possible --

DR. McKEEL: And that's -- and that would be the logical time to have added that, when they now have a license for a large cobalt source, and they're going to use cobalt inside the -- well, they basically said in both the new and old betatron buildings.

CHAIRMAN ZIEMER: Thanks.

DR. McKEEL: Yes, sir. Another concern -- now we're switching subjects, yet one more -- and this time we are going back to Dave Allen's first White Paper on the radiography portable sources in GSI.

And I'm focusing now on SC&A's use of MCNP to simulate the exposures from the 226 radium source that was used in the Number 6 Building radiography facility.

And I just wanted to read you that and this sets the reason for why -- for the next three or four slides.

It says, we simulated the

exposures and dose rates from 226 radium in the radiographic facility in Number 6 Building in GSI using the MCNP5 radiation transport code. The model of the radiographic room was based on sketch in the GSI application for an AEC byproduct material license, and it gives the NRC FOIA document date, which is replicated in Figure 4.

And so what we wanted to show you was that that drawing and that FOIA was in 1962 but it was after -- we can show you, and what I hope will convince you -- that changes had been made in the shielding of that inner radiographic room, as well as structural changes they say in the walls of that -- and to add extra shielding.

And just to further set the stage, in 1962, GSI had to give up its old radium-226 sources that they used with fishpole technique, and switch over to cobalt-60, to small half-curie sources, and so they were in the business of applying for a byproduct license for those two cobalt-60 sources. And all this material is now from the FOIA material, 2010-0012.

John Ramspott, who is a proficient digger after the facts, obtained a new map of the GSI facility dated January the 29th, 1957, and he got that from the current owner of the 6 Building and 7 Building area, and in 7 Building there is now a commercial operation going on.

And I'll show you that map in a minute which establishes that what they then called the radiograph room, the same thing that everybody else later on called the radiographic facility of the inner structure in Building 6, existed in 1957, and I think at the last meeting, we had had some new evidence, new testimony from workers, that in fact, that building did exist before 1962. Now we know it did and it may have been there all throughout the early -- the 1950s and into the early 1960s, and we know the building was there in `57, and I'll show you why we know that.

Worker testimony established that radium-226 sources were used in this facility for NDT inspection of railroad trucks, and the quote was, even earlier than the AEC were, which really, in context, meant it was -- it was used before 1953 and after that.

So that facility may have been there doing railroad track, non-destructive testing -- railroad truck, non-destructive testing -- from the late 1940s all the way up through the covered period.

Anyway the covered period at GSI starts in 1953. I think John may have said 1955 this morning but it started -- it starts in 1953.

So this is the -- kind of the signature block from that large map which John brought with him. If anybody needs to see it, it's a very detailed drawing.

And at the top, you see, you know,

the scale and so forth, General Steel Castings Corporation in Granite City, Illinois. It notes that they have another plant in Eddystone, Pennsylvania.

But this is a general drawing of the Granite City plant, and you can see on that there's a date, 1/29/57. That's critical. And up above, as well, Granite City, January 29th, 1957. And below, I've taken a section from that great big map to show you part of the 6 Building.

So, for orientation, this is drawn on there and it's a rectangle and it's labeled radiograph room. Down in the lower part of the figure would be the foundry and I am now persuaded that this area basically was open, so there were columns but there was no wall between the radiograph room and the foundry.

And the next slide shows that this was a heavily trafficked -- let's see -- yes. This area right here was heavily trafficked between the radiograph room and there was a pathway here and here, which I'll show you in a minute, a walkway where lots of people walked on their way to the foundry and the current, most accurate estimate is that maybe this walkway was no more than 20 feet and maybe as close as 10 feet to this radiography facility, so that actually some of the comments that had been made and the modeling of this facility, that there were very few workers, ‘ identifying information redacted’ 1962 survey noted that there were very few workers in this area. That is absolutely not true, by worker testimony and the fact that this foundry pathway that had heavy traffic all day long, was a few feet away from the wall of that radiography facility.

John Ramspott asked me to put in this slide and I think it's something he noticed and I think it's very important. This is a picture, basically, recently taken of the Building 6 facility as it appears today.

But the thing that's constant from

the old days is this crane, which you can see here, which stretches all across this end of the building.

The radiographic facility that we are talking about was over here on the right, you know, it was a roofless structure concrete blocks. It was here. The cab of the crane is here, the gondola where the operator sat, and there's a big hook which picked up the castings you can see here, that's been retracted out of the way.

So this hook would have to travel and the crane would have to travel and pick up a casting and bring it back, and then bring it over here and drop it down into the radiographic facility to be X-ray imaged.

John's point was that, in David Allen's modeling of the cobalt-60 source with MCNPx in the old betatron building -- now stick with me, because there is a connection -- he found that in general, the modeling with the 60 and the computer modeling agree very well with the actual data as measured by the 1971 survey workers.

But there was one big discrepancy and that was that the computer model showed 1.8 millirems per hour at one point, whereas the real data at that same point in the new betatron building showed 0.2 millirems per hour.

And David postulated that perhaps there was some -- something like a door motor that was interfering, that the computer model hadn't seen, but that the real data had seen, and that accounted for this very dramatic, nine-fold, significant difference.

So John Ramspott was thinking about all of this and he said, well, if you think about the geometry of this 6 Building where ‘ identifying information redacted’ made his radiographic survey, here we have a source here, two cobalt-60 small sources, and we are trying to calculate the dose to this guy. Below this, there was a reading there, but there are also doses calculated up on this catwalk which is above this massive steel structure, and John reasoned, and I think it's quite reasonable, that this source would have to go through and around this big, massive steel structure before it could ever get up to the catwalk to be measured.

So to us it means that the ‘ identifying information redacted’ data, you know, real data, measured data, cannot be taken literally without taking this kind of thing into consideration, and that brings us to the really key part of this slide, which is a question.

And that question is, and I would love for Dave Allen to answer it, actually now would be a good time. Instead of modeling the new betatron building with a cobalt source as a way to validate the fact that MCNPx was giving you good, valid data, we do have even better radiation survey data from ‘ identifying information redacted’, you know, Ph.D., Certified Health Physicist who was heavily involved in obtaining and helping GSI obtain their AEC cobalt license. Why did NIOSH not choose to model the Building 6 radiography site and to use that data, that real data to compare with the MCNPx model?

So I'm just wondering, David, did you all think about doing that?

MR. ALLEN: We used the 1971 new betatron survey to validate the MCNP model of the building. We then used that model to estimate dose.

For this we used dose rates measured at the site. We didn't have to use the MCNP models. There wasn't anything to validate.

DR. McKEEL: Yes, but you know -- okay. This is information and I don't want to argue about it, but it seems to me that, you know, you had real data for the old -- for the new betatron building too, from the survey.

So if you used the same reasoning

for both, why -- basically you needed -- you felt like you needed to model the new betatron data, right?

MR. ALLEN: We had modeled the new betatron building because we didn't have a radiation survey with the betatron.

DR. McKEEL: And you still don't.

MR. ALLEN: Right.

DR. McKEEL: Okay.

MR. ALLEN: But here, we didn't model the Building 6 radiography room because we had dose rates with the cobalt-60 source exposed.

DR. McKEEL: Okay. All right.

CHAIRMAN ZIEMER: So you did use the ‘ identifying information redacted’ data?

MR. ALLEN: Yes.

DR. McKEEL: Yes, and now it's a really crucial slide that I want to show you about the 1962 building, was this. Everybody referred to later drawings, but John Ramspott again discovered this drawing in another NRC

FOIA, 2010-12 document.

And that was -- and the key thing here is -- this is a radiography facility, it still shows -- it shows some added lead -- I'm sorry -- steel plates, four by four by -- four by four feet, by six-inch thick steel plate, one by four by two-inch steel plate, welded on top.

And it points to this shield here and then there's another shield here on the opposite side of the radiographic facility, it's four by four-foot by six-inch steel plate.

And then it also shows that the walls of this are 24 inch, concrete block wall and the idea is that those are two new findings, added shielding.

But here's the thing that's interesting that's not on the drawing shown in the SC&A and the NIOSH reports. This drawing has this annotation, shows additional shielding added during June/July 1962, not drawn to scale, and D. Darr, D-A-R-R, and it's signed 8-15-1962.

So we looked at the timeline for all of this and this was about the time the ‘ identifying information redacted’ survey report, the letter from ‘ identifying information redacted’, Nuclear Consultants Corporation, to GSI, to insert in their license application. That letter is dated August the 1st, 1962. So that was actually after these changes had been done.

So what our point is, is that prior to June and July of 1962, this shielding was not there and the walls -- the men still dispute the fact that the walls were ever enlarged to be 24 inches thick.

Most of them say that it was a single concrete block thick. But in any case, before 1962, the lead shields were not in place, the walls were certainly one block and not two blocks thick, and so for all the radium-226 modeling, 1962 back to 1953, you have to use a different set of conditions, and we don't believe that that has yet been done, so that's a very important thing for future work, I would say.

Okay. I want to show you quickly the point I was continuing to make about the radiographic room in Building 6. This is a photograph that we got of the area between the new betatron building here, which you can see at the top. The 10 Building is in the background, and there's the walkway between those, that tunnel, was, you know, 30 or 50 feet at the most. It was very close to that.

There's a lot of stuff in the middle outside of this facility. These are molding casks, there were railroad tracks as I will show you, and there was a road that passed one of them for 30 feet of this new betatron building, that was heavily trafficked.

And inside the radiograph room, there were these walkways -- here's one and here's another one -- on either side of the radiograph room, and they were actually very close to the radiograph building.

So the whole point of this slide is there were a lot of non-badged people on the outside that were exposed to radiation both from the betatrons and on the inside, from the radiograph room, who really haven't been accounted for in the dose reconstruction models so far.

This is from John's new giant map that he got, so this is a 1957 January drawing, and we are looking now at the space between the new betatron building, which is yet to be built in `57, but was indicated on this old map as new betatron building, right here, you know, with nothing drawn in, this is my addition.

And then the old betatron building is drawn in and you can see the two cranes modeled, and the tunnel and the railroad track running straight into the tunnel.

So in between that, there are two features I want to focus on. There are all these railroad tracks, and you saw a lot of paraphernalia, there were cars parked in here right next to 10 Building.

But also, there's this main road which goes up here and here and here, comes very close to the new betatron building, and I'm assured by the workers that this was a road that almost everybody in the factory used on a daily basis. So there was a lot of traffic past the new betatron building.

The distance between these two facilities, 300 feet. There's a sign that we photographed in 2006 on the old betatron building, and the sign says, do not approach this building within 100 feet.

And so at least then, they thought there were radiation fields that extended out that far, and so if you draw in your mind's eye -- I didn't have the time to do this -- but if you drew a radius of 100 feet around these facilities here and here, maybe there would be an area of non-overlap of about 100 feet, but there are a lot of people included in that field, the people on this road, and the people in between the railroad workers and so forth.

So I would just -- a point of this slide is, I don't believe the non-badged people's dose has been modeled along the outside of the building complex.

Now I want to get to the control room badges. I think we just about laid that to rest this morning. NIOSH and SC&A state that Landauer GSI film badge reports include data on 114, variously reported as controller or control room badges. David Allen uses the room badges terminology.

But the key point is that David Allen uses those control badges to limit doses to the GSI betatron workers. Two GSI badge handlers refute the fact that those control badges ever listed, and I'll show you an affidavit from one of those to that effect, and also we have new information about where those film badges were stored in the new betatron building.

This is the testimony from one of those two clerks. I said, this affidavit was recently obtained from the first clerk who handled GSI film badges on startup of the new betatron operation in 1964. It is clear that not only the betatron operators and isotope workers were badged. And here's what this man said. Quote, all betatron employees wore badges, operators, supervisors, film readers, photographers, darkroom employees, clerks, et cetera. I recall there were a few extra blank badges for visitors. This was rare that they were used. The film badges were exchanged every Monday morning. There was never a control room badge that was not worn by a person.

And this is a drawing supplied by John Terry Dutko of the new betatron facility and he has annotated this in red now to show the two locations where, during 1964-66, when he worked there, the film badges were racked.

Here for -- here again, here's the railroad track, here's the shooting room, the big thick walls, there's the tunnel going down that way to the break area, which adjoins Building 10.

This drawing has a wall on the break area. On this thing, Terry said that when he was there, there was no wall there. But the badge locations were first in this area, which was actually the control room, where the console was. The console control room is here.

Everybody agrees there were never any control badges left in this room. So the first site was over here where the badges were, then they were moved at some time where, when he was there, this was called an office and they were moved from the office over here on this wall, which is, you know, just below the second floor wall. There was a darkroom over here.

So the badges got moved even farther away from the control room, so whatever they picked up in the way of radiation, it certainly was -- at this point was not as great as you would expect them to pick up, maybe, in the control room. In any case, they weren't in the control room.

MR. DELL: They were not in the control room.

DR. McKEEL: And I think Mr. Dell just echoed they were not in the control room and now we know that.

CHAIRMAN ZIEMER: Just for clarification, on the second position, that rack position --

DR. McKEEL: Yes, sir.

CHAIRMAN ZIEMER: Is that a different office or is it a corridor?

MR. RAMSPOTT: It's a hallway.

CHAIRMAN ZIEMER: It's a hallway.

DR. McKEEL: It's a hallway -- I think it's a hallway on the wall, hallway of the wall --

MR. DELL: Where my office was, down at the end of that hallway, and I didn't have an office, I only had a desk, there was no wall.

CHAIRMAN ZIEMER: Gotcha.

DR. McKEEL: Okay. All right. And then, moving on, so for the badges, here's our concern. A new affidavit attests that GSI badge handlers sometimes destroyed film badges they believed to be spurious and the person who provided this affidavit believes this fact casts doubt on the validity of the entire GSI film badge program, and we have further doubts about its validity because radiographers wore badges only part-time, and we think, we are not sure, but GSI may have submitted control room badges that certainly were -- the existence of which was not known by any of the workers or the badge handlers.

Now that doesn't mean they didn't really exist. It just means that nobody knew about them except the person who supplied them and we don't know how they got to Landauer and we really don't know what they mean.

CHAIRMAN ZIEMER: A quick question on that, Dan. The one affidavit you talked about earlier, about the one person that handled it, indicated he was the only sort of middle man. He sent this stuff to Landauer and later there may have been others, we don't really know that exactly.

DR. McKEEL: No, he -- actually that's part of a longer statement he made and he spelled out exactly who they were there.

CHAIRMAN ZIEMER: I was trying to, trying to reconcile that with who is it that believes they were spurious and how would they know they were spurious, because the film badges would not have been read out. What would be the basis for saying --

DR. McKEEL: Oh, well --

CHAIRMAN ZIEMER: You know what I'm asking?

DR. McKEEL: Yes.

CHAIRMAN ZIEMER: In other words --

DR. McKEEL: So this, in -- let me see now.

CHAIRMAN ZIEMER: Or you can answer it later but --

DR. McKEEL: No, I'll answer it right now.

CHAIRMAN ZIEMER: But you don't know a priori if a reading is high or low.

DR. McKEEL: Well, here's what they said.

CHAIRMAN ZIEMER: Yes.

DR. McKEEL: So, this particular individual said he collected the badges, he sent the badges out and he saw the reports when they came in.

He said when they came in he screened them, and he looked at the reports looking for high values. And he said he had -- he was aware that some of the badges looked black when he sent them in, okay? Or dark.

Anyway when he got them back --

MR. DELL: He could not have known, they did not look black. How could he look through the cover on the --

CHAIRMAN ZIEMER: He could not have opened them or they wouldn't be usable.

MR. DELL: If he opened them, they would be useless. That's a bunch of bull --

MR. KATZ: Mr. Dell, one at a time, just -- I'm sorry, go ahead Mr. Dell if you want, but we just had people talking over each other.

MR. DELL: I said there is no way that he could look at them and tell they were black. If he did, then he exposed the film and it wasn't any good anyway.

MR. KATZ: Thank you Mr. Dell.

CHAIRMAN ZIEMER: Right, exactly my point.

DR. McKEEL: My point is that I'm not taking sides here. I'm reporting the facts. This is what the man testified, and he was -- he was a direct badge handler.

CHAIRMAN ZIEMER: Right.

DR. McKEEL: So I don't know what to -- I -- my own personal -- I'm just -- I'm reporting, I'm reporting the facts.

CHAIRMAN ZIEMER: And they are in packets so they have to --

DR. McKEEL: Well, he went on to say that he believed that -- actually he believed that -- actually he, he actually goes on to say that occasionally he would find a high badge reading and he would report it to one of his supervisors, and he said he felt like those high badge readings were discussed with employees, but he didn't -- he didn't say he knew they were. He just felt they were.

CHAIRMAN ZIEMER: But the destroying of the film badges was the one I was trying to get a feel for. Who would have done that and how would they know what to destroy, because you don't know until it goes to Landauer whether it's a high reading.

DR. McKEEL: Well, let's put it this way. This person who made this statement said he had personal knowledge, he knows they were destroyed.

MR. DELL: Well, he's wrong.

CHAIRMAN ZIEMER: What would be the basis, is what I'm saying. How would they know --

DR. McKEEL: Well, there's, there's a possibility, Paul.

CHAIRMAN ZIEMER: Okay.

DR. McKEEL: You know --

CHAIRMAN ZIEMER: Well --

DR. McKEEL: The people that we're reporting from are alive. Actually anybody can probably try to talk to them. So you all may want to do that, and answer it for yourself.

I don't know the answer to all of

those. I was convinced --

MR. DUTKO: Dr. Ziemer? Dr. Ziemer?

CHAIRMAN ZIEMER: Yes.

MR. DUTKO: May I comment on that, please?

CHAIRMAN ZIEMER: Sure.

MR. DUTKO: I was the person that reported that I overheard the individuals that handled the film badges, one of these individuals said directly to me, and I was sitting right next to him, that exposed film that was questionable was discarded.

Now I assume that he was ordered by the company to do this. But I heard statements twice by the same individual that handled film badges.

Now, that immediately set me to question the integrity of the film badge system, and we heard rumors 50 years ago that this was being done, but we could never prove it.

I did not want to name this individual by any means, but I swear this conversation took place and this is exactly what I heard.

CHAIRMAN ZIEMER: Okay, thank you.

MR. ALLEN: Just one real quick. At one point in there, Dr. McKeel, and I don't know if it was accidental, what I think you said, badges were processed and then the reports were screened, and destroyed or, you know --

DR. McKEEL: No, no, no, I'm sorry.

MR. ALLEN: Okay.

DR. McKEEL: They are kind of two separate statements.

MR. ALLEN: Okay.

DR. McKEEL: The first statement was, oh, and by the way his complete interview that was reported, all of this was described in much greater detail in my two submissions that I made to the Board.

So that's all described in detail, the complete quote.

No, what -- what this gentleman said was he collected the badges, he mailed them off every Monday, he substituted the new badges which he had received from Landauer and distributed those. Then he took, I guess, the badges off the rack, sent them in to Landauer, then Landauer sent him back -- him back the reports and that he said if he saw a report --

MR. DELL: Wrong.

DR. McKEEL: Okay, Ted --

MR. KATZ: Mr. Dell, please let Dr. McKeel finish his statement --

DR. McKEEL: I don't want to be interrupted because I am reporting what -- I am trying to answer the question. Mr. Dell may think it's wrong, but the person telling the story was not Mr. Dell.

So, in any case, so, the reports would come back to this person and he would look at them and said if there was a high reading, he would inform the worker involved about that, but he also said he informed -- he talked to a supervisor on several occasions to let him know.

Now, he didn't go into any detail how often this happened or any of those kind of things, and you know, that's just -- I didn't talk to him for hours or anything. But he's a knowledgeable person who could give more information, so I'm not sure he will, I'm not committing him to that. I'm just telling you or I'm trying to tell you what happened.

Okay. So -- and I don't know about the -- you know, I don't know exactly any of the details about the destruction of the badges, exactly who did it, that stuff.

But the summary statement I'd like to make is that from one of the reports, I'm not sure whether it's Appendix BB or the SEC Evaluation Report, there is a section that says -- it refers to the pedigree of General Steel data.

And the factors in the pedigree analysis, which I know is done at many sites, are data quality, credibility, reliability, representativeness and sufficiency.

In one of my reports, the critique thereof, I wrote back the following. This was my take on whether the pedigree of the General Steel data, based on film badge information, whether that met those criteria.

And I would just say this, NIOSH Landauer GSI film badge data 1964-66 are not quality data as the measurements are confined to periods that betatron workers, who are only three percent of the total workforce, spent in the betatron facilities.

It's not credible because, despite what this gentleman said, there's very little other testimony from GSI workers that they were ever told or talked to about their supervisors, about high readings on the badges.

In fact, almost all of the

testimony from the workers is that they never got any feedback, and in a specific case or too, if there was a high reading, one individual, who chose not to have his name used, said that he definitely was not informed of his high badge reading. He had a 7 rem dose.

Anyway, the workers in general testified that they didn't trust their supervisors or management about the badge readings.

I thought that the badge readings were not reliable and there were really no evaluations of that -- I mean, nobody has really looked at that. I don't really know how to establish that, to be honest with you.

They certainly, the data were not representative. There were 89 of 3,000 workers out of a single job class, all men, 1964-66, which was only the last three years of a 13-year covered period.

So -- and that was the only class

of people that were monitored with the film badges. So I didn't think these film badge data met any of the criteria for a good pedigree -- for any site.

Now, this is the data that I want to close on, and I'd like to apologize for this slide before I begin, because it may not be entirely accurate. It was the best I could do, late at night, trying to skip through reports.

And I would say that in my defense, it may not be perfect, but it is a good first try at a slide that I think should have been in both the SC&A and the NIOSH reports, these last two papers that we are considering today.

So what I tried to do was to reconstruct this. We had certain data from 2007, actually, and 2008, from Appendix B, and from the SEC Evaluation Report and the SC&A reviews. And the -- so what I'm trying to do is in this upper table, I say, computer-modeled annual photon dose during GSI covered period, 1953-1966, in rems per year.

So I was trying to compare what the model showed 2008 to seven, versus four years later, for betatron workers in this upper panel. And basically what you can see is that 2008, the rates, according -- in Appendix B that NIOSH found were one, 6.3 and it varied by year as Dave Allen has explained, because there were different uranium loads through time, the peak year being in 1962 and then it declined in the later years.

And so that the -- the betatron operators got a variable dose depending on the time within the covered period.

They found the same thing basically in 2012 but the numbers were lower by an order of 5 to 10 times. So 0.2 versus 1.0 earlier, 0.62 versus 6.3 earlier, much lower dose in 2012, part of which explains, is by modeling using the double-leaf lead door, which I hope you saw was an incorrect way to model.

But what about SC&A's modeling then and now? Well, Mr. Dutko pointed this fact out to me -- 2008, SC&A modeled with same code, MCNPx, said the dose to the betatron workers for the early years was 12.4 rems, and rose to 13.6 rems in the later years, and now we're down, in 2012, to 1.35 or about 10 percent of that level, and to say that some of the workers are upset by that would be understating the situation.

Now this lower panel is basically the same thing for the other workers, and I've got that titled 2007, 2008 because for others -- and I don't use layout person, which is a term used this year, because they weren't classified as truly -- it's really the non-badged, non-betatron workers in the early years versus the late.

And what you can see here is an even more startling discrepancy in the model result. So here we have NIOSH's estimate based on Appendix BB, of 1.73. That was the dose assigned, rems per year, assigned to the non-betatron, unbadged worker, 1.73.

Now we come up in this time period, you know, and the range actually overlaps this. So it's not too bad, pretty close, 1.02 to 2.03.

But if you want to be truly confused, then you will read farther in this second report, the SEC Evaluation Report, where they divide the non-betatron, unbadged workers into three groups and they give a number for only one of the three groups and that number is 0.417 rem.

So really, in those two reports, NIOSH has a different evaluation for other workers.

SC&A for other workers in this early period of time basically said that they agreed that the betatron doses bounded everything else. And the way they put it was that the betatron doses bounded the layout men and the cobalt-60 operators, which in turn bounded the chainmen and the chainmen in turn bounded all the other workers.

So they didn't actually come up with any actual values for this large set for the GSI workforce, and that's why there's no number.

However, please focus on this number. For the layout numbers now, and I want you to know that -- the technical difference between this and this, so NIOSH 2012 for the layout workers, one to two rems per year, SC&A 9.2 rems per year.

So this is a four and a half to nine-fold difference, depending on which of these ranges you use. Was there a difference here? Yes, there was.

Here David Allen accepted that the tunnel units from the new betatron were bounded by a double-leaf steel, lead-lined door. That's his model.

Dr. Anigstein looked at it and he

said he didn't believe that point was proved and he said, being claimant-favorable, and weighting the evidence the way he saw it, you should discard the idea that the double-leaf, lead-shielded door was there, and he came up with this number.

So that brings me to the conclusion and the last slide, but again I want to focus on the two really big changes in this slide, and that's the SC&A estimate of the dose the betatron workers in 2008, 12.4 to 13.6, 2012 1.35, a precipitous decline in the dose, and probably they're worse, since they were basically agreeing in 2007 and `08 with NIOSH, which lists the dose to the other workers as 1.73 rem, now that's skyrocketed up to 9.2 rems.

So I would like to offer the final closing slide. That's the way -- this is the way I see it. The way I see it is that NIOSH and SC&A -- MCNPx was used in both and both of their models disagree with each other and the film badge data, and are both based on, I said many -- why don't you take out the many and just say erroneous assumptions that need to be corrected and the models need to be corrected.

Second point is that compared to 2007 and `08 model data, SC&A betatron operator dose show a 90 percent decrease while layout doses sharply increased compared to all NIOSH estimates from the non-betatron workers. So that's a discrepancy just within the SC&A modeling data in two time periods.

We can't resolve this today. I don't think we can resolve it in two weeks. I don't think that's going to be enough time to redo those models, reissue those papers and come out with a better table than I just showed you. I don't think that's possible.

So what I'm saying is -- and I said it all along -- I think we are at the point -- I, when I wrote this -- when I wrote this slide, I knew we were going into a second meeting, but the truth is, whether it was one meeting or not, I think it's time for this Work Group to say that NIOSH and SC&A, taking into full cognizance everything that Paul Ziemer said, everything that Wanda Munn said, everything that Dave Allen said, everything that Dr. Anigstein said, that SC&A and NIOSH cannot come to a model that fixes a dose that's stationary. They go up, they go down, they're wildly discrepant from each other, and it's time to say that this site, that has no bioassay data and no badge data except for three years on only three percent of the workforce, and even the GSI betatron film badge data is diluted by the fact that only a portion of those folks that have badges actually were betatron isotope operators. The rest of them were people that were photographers et cetera. I think it's time for this Board to pass on this SEC to the full Board, which is going to take another weeks or months or longer, and get on with a final SEC position on this site.

And I do really thank you. I'll send -- make sure everybody gets a copy of this.

CHAIRMAN ZIEMER: Okay, thanks, Dan. Let's see if we have other questions. We've asked some of them as we went.

MEMBER BEACH: I have just a real quick question. Building 9 was mentioned and I know I was looking at that earlier.

DR. McKEEL: Yes.

MEMBER BEACH: Where is Building 9? It was never --

DR. McKEEL: Let's see.

MR. RAMSPOTT: Building 9 is the immediately next to 10.

MEMBER BEACH: Is it right close to 10?

MR. RAMSPOTT: And the train tracks went into 9 and 10, so castings from the betatron, from -- actually came in down 9 and the rest of the plant, and across 10.

MEMBER BEACH: And then what

percentage was 10 or 9 used? Do you know, Dan?

MR. RAMSPOTT: Oh, the building?

MEMBER BEACH: Yes.

MR. RAMSPOTT: Oh, totally?

MEMBER BEACH: All the time?

MR. RAMSPOTT: Oh, absolutely.

MEMBER BEACH: Okay.

MR. RAMSPOTT: Yes. Actually, 8, 9, 10 are connected together. No walls.

MEMBER BEACH: Okay.

DR. McKEEL: Josie, on this diagram, on the big --

MR. DELL: It's all one big building.

DR. McKEEL: This is the -- this is the 10 Building right here, running horizontally along here. Here's where the railroad tracks in 1957 were approaching where the new betatron building would be, and then in 1963, when it was actually built, they sent it up here.

Here's 9 Building right up -- so they're a really skinny fit with very long --

MEMBER BEACH: Thank you.

DR. McKEEL: And these buildings were wide open. They're columns. There's no wall. So it's really like --

MR. DELL: Like a big building.

CHAIRMAN ZIEMER: Okay, other questions? Okay. Thank you, Dan.

DR. McKEEL: Thank you.

CHAIRMAN ZIEMER: And I think we have a pretty good grasp of your points, I told you I am still digesting and I am seeing some of them for the first time today. The Chair is not ready to do the --

DR. McKEEL: I understand.

CHAIRMAN ZIEMER: -- the third point that --

DR. McKEEL: I understand.

CHAIRMAN ZIEMER: But you know, whether we have agreement or disagreement in two weeks, we are going to have to do something and I understand that. We're at a point where I think we have gathered about all the gathering we can do and we have to --

DR. McKEEL: I think this was a great time to do that.

CHAIRMAN ZIEMER: We have to sift through it.

DR. McKEEL: I'm probably not going to be able to come in person to the next meeting, but I sure will --

CHAIRMAN ZIEMER: Unless we meet in St. Louis or down in southern Missouri.

DR. McKEEL: Come to Van Buren --

MR. CHUROVICH: May I make a comment?

CHAIRMAN ZIEMER: Comment?

MR. CHUROVICH: Yes.

CHAIRMAN ZIEMER: Go ahead.

MR. CHUROVICH: First of all --

MR. KATZ: Sorry, we couldn't hear. Who is this speaking?

MR. CHUROVICH: Dan Churovich. I

was a timekeeper and clerk in 10 Building.

MR. KATZ: Thank you.

MR. CHUROVICH: Back in `52 or `51 to `61.

MR. KATZ: Thank you.

MR. CHUROVICH: And what I have to say is that -- why so few -- why is there so few badges and why, the ones that they do have, all of them show everything was hunky-dory and some workers, like foremen and like timekeepers like myself, et cetera, was not given any kind of consideration that they could be harmed by the radiation when the -- I can attest to the fact that the old betatron had that ribbon door they talked about, because it just rolled up on a spool. I knew you couldn't put lead plating in that.

And also, no one knew that this was going on at the time. It was a secret from us. We were literally not told that they had any uranium around that place. They brought it in and secretly, even -- I understand the operators in the betatron didn't know what they were X-raying. Why was everything so secret and why is it now that everything was tried to confuse this issue so that we -- a lot of people were turned down because they didn't work at the place, and that's just terrible. That's all.

CHAIRMAN ZIEMER: Okay. We hear your comment. I wonder if we should take a ten-minute break and then we'll hear from Bob. A quick, ten-minute break, comfort break, and then we'll have an hour, Bob, to hear from you and then we're going to go home. Okay?

(Whereupon, the above-entitled matter went off the record at 1:45 p.m. and resumed at 1:56 p.m.)

MR. KATZ: We're back on the line and we're going to have a presentation by Dr. Anigstein now.

CHAIRMAN ZIEMER: Okay, so this is the SC&A review of the NIOSH White Paper. So you're -- that report was distributed over the weekend. I think all the Work Group Members and petitioners have copies.

And Bob has got a PowerPoint presentation here for us. And Bob, do you want us to ask things as we go along or do you want to go ahead through it first?

DR. ANIGSTEIN: Well --

(Laughter.)

CHAIRMAN ZIEMER: Not that we'll pay attention to what you'd like but --

DR. ANIGSTEIN: I mean it's a question of if I am going to get to finish.

CHAIRMAN ZIEMER: Well, okay.

DR. ANIGSTEIN: Questions, yes, comments -- comments, no. How is that?

CHAIRMAN ZIEMER: Okay. If something needs to be clarified, we can ask.

DR. ANIGSTEIN: Yes, by all means ask questions.

CHAIRMAN ZIEMER: Okay. Do we have -- we don't have the PowerPoint?

DR. ANIGSTEIN: Pardon?

CHAIRMAN ZIEMER: Do we have the PowerPoint?

DR. ANIGSTEIN: It's not a PowerPoint. No, I didn't distribute it.

CHAIRMAN ZIEMER: I didn't think you did.

Go ahead, Bob.

DR. ANIGSTEIN: Okay. All right, so I'm going to do a quick -- the nature of the presentation has changed considerably throughout the course of the meeting but I'm just going through the slides quickly.

I'm just going to give a history --

CHAIRMAN ZIEMER: Be sure to speak up there, Bob.

DR. ANIGSTEIN: A quick history of the document review. I'll give you a quick history of this. Okay, the first report came out June 25th, 2007, which was the Appendix BB that's been talked about frequently.

Then we were tasked with reviewing

this and we produced our review March 17^{th}, 2008, was the first version that came out. There have been numerous White Papers and memos and responses to White Papers, SC&A White Papers in between.

These are the ones that deal with the data transfer. That's why I highlighted these, and then of course, the paper, the report that you just heard Dave Allen talking about came out in January and then our response on March 12.

Just for those who are not too familiar, which I guess is almost everybody is familiar with, this is the aerial photo of the Granite City facility while it was in operation, and from there to there is enlarged to give you an idea of the orientation. This is the new betatron and you can see it goes right into the 10 Building, the 10 Building here. The old betatron is considerably further away and this is just a Google Earth picture of the new betatron.

And this is the typical -- this is a photograph, which was furnished by John Ramspott, passed on by John Ramspott, it was furnished by one of the workers.

And we just used this as a model simply because the light was better here. We had information on this, we might as well use it.

And we -- in our model, we just shot -- we did he one shot at the casting, we had the betatron going directly at this hollow axle. That is the betatron here, there's the magnets and the beam goes -- the doughnut is there so the beam goes out like this.

And all right so the source of the exposure from the betatron, can be stray radiation during the operation of the betatron, either photons or neutrons for the betatron target has sufficiently -- the electrons kind of hitting it at 25 MeV as well as the photons from bremsstrahlung.

Then you may have, question mark,

residual activation we talked about in the betatron apparatus, and then there is the delayed radiation from photoactivated metals, so that if you approach the metal, be it uranium or steel, after the beam is off, you're still going to have -- for a while it's going to have some radiation coming out.

Then you have the skin, exposure of the skin, first of all just from handling uranium you get a beta dose, photoactivated uranium isotopes, which turn out to contribute very little actually, and then the activated steel.

This is the overview of SC&A activities during these last two months, what we did since seeing the Dave Allen paper in the middle of January.

We revised the MCNPx model of the new betatron. We had actually constructed a model of the new building and of the old betatron building back in 2008.

We had -- where we were working --

I'm going to do a lot of skipping, back and forth. We were working with this initial -- this was the only information that we had back when we started in 2008, this and other drawings, but they were all basically the same, of the new betatron building from the FUSRAP -- the Formerly Utilized Sites radiation -- and so this was done starting from 1989 to about 1991.

So the building probably had been modified, I think these walls at least, the walls had been opened, I mean, unless you think that they were completely inaccurate, which is not likely.

But this is all we had to work with, so then subsequently, we got a much better picture from the AEC licensing records, and first of all, here they were the -- whoever was making these things was very interested in the details of this, while people doing the FUSRAP were just giving a drawing so they could show here's where we sampled for uranium.

So they didn't have a great interest in getting every detail right. So this is the first -- going back to what we did. So we revised the model, comparing it to the survey report, actually in earlier information like from `68, we revised -- we ran the model and revised the photon and neutron dose rates for the betatron in the control room and in the Number 2 Building. These were the only -- this -- they had earlier done it in many locations, and these were the two that we focused on because they were significant at this point.

We revised the neutron doses to the betatron operators. The reason we focused on the neutron doses rather than the photon dose is we had for the film badges. So we really were only interested in using the model for the neutron doses, and then the dose of the layout man, because he was not badged, even though he might have -- the layout man may have actually been a betatron operator who rotated jobs, while he was working as a layout man, he was not wearing a badge.

We then -- we also revised our initial MCNPx analysis of photoactivation of uranium and steel, not because information changed, but because the MCNPx codes changed considerably over these three years.

Back in 2007 was when they first -- there was an MCNPx of 2.5 or 25 as they call it internally. We did not have the ability to do this photoactivation.

But they introduced it somewhat around that time, early 2007 I think, and we ended up using version 26E. They are now up to 27E and there's been a lot of refinement in those calculations there.

And this one -- the earlier one was only available to beta testers, now this one is on the RSICC, you can get it directly from RSICC. So anyone qualified can buy it.

So we calculated a new beta doses

for the skin. The photon doses were unchanged. Actually it went down slightly but they were small enough there was no reason to change them.

We then were able to put this information together and to form a bounding estimate of residual radiation -- oh no, sorry -- separately we did a bounding estimate on this mysterious residual radiation from the betatron which I'll talk about.

And then finally we compared our estimates with NIOSH's estimates. So this is the earliest -- now all the AEC literature, a thousand pages, a lot of which is redundant and duplicated, but still, there's a lot of material there.

This is the first drawing of the betatron building that shows up, and here they indicate this was January -- this is a little hard to read and so I put it into the legend but this says 1-10-68.

And they indicate the double-leaf

door with the lead shield. They also indicate these additional walls that were not in the FUSRAP write-up.

One of the walls looked like a line but we had not idea how thick it was, so we just left it out of our version of the model. This wall was there, we could scale it, this wall was not there. This wall was not there.

And then the better drawing came later. They simply redrew it and a little neater, neater lettering. Mostly the only improvement is in the lettering, the actual contour of the wall is more detailed, more correct.

But it's not to scale and the reason is I superimposed the MCNPx model, I reconstructed the model using the dimensions that are written here, 97 feet, 77 feet, 8 inches, 112 feet, 71 feet -- we put those into the model and this is what MCNP gave me back.

I superimposed it too and they

were just -- all they took was a ruler and just drew lines, not very carefully. It's clearly not to scale, because this is 10 feet, this shows it as like three feet.

But nevertheless we did the best we could with this information. Wherever there were numbers, we used the numbers, but the source here, they didn't give you any -- they just put an X here. They didn't tell you where it really was in terms of distance.

So by using their outlines and measuring, I ended up putting the source here because what's important is where this shield ends. I put it the same way with respect to the shield, the same with respect to the actual wall, ended up in a slightly different position on the drawing.

Okay, so this is the yellow and the green. The yellow is the sand and green is the concrete. Even the door to the control room is a little differently located than it shows on the drawing. That's the best we had.

Here are our issues regarding the DCAS model, most of which I have already raised, just going over quickly during the discussion.

The betatron control badges, that what it was called, betatron CTL, Dave assumed that it was kept in the control room desk but another drawing showed the desk to be located right about here.

And we don't agree with SC&A's position and we cannot make that assumption. It may have been there. It may have been somewhere else. We just don't know where it was.

So consequently there's no documentation on it and so far the only testimony we've heard was it didn't exist. I think it did exist because it's on every weekly badge record, it's on badge number 1, but we just don't know where it was kept.

The second is, the assumption was made, I can understand, they said it's in the betatron building, that they were kept in the control room.

They in fact were kept in this location at the -- one of the gentlemen on the phone, I can -- if he wishes to identify himself he can -- gave me this information a few days ago and he said, you walk in the main entrance, you walk by, this is the bathroom here, you walk past the bathroom, and they were, the film badges were on the wall on the left. So this is from the conversation, the best record, that they were -- this is where the rack of the badges were. It was not in the control room, and it was presumably a low radiation area.

CHAIRMAN ZIEMER: Just a comment, now that agrees with what I think we heard from you, right?

DR. McKEEL: Well, except that's location number 2.

CHAIRMAN ZIEMER: Yes, location 2.

DR. McKEEL: And the other fellow

said that they originally --

CHAIRMAN ZIEMER: Earlier it might have been in that office.

DR. McKEEL: In the office location --

DR. ANIGSTEIN: Yes, that's where the same worker told me, yes, it was in the office earlier, but I just --

CHAIRMAN ZIEMER: It's not the control room.

DR. ANIGSTEIN: Yes, it's definitely not the control room. He did say it was earlier but I didn't quite -- he didn't quite clarify where or what period and I just settled for what -- the only purpose of this was to show that it's not the control room.

CHAIRMAN ZIEMER: Right.

DR. ANIGSTEIN: That we do know where.

CHAIRMAN ZIEMER: And that's a little further away, actually.

DR. ANIGSTEIN: Yes, well, not

only is it further away, but the control badge -- not the betatron control -- but the unnumbered control badge would have been kept there. In any radiation safety program,. You keep the -- you store the control badge right where you can store the badges, and, which is more claimant-favorable -- that's the claimant-favorable assumption because then they subtract whatever -- they develop them all at the same time, so whatever variation may be in the processing, in the developer of that day, is reflected equally on the control badge. It's still blank, it's a laboratory blank, and you subtract -- Landauer subtracts the readings from the other badges.

So that 10 millirem is already with the background subtracted. Whatever the badges would have accumulated during the 100 hours of the week that the worker is not using the badge is already taken care of.

DR. McKEEL: Dr. Anigstein, I just have a brief comment that the unanimous testimony of the people I've talked to is that they are unaware of the CTL --

DR. ANIGSTEIN: And I am not using it.

DR. McKEEL: Okay.

DR. ANIGSTEIN: I'm just starting it so --

DR. McKEEL: Okay.

DR. ANIGSTEIN: We're in -- we may not be in agreement, but at least the outcome is the same.

DR. McKEEL: Okay.

DR. ANIGSTEIN: Okay. So instead of the 15 positions, we just utilized one position. Here is the diagram of -- this is the casting, because we are doing a horizontal cross-section, it's a hollow pipe, so you see it as two lines, cutting across the pipe.

This is the betatron. Compared to the size of the room, it's very small. This is the actual donut, this little tiny dot is the aluminum cone.

So the beam goes straight in this direction, and that's the only shot we consider. However, I do have an aside now I'd like to add, I think I understand better the discussion of how, based on Dr. McKeel's written documentation, the roll-up door was here. This is the beginning of the 10 Building. It's not shown here, but this is the 10 Building.

The roll-up door was here. Here you have the rail tunnel. They call it a tunnel, but of course it's above ground. And here is, at least according to the drawing, where that steel -- the double-leaf, lead-lined door was.

So they're two different doors, so there is in fact -- excuse me, yes they are -- everything Dr. McKeel showed was the steel roll-up door was between -- was in the 10 Building, looking towards the betatron, that's where you have the steel door. Same thing -- same thing on the old betatron.

DR. McKEEL: That was in 2006.

DR. ANIGSTEIN: Yes, I understand that.

MR. RAMSPOTT: And the FOIA says there was a steel mesh gate at that same location, in a FOIA document. So you've got a wire gate --

DR. ANIGSTEIN: Okay, in any case, in any case that does not -- you can have both. You can have a door here and you can have a door here. And if you were to -- and from a radiation safety shielding standpoint you put your shield where your radiation is.

MR. RAMSPOTT: No.

DR. ANIGSTEIN: All right, you're allowed to disagree. You put your shield where the radiation is, so you will put your shield here and here there may be a reason to have a door just to keep people out, separating this thing.

All right, let me go on. So anyway, this is where we assume, this is the shot that we use for our representative case, and I know there were dozens of possibilities, but you have to pick one.

So we used this as a representative case and probably a limiting case, because the -- one of the gentlemen that's on the phone now, or at least was a while ago, said this practice of shooting on the railroad tracks only accounted for about 15 percent of the time. The rest of the time they were following the normal protocol and shooting inside, near the middle of the betatron shooting room.

So instead of -- most of the time the betatron would be here shooting castings more or less in every -- in different directions, as Dave Allen indicated, and so only about 15 percent of the time, they were on the railroad track.

So we use that as a limiting case, trying to come up with a bounding estimate, we used that as a bounding estimate -- that's very conservative -- and say it happened all the time. That's extremely conservative, extremely claimant-favorable.

Okay. So this is the case that we modeled. And finally this is what we came up with. Now, one of the suppositions, and I've since had reason to rethink it, it's in my report, and that is what about this mysterious radiation from the betatron?

Let's say it happened and let's say it hit the worker in the back. Well, if you want to do a ratio, and it's in my report but let me put it here, if you want to take a ratio of how much exposure the worker could have gotten, and how much exposure the badge could have gotten, if you read it coming from the back.

We used the model, the current table put out by ICRP, report number 74 or page 74, uses an earlier anthropomorphic phantom, this is just geometric shapes that are easy to model.

So you have a human body, the torso is an ellipse, the various organs are the different shapes, like an ellipse, a truncated cone, and so forth.

This is some of the -- actually they are redoing it now with a more realistic modeling, but it's androgynous. So they use the same model for a male and a female.

So they add on, if you want to model -- if it goes to a female breast, they simply put breasts on the same model. Well, a breast is a pretty good surrogate for the film badge. They are worn on the chest often, so on that side of the body.

So I looked at the ratio. What is the dose to the whole body, the effective dose, if the radiation is coming from the back, compared to the dose to the breast, which will be the surrogate for the film badge.

And the worst you can get is the lowest energy, which is 30 keV, anything lower than that NIOSH doesn't even consider in the dose reconstruction, and there, the breast got 10 millirem, the whole body got 26 millirem.

So you have at most, so if you say that no worker got more than 10 millirem, assuming that all of the radiation came from behind, and all of it was 30 keV, the most they would get is 26 millirem.

The reality is, I was later told that there is a problem with this because the -- again, Joseph Zlotnicki, that was formerly from Landauer, said that -- and also my colleague ‘ identifying information redacted’, I have to say this was done under time pressure -- said no, the film badge is not the same back to front, front to back, because from the front, it has the metal filters, from the back it doesn't.

So from the back it will actually over respond. So actually when I say it registers 10, or the 26, you divide it up 26, the dose would be -- the film badge will probably get more than 26.

But anyway I used that as a limit. And the only purpose of this was to establish and to -- in agreement with Dave's report, to establish that no way is the betatron operator the limiting individual for photon exposure to the whole body.

The reality is the layout man gets a much higher dose. So if NIOSH was to assign the external dose of the layout man to all workers, we don't have to worry about the betatron operator, because whether it's one -- whether he gets 10 millirem or gets 26 millirem, or anything as long as it's not much, much higher, the layout man is going to be higher, and then the real betatron operators will be assigned the dose of the layout man, because, again, they sometimes will have worked as layout men, not wearing a film badge.

So I think we can pretty much put that to rest as a non-issue, that even if there is a little bit of radiation coming from behind, and it's more than likely the readings are spurious and were caused by electromagnetic interference with the meter, but regardless, it's not -- it does not affect the ability to reconstruct doses.

Now, we got higher doses that give us -- so here's the comparison, the exposure, but again, it's really irrelevant. Neutron doses are relevant and we got higher doses because we did not scale back the exposures because of this -- this betatron control badge. We did not take that into account.

But consequently we assume -- we didn't scale it at all. This is simply the calculated dose to the neutron dose, to the betatron operator from two sources, from the operating betatron while the operator is in the control room, taking into account, you know, the long shot, the short shot, how much time -- he spent long periods in the control room, shorter periods in the control room, all of that is taken into account, and this is the neutron dose using the latest model of the betatron building.

And so we get 480 millirem to this period. Oh, and this also includes the neutron dose from handling uranium. There is a small, small amount of neutron dose from the uranium, from handling the recently-irradiated uranium. It has a little photoactive -- photofission there and there is a small, small neutron component.

So this is where we got these numbers. Then the beta dose again comes from handling the uranium. And we got somewhat different -- I'm not quite sure what the difference is, why -- because I think we used the same approach but there were some differences there between my modeling and the DCAS modeling, the beta dose to the hand and forearm, the beta dose to the skin one foot away, this is to the betatron operator.

So the layout men -- oh, and they

also get -- I'm sorry -- they also get a beta dose from the irradiated steel. They are assumed to be handling the irradiated steel half the time. Half the time they are doing the layout, they are touching the steel.

So there, we get a higher dose -- yes, excuse me, that was the explanation. We get a higher dose because as it turns out, repeating -- using the latest version of MCNPx, which is where the major difference is, you get a fivefold higher concentration of the beta-emitting isotopes generated from the steel. It's a just more refined model and the beta doses is from the steel, not from the uranium.

CHAIRMAN ZIEMER: Is that simply a difference in you using the later version versus --

DR. ANIGSTEIN: Mostly, yes. Yes, it is, because --

CHAIRMAN ZIEMER: It's not a difference in assumption, starting assumption or anything, it's a refinement in the model that has caused that?

DR. ANIGSTEIN: No. No, we didn't change the model, because actually Dave took our numbers directly for the beta dose from the steel, and so we --

CHAIRMAN ZIEMER: I'm trying to get a feel for the difference in the numbers I'm seeing on the chart.

DR. ANIGSTEIN: Under which, under which column?

CHAIRMAN ZIEMER: On the beta dose to the skin.

DR. ANIGSTEIN: Yes. The beta dose to the skin is primarily due to the MCNP -- newer version of MCNPx --

CHAIRMAN ZIEMER: That's what I'm asking.

DR. ANIGSTEIN: -- predicting higher concentrations of the beta-emitting activation products in the steel.

CHAIRMAN ZIEMER: And you're

saying DCAS took the same starting numbers but they were using an earlier version?

MEMBER BEACH: 2008 version.

DR. ANIGSTEIN: They -- no. They took the actual numbers from the report, my 2008 report.

MR. ALLEN: If I remember right, we took yours for steel, did them for the uranium, and this is a combination of the two, right? The steel and uranium beta dose?

DR. ANIGSTEIN: Yes, yes, yes.

MR. ALLEN: So there's a little difference there and we used -- we used a different model for the uranium, very similar to what you did.

DR. ANIGSTEIN: Yes, you did, you reran the uranium but you did not rerun the steel --

MR. ALLEN: Right.

DR. ANIGSTEIN: You just took our results for steel, and we are -- and so -- I felt a little badly towards Dave, because he was accepting our results and I said, wait a second, we don't accept the results anymore. But it's -- yes, the interaction.

So basically, and the basic conclusion is: we believe, that's the position, that doses during this period of the betatron -- from the betatron operation, and these are limiting. I just want to point out a couple of things. One is I have got a question mark. I think Dave, I think there was a mistake here in these numbers. You didn't divide by two to account for the half here. Here, you divided by two, `65 to `66 goes down exactly by two, and here I don't think you divided by two for -- well, over the six months.

MR. ALLEN: I'll have to double check. It kind of looks that way.

DR. ANIGSTEIN: Yes. Otherwise it would mean that the monthly rates, they went up -- and this is only a six-month period, so I guess, you know, it was just a slip.

But another -- another point I want to make is: first of all, this is you assuming -- this is assigning the new betatron to the old betatron, and let's just say it's claimant-favorable. It's simple.

We did run the old betatron, satisfied ourselves, and it's in the 2008 report, that the doses are lower simply because the energies are lower.

And you didn't have, as far as we know, there wasn't this business of shooting on the railroad tracks, but at any rate, the energies were lower.

And that time I just scaled the energy, naturally the exposure rates were considerably lower, it was 100 -- 100 Rs per hour, per minute or maybe 100 -- as opposed to 160. They were considerably lower, through the compensator.

CHAIRMAN ZIEMER: So SC&A is suggesting that if you use the new betatron values to bound doses during those years, and someone is working either then or earlier in the old betatron --

DR. ANIGSTEIN: Right.

CHAIRMAN ZIEMER: -- you just -- you give them the same value even though you are overestimating.

DR. ANIGSTEIN: Right, that's bounding then if they want to, I mean, NIOSH --

CHAIRMAN ZIEMER: Are you guys saying the same thing as that?

MR. ALLEN: Yes.

CHAIRMAN ZIEMER: Okay. So -- but why not give them what they had for the old one?

MR. ALLEN: It would make sense.

CHAIRMAN ZIEMER: It's just easier to do and you are claimant-favorable because you are overestimating?

MR. ALLEN: It's claimant-favorable plus we had the dimensions in the dose rate survey of 1971, to kind of calibrate this model for the new betatron building.

CHAIRMAN ZIEMER: So you're more confident that the model is --

MR. ALLEN: There was a lot more unknowns with the old one.

CHAIRMAN ZIEMER: More unknowns with the old model, but you know enough to be able to say, in spite of those unknowns, the new one will capture it, because of the higher energies?

MR. ALLEN: Yes, you can still -- if you still have drawings, you can scale off of those drawings, but it's not like having the dimension that's measured and put on the drawing.

DR. ANIGSTEIN: But you wouldn't have this layout worker, because -- and that's the other issue. I mean, it's not an issue, it's just the -- I'd like to point out the -- both the strengths and the weaknesses, and here we have the layout man always getting the same dose. But in reality this is a layout man in the 10 Building --

CHAIRMAN ZIEMER: I understand.

DR. ANIGSTEIN: -- being irradiated by the new betatron. The new betatron wasn't there prior to `64. So that would be a hypothetical construct, and if you want to go back and -- but you can say, well, there will be other workers getting other exposures, and this is probably limiting. So you can use that as a kind of a, as a realistic bounding value.

But again, the bottom line is: we disagree in detail but not in principle. I think that is -- GSI is extremely well-documented and even though there may be, like always, some minor inconsistencies where one person recalls this and one person recalls that, and workers that I've spoken to will contradict what other workers have said, and after 50 years, what do you expect? It's not, it's not going to be -- that's not surprising.

But if you put the whole picture

together, and you get a reasonably consistent picture that's adequate for, again, giving a bounding estimate, you're not going to get the right number for every single individual, it's just a bounding estimate, and the fact that during that time period, or during the covered period with the badges, there was one incident of, in one week, which is some kind of an incident, most likely to the film badge rather than to the worker, of over two rem in one week, and the same worker had a film badge for every week and it was always m, except that one reported. And the others had: 300 was the second highest, the third highest was 40 and after that there were either actual numbers of 10 or m which we equate to 10.

So -- and there are very few missing badges, because we went through -- I went through every week's records and there was very rarely was there a missing badge. Sometimes somebody loses their badge, somebody takes it home.

But the film badge record seems to be extremely complete, extremely consistent. There were some incidents and questions that were raised as we have discussed, in later years, but that is outside the covered period.

So that's about it now.

CHAIRMAN ZIEMER: Have you finished your --

DR. ANIGSTEIN: I'm finished.

CHAIRMAN ZIEMER: Okay, I'll open it up for questions to the Work Group. I've already asked several but Wanda, did you have additional questions?

MEMBER MUNN: The only question that I have in my mind, and I haven't gone back and reviewed our original documents, has to do with the old betatron building.

DR. ANIGSTEIN: Yes.

MEMBER MUNN: And I can't remember whether we had good as-builts on the old betatron building or not.

DR. ANIGSTEIN: No, the old

betatron building would only have the FUSRAP. Those later FUSRAP drawings.. That's the only thing we have. The only reason we have these is because they wanted a license for the 80-curie source, and they did this radiation survey and they show here's where we are going to use it. I think they ended up using it in the old betatron as well, but again, that was not near -- not right next to an area, 10 Building where you have workers --

MEMBER MUNN: Correct.

DR. ANIGSTEIN: -- working, you know, on it. They may have been passing by, they may have outdoors, but not somebody who could plausibly have a work station right outside that door.

MEMBER MUNN: It was so far removed from the other activities --

DR. ANIGSTEIN: Yes.

MEMBER MUNN: At least it appeared to be so, on the --

DR. ANIGSTEIN: Yes, oh there --

it was several hundred feet away.

MEMBER MUNN: Yes. Yes.

CHAIRMAN ZIEMER: Josie.

MR. ALLEN: I got one -- one thing to say about all this, okay, about everything today, is the location of the badge and the control room or whatever, that was my bad assumption. But now we're showing a badge rack in the building that has, from everything we've been told so far, has -- everybody either has their badge on that or it's on them in the control room, or the betatron is off and they're out in the shooting room.

CHAIRMAN ZIEMER: Yes. Yes.

MR. ALLEN: So the same kind of concept still applies to the badge rack --

CHAIRMAN ZIEMER: Right. So does that change --

MR. ALLEN: It changes the numbers --

CHAIRMAN ZIEMER: That's going to change a possible number in the control room for you, won't it, because --

MR. ALLEN: It will --

CHAIRMAN ZIEMER: You're saying that -- you're going to be saying the 10 is not in the control room, it's out here somewhere, which conceptually pushes the control room up some amount --

MR. ALLEN: Right.

CHAIRMAN ZIEMER: -- in your model. So your other doses are going to change upward a little bit?

MR. ALLEN: Yes. It'll make changes to the numbers, not the general concept.

MEMBER MUNN: They should be relatively minor.

CHAIRMAN ZIEMER: Yes. And one thing that was a little new to me, Bob, was on the door. You're saying that, and I guess these folks are asking, or maybe challenging that, that there may have been a shield on an inner door, which was a roll door. Do we know that for sure?

DR. ANIGSTEIN: Just to say, however -- I should say in my -- I'm just throwing that out, however in my model, because it was not, because we can't be certain that the lead was not added later, there's no lead in my model.

CHAIRMAN ZIEMER: Okay.

DR. ANIGSTEIN: But my 9.2 rem to the layout man assumes that he is --

CHAIRMAN ZIEMER: Right, so you didn't assume any lead in there?

DR. ANIGSTEIN: No, I picked the worst location --

CHAIRMAN ZIEMER: Right. But while you're doing that -- while you were out of the room, Dr. McKeel showed some numbers comparing the earlier SC&A results with the later runs, and that was remarkably higher, but you had some questions on the earlier models that didn't seem to change, I think, on SC&A, right?

DR. ANIGSTEIN: The earlier model

-- two things. The earlier model to the betatron worker calibrated was not from MCNP. It was from this 15 millirem -- it was from the 15 mR per hour, at that time we took it as gospel. It was before we had film badges.

DR. McKEEL: To the layout men?

DR. ANIGSTEIN: So the reason that they had to shoot 12 and 13 --

CHAIRMAN ZIEMER: In your earlier models you -- okay, I --

DR. ANIGSTEIN: That was most of the exposure was from this residual betatron operation.

CHAIRMAN ZIEMER: You were modeling the residual time based on the 15 --

DR. ANIGSTEIN: Right, right. It was not an MCNP model, it was just -- the scaling was just the inverse square law and time and motion studies.

This is, in case you're curious, I put the layout man, either he -- he couldn't be on the railroad track, because he would be blocking the rail cars. So I assumed his casting was either here or here. We did both and took the higher level, so he is just maybe 20 feet from -- it's probably unrealistic. This is the worst location, based on my limited knowledge, where he could be for that eight hours a day, and he doesn't even -- and even in the earlier model, we had a -- which NIOSH also used -- we had a -- there was, I guess it would be easier to show it here, out here you can see it, right here.

There was a restroom. It was used not by the betatron workers, but by other plant workers, in the 8, 9, 10 Building. And that one was within line of sight with nothing in between to the betatron.

Well, that's not true anymore. Now we know this would have been here, now we know we have this wall and having put that wall there, the dose to the restroom now is lower than the dose to the location of the layout man.

So we simply assumed that the layout man spent eight hours a day on his job because he would actually be getting less dose if he went to the restroom.

CHAIRMAN ZIEMER: Now, Bob, for purposes of what you've demonstrated or are demonstrating today, you've identified this, which in your mind is a worst case scenario. Are you using numbers from that to assign to all those folks? Whereas I think NIOSH is saying -- you're looking at several different ones, and you're not assigning that worst case 100 percent of the time, you're scaling it in a sense, is that right?

MR. ALLEN: Right. That worst case there, I did just a quick scoping --

CHAIRMAN ZIEMER: Well, I'm trying to get a feel for the comparison that I think Dr. McKeel was raising the issue of the difference in the comparisons of the models, but are you -- you're using 100 percent time for the worst case and you're using a scaling

--

DR. ANIGSTEIN: That was not the worst case, because the worst case, you see, in Dave's worst case, he was shooting like this. He was shooting not at the casting. Let me go back, angling not at the casting, he was shooting like this at the casting, now the betatron was here, here and here, so there was going to be much more going out the door from that direction and --

CHAIRMAN ZIEMER: But he wasn't assuming that that happened all the time either.

DR. ANIGSTEIN: But then, using these assumptions about the betatron control badge, this only represented something like 2.5 percent of the time --

CHAIRMAN ZIEMER: That's what I'm asking.

DR. ANIGSTEIN: And 97.5 percent of the time it was shooting towards the back wall.

CHAIRMAN ZIEMER: Right.

DR. ANIGSTEIN: So there was much less radiation going out of the building.

CHAIRMAN ZIEMER: Right. Well, I'm just trying to get a feel for what's being proposed in terms of bounding, if you use a weighted sort of distribution of those versus taking a worst case and saying, well, worst case will bound everything but is that really realistic?

DR. ANIGSTEIN: Again, this is not -- my worst case is not as bad as his worst case.

CHAIRMAN ZIEMER: No, no, but he wasn't using worst case to assign the doses either.

MR. ALLEN: I was using a worst case for a small percentage of the time. You were using a less worst case 100 percent of the time.

(Laughter.)

CHAIRMAN ZIEMER: That's right.

But you guys are both trying to show that you can bound -- if we were to accept bounding in principle, you still have the issue of, okay, but then what's the number you would assign? And you know, is it -- and I think Dr. McKeel's point is that those are a ways apart at the moment.

MR. ALLEN: Well, I don't know if they're that far apart. I was going to say, I did a real scoping, just a scoping-type of, you know, I wouldn't trust this run, I just did it overnight real quick, and without the lead in the door and with the badge rack in the new location, and that run there that Bob did, the estimate he did to give the nine rem to the layout man, it gives you about 60 millirem a week at the badge rack.

CHAIRMAN ZIEMER: Yes. Well, the only thing I'm getting at is if there's any refinements, we want to see them pretty fast, okay?

MR. ALLEN: Yes, that's why I'm

mentioning this, because I would like to try to make that refinement, but I don't want to go to that trouble then have everybody say the hell with that.

But, I mean, the truth is you had the badges at the badge rack or on the person in the control room or in the shooting room, and six millirem at the badge rack is the lowest dose --

CHAIRMAN ZIEMER: Well, the bottom line is what we're going to eventually have to grapple with is if, option 1, if we say yes, we think you can bound, what is it -- what's that going to be, and petitioners need to know what that's going to be and what the basis is.

MEMBER BEACH: And if it's going to cover all years or --

CHAIRMAN ZIEMER: Yes, right. And so we're not going to have that comfort degree if there's all these numbers out here that are far apart. So it's --

DR. NETON: The main difference

seems to be, though, is: do you give any credibility to the badge readings -

CHAIRMAN ZIEMER: Right.

DR. NETON: -- in trying to establish the bounding, or do you ignore them completely and come up with numbers based on just workers --

CHAIRMAN ZIEMER: Right.

DR. ANIGSTEIN: No, the badge -- my model assumes the badge readings --

CHAIRMAN ZIEMER: But they both used the badge -- the approaches are the same, they just haven't used as many options. He's used one scenario and you've used --

DR. NETON: I just heard Dave say that the badge rack would be receiving 60 millirem per week.

CHAIRMAN ZIEMER: Well, he made an assumption about where the badge rack was --

MR. ALLEN: Based on the new stuff, I mean, I ran this like yesterday.

CHAIRMAN ZIEMER: Yes, right, so -

-

DR. NETON: And so there's an inconsistency there between --

CHAIRMAN ZIEMER: Okay, well --

MR. ALLEN: I guess the question for the Work Group right now is: is the concept that that badge rack can't be more than 10 millirem a week acceptable to the Work Group or not? That seems to be reality to me.

MEMBER MUNN: Well, that's what the badge reports say. Correct?

MR. ALLEN: Correct.

DR. ANIGSTEIN: But there was a control badge at the --

MR. ALLEN: Right, but the control badge --

DR. ANIGSTEIN: -- was subtracted, so whatever their badges got during the badge rack --

MR. ALLEN: But the control badge is on the Landauer reports, it was always zero until 1971, and Landauer normally subtracted on a dose basis. They would read the dose on all these things and then subtract that dose --

DR. ANIGSTEIN: No, but there would have been already the report -- no, that's not correct. This is again, the people who worked at Landauer said they -- the report would -- the control badge would be subtracted, not the betatron control --

MR. ALLEN: I know, the control badge is also on the report.

DR. ANIGSTEIN: The control badge would be subtracted already prior to them sending out the report. They might either -- he said there were two possibilities. One, either they assigned the dose to the control badge, or they simply took the density, as a factor of the density before calculating the dose.

MR. ALLEN: Which is directly proportional to the same thing. It's a calibration curve. It's the same thing.

DR. ANIGSTEIN: Yes, yes, it's the same thing.

MR. ALLEN: But they wouldn't subtract the control badge dose from itself and then record that.

MEMBER MUNN: No.

MR. ALLEN: What I'm saying is --

DR. ANIGSTEIN: I hear what you're saying.

MR. ALLEN: We have the number and what they subtracted was zero.

DR. ANIGSTEIN: Yes, and they do report the -- let me ask that question of my colleague.

CHAIRMAN ZIEMER: Dan, do you have some additional questions or comments? You want to react to what --

DR. McKEEL: I do want to react. I want to modify my last slide. So I looked at Bob's table, which I've got to admit, Bob, are we going to get that -- your PowerPoint presentation? Can we get your PowerPoint presentation?

CHAIRMAN ZIEMER: Give it to Ted and he can distribute it.

DR. ANIGSTEIN: I'll put my slide back up.

DR. McKEEL: No, I don't need your slide, I just want to know if we can have it to examine it.

MR. KATZ: You can send it to me and I can distribute it.

DR. ANIGSTEIN: Oh, yes, yes.

DR. McKEEL: All right, well -- so I was writing down the differences between the SC&A and the NIOSH numbers for photons and neutrons and the beta skin dose just to the forearms and the hands.

And earlier on there's been a lot of what I would call -- gee, I want to be polite, but I want to also be a scientist -- talk about roughly similar and the same and so forth, and somebody, maybe David, maybe Bob Anigstein, I'm not sure, somebody said that roughly if a model agreed with another model, with real data within 200 percent, twofold, that would be okay. Maybe you said it. Somebody said it.

DR. ANIGSTEIN: I think I said it.

DR. McKEEL: Okay, good. So I would say I disagree with that. I think that in academic papers where you propose a computer model and you test it with real data, I don't believe anybody would buy it within twofold. I think they would say 10 to 20 percent, from the papers that I've seen.

But let's say 200, let's say 200 percent. That's fine. So I did a bunch of ratios here between SC&A and NIOSH, just looking at them, and basically, for most year, let's say for photons, the ratio is three or higher, 300 percent or higher.

For neutrons the difference is fourfold up to fivefold. That's the point. The ratio has changed from year to year, and if you look at beta skin dose, they run along almost one to one, one to 0.8 for quite a long time, and then after 1962, you notice a precipitous change in the ratio which goes down now to 1964, SC&A 10.7, NIOSH 3.5.

So that's 300-plus percent. So I'm just saying that, you know, numbers -- when you are in the business of doing quantitative analysis, numbers matter, and these numbers do not agree with each other, and I think that if I were the editor of a peer-reviewed journal and I had an editorial board, I would expect my reviewers to point that out, that these numbers are not in agreement.

So that's one comment.

CHAIRMAN ZIEMER: Incidentally, this reflects something, and you kind of raised it earlier, Dan, SC&A is not taking the NIOSH model and revalidating it, it's sort of a -- it's kind of a different model.

DR. McKEEL: But you've got to --

CHAIRMAN ZIEMER: I know, I'm

saying, so that's, that's what we're saying here, and we do want to have some assurance that, and Bob's here, as in the next two weeks, just that looks very specifically at the NIOSH model, however they come out with it, with any final modifications, and make sure that you know, that you guys would come up with the same thing using their assumptions if you -- unless you think their assumptions are way out in left field.

But I mean right now we are talking about, okay, here, I'm going to try to see if I can -- you've kind of modeled independently here from what was done and that's led to this issue.

DR. McKEEL: Well, again this is -- these are not independent models being compared. These are so biased, because we start -- the starting point is an SC&A calculation that is then -- and it said NIOSH used their input parameters to MCNPx. So they're not independent models. They're actually comparing the same models, and that's the further point, which is an enormous point that just can't be overlooked, and that is that MCNPx is a research computer code. It is not fixed in stone. It's not like IREP, and even IREP is upgraded from time to time. But it's not even standardized like IREP. That's used all over the world for all sorts of things, as you all know better than I do.

But he's saying that in the specific version that may be two weeks apart, the numbers change.

DR. ANIGSTEIN: It's three years apart.

DR. McKEEL: Okay, but they've changed a lot, Bob. Right.

DR. ANIGSTEIN: No, they were just beginning to develop these capabilities --

DR. McKEEL: I understand that, I worked with a man --

DR. ANIGSTEIN: -- it is now the final one because it is already -- at the time was only available to beta testers.

DR. McKEEL: I understand.

DR. ANIGSTEIN: At this point it is now being distributed by RSICC as the final, official version.

DR. McKEEL: I understand that, but my friend who is a programmer distributed a number of successive, official versions, and all I can say is the software gets changed.

And what you're saying is you're here to assign -- whatever winds up in Appendix BB, like that 1.73 R per year for the non-badged workers, that's what they got for 94 percent of those dose reconstructions, and, you know, if you come out with a number that you know could change any time depending on the code, you have to stick with that number.

So all I'm saying is: please be reasonable about that. I mean, you know, at a certain point there's no bright white line between what is acceptable agreement. But I suggest that those two -- the numbers are far apart, and that we don't even know, I don't know, you know, there's MCNPx running on two different computers. I still haven't heard this morning, David, if the exact code that you were using, the version, was exactly the code that Bob Anigstein was using. I personally, if I read these numbers, I'd want to know that. I'd want to know exactly what version --

MR. ALLEN: Using the computer run with the exposure model, I mean, the computer --

DR. McKEEL: No, I want to know what -- I'm calculating it with --

MR. ALLEN: He was running 26E a few years ago and now he's running 27E.

DR. McKEEL: But it's a different -- that's a different code.

DR. ANIGSTEIN: It is.

DR. McKEEL: And, as Bob says, as Bob says, they also have an ancillary database that includes a lot of other data that can be culled in a sub-routine, I'm sure, into MCNPx. I don't know if NIOSH has that.

DR. ANIGSTEIN: No, it's a standard -- the data, the database, the data files, I should really say, are distributed with the code. Everybody who gets that code package gets the identical code and it runs identically on every PC.

DR. McKEEL: Okay.

DR. ANIGSTEIN: So, it's not like one machine, you know, runs it differently than another. We have the same operating system.

DR. McKEEL: I do understand that.

DR. ANIGSTEIN: And also, because of this fact, as I noted in my report, because of this, we got an independent MCNP expert who knew nothing about this. I mean, we put him on there, actually he worked for SC&A in the past, also doing exactly the same thing, doing independent QA. He's from Los Alamos, Ph.D., CHP, he looked over this and he completely agreed. He checked everything. He found discrepancies like of three thousands of an inch where I miscopied a number from the --

DR. McKEEL: Bob, he's validating your measurements but what I'm saying is --

DR. ANIGSTEIN: He validated the calculation. He didn't validate the measurements; he validated the calculation.

DR. McKEEL: I understand. Your numbers and David's numbers differ from each other by -- the ratio --

DR. ANIGSTEIN: Because of different assumptions.

MR. ALLEN: It's not because of MCNP for the most part, it's because of what we do with MCNP as a tool.

DR. McKEEL: Okay, but I'm saying that if I were the Board -- what I ask of the Board is to insist that you all be closer together, to accept these data.

CHAIRMAN ZIEMER: Well, that's basically what I was asking --

DR. McKEEL: Yes, I know that, I just wanted to make sure. Then I agree with you, but I just --

CHAIRMAN ZIEMER: Yes, because it's hard for us as Work Group Members if these are way far apart by 300 percent, so --

DR. McKEEL: And then I have to put my final statement about the double-leaf door, and that is that the workers are unanimous, 100 percent, not a dissenter, that it was the door to the tunnel, not the door to the break area, that in 1964-66 was that red, ribbon, roll-up door that I looked at, and my point is that even -- you know, even if you model -- forget the lead. Take the lead away. Just talk about a double-leaf steel door versus a roll-up steel door. The steel's not the same. The thickness is not the same --

DR. ANIGSTEIN: I modeled a very thin one sixteenth inch steel, which is negligible amount of shifting.

DR. McKEEL: Well, whatever you

modeled, I'm just saying that those two doors are different, but the door that was there, if you want to use reality, was the red ribbon steel door. I promise you that. That's all I'm saying.

CHAIRMAN ZIEMER: And I think we probably can accept that as the --

MR. ALLEN: Yes, I think I have to, because when you look at it, it's very clear to me in 1971 there was lead in that door, just looking at the dose readings that were taken five feet versus 10.

MR. DUTKO: Dr. Ziemer --

CHAIRMAN ZIEMER: Hang on --

DR. ANIGSTEIN: January `68, actually, was the first roll-up door.

DR. McKEEL: I will say that there is no testimony on the record, and there were men who were there in `71, nobody has ever confirmed that by visual sighting. You had folks --

MR. ALLEN: Well, you would never

see the lead in the door.

DR. ANIGSTEIN: You wouldn't see the lead because you would have sheet metal on the inside -- on both sides.

(Simultaneous speaking.)

MR. RAMSPOTT: No, I have pictures. It's not made that way. No. It's rusted on both sides. It's a single piece of steel --

MR. ALLEN: The double-leaf door in the old betatron building?

MR. RAMSPOTT: Absolutely. I've got pictures right here.

DR. McKEEL: Absolutely. Now, it is possible that there was a piece of lead on there that was then removed carefully and gone. I can't prove that, you know, between -- but it wasn't there in 1966, that's the truth.

MR. RAMSPOTT: About the same thickness as a stop sign piece of material.

MR. ALLEN: And hollow in between?

MR. RAMSPOTT: I'm sorry?

MR. ALLEN: Hollow in between?

MR. RAMSPOTT: No. Oh, no, it's one piece -- it's one thin piece of steel.

CHAIRMAN ZIEMER: Mr. Dutko, did you have another comment?

MR. DUTKO: I didn't want to interrupt anybody, sir. I'd like to comment briefly.

CHAIRMAN ZIEMER: Yes, go ahead.

MR. DUTKO: I left in November, late November of 1966. I promise you, there was not a double-leaf door on at that time. It was a red ribbon door.

Maybe I'm wrong, but I was there. There simply was not any doggone lead there, nor did anybody else I worked with ever see any lead or see evidence of it.

CHAIRMAN ZIEMER: Yes, I think we're agreeing that that's the direction we are going with this.

MR. DUTKO: I just wanted to make

that clear, sir.

CHAIRMAN ZIEMER: Thank you.

MR. KATZ: Thank you.

MEMBER BEACH: So Dave, are you going to -- your new model without the lead --

MR. ALLEN: I'm going to take the lead out of it.

MEMBER BEACH: Perfect.

DR. NETON: Get the lead out there.

CHAIRMAN ZIEMER: We're all going to get the lead out.

(Laughter.)

CHAIRMAN ZIEMER: Thanks, everyone. That's been very helpful, certainly for me, and we're going to --

MEMBER BEACH: So I have one other question. How soon do you think you can get the updated matrix to us, Bob?

DR. ANIGSTEIN: The matrix?

MEMBER BEACH: Yes.

DR. ANIGSTEIN: Maybe in a week.

MEMBER BEACH: Okay. Thank you.

CHAIRMAN ZIEMER: So we have it as a reference when we are meeting, and then -- so we'll get those new numbers from Dave and Bob, we want you to take a look at Dave's final numbers too.

DR. ANIGSTEIN: Will do. I've got to rush out.

CHAIRMAN ZIEMER: Thanks.

MEMBER MUNN: Safe travels.

MR. KATZ: I've got to rush too.

CHAIRMAN ZIEMER: Thanks. And Dan and John, thank you for coming. Appreciate it.

MR. RAMSPOTT: Thank you all for listening.

MR. KATZ: Thank you all, everybody, this was a great discussion. I'm glad I was here.

MR. KATZ: Thank you for coming, Dr. McKeel and Mr. Ramspott.

(Whereupon, at 2:58 p.m., the above-entitled matter went off the record.)