UNITED STATES OF AMERICA
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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TBD 6000 WORK GROUP

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WEDNESDAY
MARCH 28, 2012

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

PRESENT:

PAUL L. ZIEMER, Chairman
JOSIE BEACH, Member
WANDA MUNN, Member
ALSO PRESENT:
TED KATZ, Designated Federal Official
DAVE ALLEN, DCAS
ROBERT ANIGSTEIN, SC&A
JOHN DUTKO*
DAN CHUROVICH*
JENNY LIN, HHS
JOHN MAURO, SC&A
DAN McKEEL*
JAMES NETON, DCAS
JOHN RAMSPOTT*

*Present via telephone
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(8:30 a.m.)

MR. KATZ: All right. Good morning everybody in the room and on the line. This is the Advisory Board on Radiation Worker Health TBD-6000 Work Group. We're just getting ready to go. We'll begin with roll call. We are speaking about a site. So please speak to conflict of interest. And we'll do roll call beginning with Board Members.

(Roll call.)

MR. KATZ: All right. We have an agenda for the meeting. It is posted on the NIOSH website and I believe there is some new materials on the NIOSH website, too, to go along with this meeting.

And it is your agenda, Paul.

CHAIRMAN ZIEMER: Okay, thank you. We will officially call the meeting to order. I want to take just a moment to give us an overview of the agenda today and
then we will proceed from there.

First of all we have an update from NIOSH. Dave Allen has provided -- I'm going to call it an update -- from his previous White Paper on the betatron operation model and that was distributed since our last meeting and I believe the petitioners also have a copy of that. And we will take a look at that.

And then we have a document from SC&A, which is kind of a summary document. It is dated March 25th and it is called Review of Addendum to Dose Estimates for Betatron Operations White Paper. And that was distributed to everyone. I believe the petitioners also received that.

And then we have several documents from the petitioners and I do intend for us to look at those in some detail as well this morning.

We have, I'm looking for the dates on these, but we have actually several
documents from Dan McKeel and the first of these, and Dan you may have to help me here, I have one which was the original critique of the January White Paper and I want to use that as well. And then we have the March 11th document, which was previously distributed.

And we have some material from March 27th, which was emailed and included with that actually on March 23rd we have a document called McKeel Response to Allen Addendum 3, Part I, Items 1 and 2. And then we have Part II comments. And then I believe, Dan you put those all together into one document that you re-circulated but I believe those are the two most recent ones.

MR. ALLEN: That's correct.

CHAIRMAN ZIEMER: So we will have a chance to look at all of those as well.

And then we have also distributed by SC&A the latest updated matrix that has been distributed and the matrix, I'm looking for the date on that. It was within the past
week. Everybody should have gotten that. March 22nd. And we want to go through the matrix in some detail as well and look at those individual items.

So we have a good amount of work before us today to get through all of these items. My intent was that by the end of our session we might be able to be in a position to make a recommendation on the SEC petition and we will have to see where we are at that point because there are some new materials and some new issues that have been raised. So we will have to see how that develops.

So let's proceed first with the update on the White Paper from Dave Allen. And Dr. McKeel, let me certainly invite you if you have comments or questions, as we proceed you can raise those just as if you were here at the table. I know you weren't able to travel today but please don't hesitate to raise questions as we proceed.

Okay, Dave, give us an overview of
the update and modifications that you have made.

MR. ALLEN: Okay. The addendum that I put together was based on our last meeting two weeks ago where some of the information that came out and I was asked to recalculate a few things.

The beginning of the paper mentions the two issues that were the primary reason for recalculating some of the dose and that was that the lead was not in that double-leaf door prior to 1968, during the covered period.

And the second was the badges were not stored in the control room but stored in a badge rack that had been mentioned is in two different locations. And I will address that here shortly.

I put the map in there. One of the two maps we had of the location of the badge rack. And I recalculated the shot scenarios based on where the badge rack is in
this addendum as well as no lead in the door
and simply redid the calculations that we did
in the original White Paper.

And I also mentioned a handful of
other issues that had been raised that didn't
require recalculation of dose and why they
didn't.

And about halfway through there is
small header that says "Adjusted Values" and
that is the recalculated doses that I have put
together.

And then also towards the end Dr.
McKeel wanted, I would say requested or
suggested or whatever, that I put together an
example or some calculations associated with
what I was saying about the residual
radioactivity of the betatron machine itself.
Not much here that would be actually
favorable to include that. So the last part
of this was I just put together an example
calculation, starting with an assumption that
assumed you had five millirem each week from
this residual activity. What would that mean for the dose estimate? That is not the estimate we intend to use. That is a what-if example at the end of this.

And that is an overview. Would you like more detail?

CHAIRMAN ZIEMER: Well perhaps we could ask some questions and clarify some issues.

Number one, there were two locations identified for the badge racks. So would you look at two different sets of calculations or do those two locations affect the outcome at all?

MR. ALLEN: The one I used is the one that is in the figure in the addendum. The two locations were that location and then one in the office. If you look at the figure I put in, it is somewhat close to where that black area is, a little bit more to the left of that.

My thought was that most of the
radiation that is in the control room I already knew. I am going to assume that the rest of that area that most of the dose rate is caused from what is coming through that thinner wall in the tunnel there, the scattered radiation, not the direct radiation coming through the ten-foot chilled wall but the thinner, 16-inch wall.

The location I chose is further away from that wall. And in this case, that gives you a more favorable estimate. Also with the presentation that Dr. McKeel put out, it said that that location was changed to the hallway in 1964 and the bulk of the film badge data we have come after that.

So in reality we have a little bit before that. We don't know when in '64 or I don't know when in '64 it was changed. But the whole concept should work in both locations because we have some data prior to that movement, since we have starting in January of '64 and we have some data after
that movement.

So you could do this type of calculations in both locations but this one should have been more favorable.

CHAIRMAN ZIEMER: So the idea here is that to use this location that results in a higher value in the control room, if you back calculate.

MR. ALLEN: It results in a higher dose estimate for the layout.

CHAIRMAN ZIEMER: Oh, for the layout people, which is the one that is going to haul them away, drive it.

MR. ALLEN: Yes, because we are basing it on ten millirem at the badge rack. And the location I chose is a lower dose rate at the badge rack than the other location.

CHAIRMAN ZIEMER: Okay, any questions on that part of it?

Then --

DR. McKEEL: Dr. Ziemer?

CHAIRMAN ZIEMER: Yes?
DR. McKEEL: This is Dan McKeel.

CHAIRMAN ZIEMER: Sure, Dan.

DR. McKEEL: I would just like to make a clarification. What I actually said was that the indication I had from the workers was that that second position was changed sometime between 1964 and 1966. I don't really know when. I'm not sure they do either. So I am just indicating that sometime during the film badge period, when we had badges, that location was changed. And it certainly seemed to me and to the workers that that second location was farther away from the control room. So in effect, the badges sitting there would get a lower dose compared to what they were given in a more forward position.

MR. ALLEN: Right. I might be wrong which way you said. The location I chose gets a lower dose rate --

CHAIRMAN ZIEMER: Because of the walls plus distance or the walls and the
distance both.

MR. ALLEN: Right, because the bulk of the radiation in that vicinity is coming through that thin wall. It is scattered radiation coming through that 16-inch block wall. This is quite a bit further away than the other one. The other one is actually fairly close to that 16-inch wall.

MEMBER BEACH: So you are using the one that is closer, not the one that is further away.

MR. ALLEN: It is further away from the 16-inch wall and I think a little closer to the ten-foot wall.

CHAIRMAN ZIEMER: Well I think he is saying he is using the one that results in the --

MEMBER BEACH: Highest dose.

CHAIRMAN ZIEMER: -- highest dose to the layout workers.

MEMBER BEACH: Right.

CHAIRMAN ZIEMER: If you used the
other one when you do the calculations, you get lower dose to the workers.

MEMBER BEACH: That's what I thought I heard.

DR. MAURO: Excuse me, Paul.

CHAIRMAN ZIEMER: Yes?

DR. MAURO: Would you mind, I've been following this very closely. I have read transcripts and all the material. And SC&A has been putting out a lot of paper.

CHAIRMAN ZIEMER: Right.

DR. MAURO: And I find, one of the things I often do is I try to step back and say okay what do I see. And I would like to express very briefly SC&A's position on this. Well, SC&A's scientific position.

When all is said and done, all of the material that has been distributed and discussed I see as divided into two major categories. The original radiography work with the fish pole, the radium work, and the betatron work. It is SC&A's position that --
I'm going to make one qualifier -- that there are no SEC issues associated with any of the calculations dealing with the betatron. The only question that Dr. McKeel raised that really wasn't explored at the last meeting that one could consider a possible SEC issue is whether the betatron is a good tool, a reliable tool that you could trust as a way to reconstruct doses with sufficient accuracy, given the fact that there are certain aspects of the code that are still being so-called beta tested.

But as far as we are concerned, given that you accept the models as being sufficiently accurate and reliable, SC&A's position, there are no SEC issues associated with any of the calculations, including everything that we are talking about right here. However, SC&A's position is there are SEC issues associated with the radiographic work that was done between 1952 or '53 and I say right up to 1962 when the health physics
program took hold with the AEC license.

So in order to just sort of -- I know that the last transcript, I know one of the statements that we made was that we were trying to focus in on the SEC issues. That really was the first priority. And I know that we have been spending a lot of time on matters like this which at least from SC&A's perspective, use it as you see fit, are not SEC issues. And I just wanted to put that on the table early so you understand where SC&A is coming from.

CHAIRMAN ZIEMER: Thanks John for that comment. One of the reasons we are spending a fair amount of time on some of these issues is because there are questions that the petitioners have raised that we need to answer on their behalf so they understand why you, SC&A, and NIOSH believe that dose can be reconstructed for the betatrons as well as other things that were used during at least this time period here.
One of the other questions with the neutrons and the differences, I guess again that had to do with assumptions made in the modeling between SC&A and NIOSH but maybe you could clarify because if we do dose reconstruction you end up with a particular model. And then the petitioners have raised the question about why the doses appear to have decreased on some of these such as the neutrons. Maybe you could clarify that.

MR. ALLEN: Yes, the way the White Paper was put together was to explore different shot scenarios and then try to find the combination of scenarios that would meet the other criteria we have in ten millirem badges, in this case at the badge rack, and the utilization factor that we had in there for how often it was actually on versus setting up shots.

And with the photon dose for the betatron operators, that scenario didn't matter. For layout guide, it did. However,
for the neutron dose, it was then based on the
timing of those shot scenarios.

So I think in both White Papers, I
mentioned how many hours each particular
scenario the Excel Solver came up with and
then the neutron dose rate times those hours
were essentially what I gave to the betatron
operators. When we changed the assumptions
like taking out lead door and moving the badge
rack, it changed dose scenarios and how many
hours and that changed the neutron dose.

That's essentially where we are at
those two. It is not a huge dose and fairly
small compared to the photon dose.

CHAIRMAN ZIEMER: Right. Any
questions, Board Members?

DR. McKEEL: Dr. Ziemer, this is
Dan McKeel.

CHAIRMAN ZIEMER: Yes, Dan?

DR. McKEEL: I have a comment and
it is a comment to what Dave Allen just said
and what Dr. Mauro just said.
My concern about the betatron, I don't think it has been adequately presented. I'm going to try to present it today and with a little bit more clarity. But just so everybody is sure the way I feel about it, I believe that what we have for both betatrons is basically MCNPX modeling without any real data to validate that model. And as I expressed on 3/15, in my view a model, a computer model, I don't care how sophisticated the code may be, it can't be validated without real data to validate it.

And I expressed then and still feel today that an agreement between models and real data, at least in the academic world, is on the order of ten to 20 percent, not 200 percent.

And I also pointed out on 3/15 I really would like it to be addressed today specifically and not vaguely is that the SC&A and the NIOSH models which Dr. Mauro did complement one another and he had no problem
with believing that the betatron dosage can be calculated accurately. They don't agree with each other between 2008 and 2012 and they don't agree with each other that either of those time periods are a factor of only twofold. They differ from each other by a factor of three to fivefold at the last meeting. And I pointed that out in my slide and that slide has been left with all of you. So I will bring that up later on.

For the neutrons, the situation, as far as I am concerned is much worse. There is no real actual neutron data. The film badges did not measure neutrons. So there is no data of that type. There is no survey data for either betatron building while the betatrons were in operation. And we know that the betatron beam consisted about 15 percent give or take a little bit which the exact fraction really has never been determined by anyone here. But 15 percent is the number that I have seen represented.
So the betatron beam had a neutron component to it and the most direct way to measure that as everybody in the room knows, is with Bonner sphere. And as far as I know, not only is there no data like that at GSI, but nobody has obtained any data like that from another betatron site and there are lots of Allis-Chalmers betatrons.

So I think you are saying a model is validated basically by itself done by two different organizations but not using independent models. You know, it is Dave Allen said several times at the March 15th meeting that he used input files that SC&A first developed for the betatron. And while I understand the practical expediency of that, that still doesn't constitute an independent model.

So I just wanted to put that on the record. I don't believe there is any real betatron data to go by except for, we'll talk about that I hope, the film badges themselves,
which is very limited. I'll let it go at that. Okay?

CHAIRMAN ZIEMER: Okay, thank you.

I don't know if either NIOSH or SC&A wants to respond to those comments. Bob?

DR. ANIGSTEIN: Yes, I have several responses to Dr. McKeel's comment.

First of all in terms of validation, the MCNP code has been around for decades I think, at least since the 1960s. It has been validated innumerable times by innumerable studies. All the aspects of the code has been validated with the ones that I have heard of or very closely corresponded within two percent.

As far as this particular model is concerned, because it was then -- because part of our model was adopted by NIOSH, it puts us in an unusual position because we had an internal discussion about this by SC&A. Then they asked to review its own model, essentially. So we went to an outside expert,
somebody who had worked for SC&A in the past but had not ever done original calculations for the NIOSH program, the OCAS program. He had just done QA.

And he is Michael Mallard who is a MCNP, Ph.D., CHP, has a been number of years with Los Alamos, which is where the MCNP code was first developed and still continues to be under development.

He independently reviewed all the assumptions, the input files, and he found perfect agreement. Correction. He found a transcription error of three thousandths of an inch in one of the contours of the aluminum columns in one spot on the periphery and the machine tolerances were five thousandths of an inch. So I consider that to be adequate conformity.

In terms of the neutron component, what Dr. McKeel I believe is referring to are medical betatrons. Now it is the same tube inside but the construction is very different.
In medical facilities, space is limited. And the primary concern is shielding against photons. So the most effective photon shield within reasonable cost is lead. So the medical facilities use a lot of lead shielding, which is very effective against photons per inch or per linear inch of the shield, but not very effective against neutrons.

Whereas, at industrial facilities such as GSI, they have a lot of space available. They resort to more cheaper material such as sand and concrete. So there is first of all much more distance involved. They don't come within the -- I forget what the betatron shooting room is but it is on the order of 50 to 100 feet. Yes, I do remember it now. The numbers come back to me. Outer dimensions are 97 feet in one direction, 112 feet in another direction. And also the sand and concrete, lower atomic number materials are actually more effective against neutrons.
So the neutron-to-photon ratio is very different for this industrial facility than it would be for a medical facility. But the measurements are not made right up close to the betatron. They are made in occupied areas where people have access while the betatron is on. So that would account for the difference in the neutron/photon ratio.

As far as the neutron generation, that is done entirely within the MCNP model, where the electron beam strikes at the target. We have very accurate drawings of the configuration of the target. The actual design drawings, we reproduced them pretty correctly in the MCNP input file. And what happens is the electron beam hits the target. Its primary purpose is to generate bremsstrahlung photons. And at the same time, because of the electronuclear interaction a 25 MeV electron hits a neutron, hits a nucleus, where binding energies are on the order of ten MeV, it liberates some neutrons.
And again, the latest version of the code uses the latest physics. I mean, basically as I recall, I'm not quoting, the regulation under which we are operating is the 82 point, federal guidance under which we are operating says we should use the latest science. Meaning, we should use this year's science, not science ten years from now which may very well advance but the current science. And the current science is what is in the latest release of the MCNPx code, where the team, MCNPx development team, continuously researches the literature and they construct the cross-section and the data files, go through every model, there are two components at least. There is the algorithms, how do you -- what are the physical laws governing a certain interaction, in this case the high-energy electron hitting the target and then what numerical data do you use, do you input into that model.

So the algorithm I don't think
changes much but the numbers that you use, the data gets updated periodically as new research in physics gets published and evaluated and accepted and they use the ENBSF, I believe it is, the evaluated nuclear data file that is maintained -- it is maintained at Brookhaven National Laboratory but is essentially an international collaboration to allow people such as the MCNPx developers, among others, to access the latest data. They don't have to search the literature themselves. This is already done by people, it is a full-time job, who research the literature, evaluate it, when they see there are findings, new publications which meet the test of being acceptable, they are incorporated into this file.

So I think we are using the very latest and the very best science available to do this.

CHAIRMAN ZIEMER: Thank you, Bob.

DR. McKEEL: Dr. Ziemer?

CHAIRMAN ZIEMER: Yes?
DR. McKEEL: I must respond. Because what I am saying is being misconstrued and so let me put it another way.

In my opinion and I believe this is the way it is, MCNPx or ATILLA, which NIOSH first used to do their models, that is a tool. It is a piece of computer software that does many things but falls under the broad general paradigm of transport code.

Now that tool, just like you would use an electron microscope in my work or a light microscope or a phase microscope, or a differential interference microscope, they are tools. And you apply those tools to a particular model. And in this case, there were many models with various source terms that OCAS-IG-003 mandates must be all models accurately, with sufficient accuracy to comply with the mandate of the EEOICPA Act as amended.

Now, then you apply the tool MCNPx to a problem. And the problem is to model the
betatron output doses for photons and neutrons which should simplify things. That problem -- that the use of MCNPx the tool has to be validated for that problem.

I agree that the code itself, the lines of code, the subroutines, et cetera, that they have been validated for other problems I am sure many times. I have seen many, many articles. But the point I am trying to make is, and I have sent these to the Work Group and the full Board and made comments about them. There are many papers in the literature where MCNPx, the tool, the software tool is applied to a given problem and then the investigator writes up a paper and presents it to a peer-reviewed article or journal to be published. And as part of that submission, the peer-reviewed journals insist that you have not only the model results with the tool MCNPx but a real-world validation that the values generated are accurate.

And for instance I sent you one
where MCNPx was used to model neutrons. Well
the neutron real data is measured with Bonner
spheres. And I am saying we do not have any
kind of data like that for the betatrons.

So you know, we can go around and
around with this argument. I personally think
that the -- and to be honest with you, I
really want this to go before the entire
Board. The Board has previously ruled that
the radon model, for example, that was first
generated by SC&A, based on sound premises,
was not valid. And the full Board agreed with
that. The Work Group got deadlocked on it.
The full Board voted the radon model was not
valid.

So there is another example that
yes, the methodology was well-explained and so
forth and actually NIOSH and SC&A both agreed
that it was a good model but the Board
rejected it. I am asking the Board to do the
same thing now based on the same kind of
reasoning. That there is no measured real
data against which to validate this particular use of the MCNPx software tool.

And I think I will let it go at that.

CHAIRMAN ZIEMER: Okay, let me add a comment here that typically one does not use the system that you are trying to model to validate the modeling approach. That would be a circular argument.

The MCNP model has been independently validated against other systems. It would be like if I want to calibrate a balance, I don't use the weights that have been weighed on that balance to calibrate the balance. I have to have those weights independently calibrated. And that is, I think the argument you are making. It sounds --

DR. McKEEL: No. No, that is not the argument I am making. I understand that. I agree with you.

CHAIRMAN ZIEMER: Well the only
reason for using the model is because you don't have the data. We don't have Bonner sphere data for this.

DR. McKEEL: That's exactly right.

CHAIRMAN ZIEMER: And that is why you use the model, that is the MCNP code to generate the information because the physics of it are very well known. We have the information about the beam. We know the energies. So we have the known basic data from the operation. Then the code, which has been validated independently then generates the information about the photon and neutron output.

DR. McKEEL: Well let me ask you a question then.

CHAIRMAN ZIEMER: If I already have Bonner sphere measurements for these beams, I wouldn't need to use that code. That's the only point I'm making.

DR. McKEEL: All right. Well, let me ask you a direct question.
CHAIRMAN ZIEMER: Yes.

DR. McKEEL: Are you aware of any paper in the literature published ever that has used MCNPx to model an Allis-Chalmers 24 to 25 MeV betatron?

CHAIRMAN ZIEMER: I'm not personally but I haven't looked for one.

DR. McKEEL: Has anybody ever seen such a paper?

DR. ANIGSTEIN: I'm not aware of it. Probably one reason would be that there are only in the United States two operating. The last I heard, there were two operating Allis-Chalmers 25 MeV betatrons. This is a tool that is now obsolete. It has been replaced by a much newer --

DR. McKEEL: Dr. Anigstein, these machines have been out in the marketplace and used for 40 years. And there are betatrons -- no. The betatron model itself is not at all obsolete. There are betatrons being sold today generally in the six to ten MeV range.
that are portable and are used widely for NDT work. So there is plenty of opportunity to have such papers appear in the literature. I'm just not aware that I have ever seen one.

And I am calling on everybody this morning. If you have seen one, please tell me what it is. Put it on the record.

I'm saying there is no -- there is a principle in science that things are not accepted unless they are replicated. And I am saying that this is a first issue.

And going back to Paul's analogy about the weight, yes he used a weight that is calibrated by the National Bureau of Standards but what you actually do when you put something on that scale is you are using it to calibrate the scale. So if you put a ten-gram weight on there and the balance shows it weighs 20 grams, then that balance is not validated. And that is what I am trying to tell you, that there is no National Bureau of Standards gold standard. There is a code
which has been validated but it has not been validated for measuring betatrons and its output. And I would also just like to put on the record right now that the model that is used by both SC&A and NIOSH is very simplistic. The betatron have a lot of other components to its radiation emissions.

   For example, there has never been any modeling of the leakage from the beam from the machine itself. Not from the cone but through the column itself.

   In the earliest days when I worked with an electron microscope, which is really an electron particle accelerator that sends the beam down and bounces off a target that you visualize to examine usually biologic tissues or very thinly cut materials. And those machines from the beginning had inherent leakage. They were much lower voltage, you know, 50, 100 keV but there was leakage through the columns. None of that has been quantified in this entire exercise over these
four years. And it is very naive not to do that.

So you know, this model is a simple model of how a betatron would operate. And it is not productive to carry this forward anymore other than to say I don't believe that you have real-world data to validate this model.

I'll just let it go at that.

CHAIRMAN ZIEMER: Okay, thank you. John has a comment, John Mauro.

DR. MAURO: I just want to point out that I understand what Dr. McKeel is saying. And quite frankly, recently I have been engaged in a similar type of situation where a company was designing an accelerator for medical purposes and they were putting in place the tech specs, the design. All the physics was done, all the shielding was laid out. The whole program was put in place. And all the modeling was done to predict the fields with and without the patient, that sort
of thing.

And one of the tech specs, just as far as operations go, is that once a year their license to operate this requires a team to come in with the machine on and take measurements at various locations outside the envelope, the shielded envelope, to see in fact if there is any leakage or is any surprises.

So I would say to take the side of Dr. McKeel to a certain degree, yes. One of the things for defense in depth you do at least in the medical community today is to confirm that the machine is in fact performing as designed and as originally tested when it was installed and then annually come in.

Now, a thought that came to mind is that we did not talk about, the degree to which these types of annual tests might have been performed. It sounds like perhaps they weren't. I don't know. It is not so much -- You know, is the machine performing the way it
was originally designed and spec'ed for? I guess we haven't had that conversation and it is a legitimate question. It is something that is done today. To the degree to which it wasn't done, how serious a challenge is that to our ability to reconstruct doses is certainly a legitimate question. So I think that out of this conversation comes that legitimate question.

DR. McKEEL: Dr. Mauro, I appreciate that support. And I would just like to point out that a long time ago John Ramspott and I pointed out to you all that 'identifying information redacted', the paid consultant that NIOSH CDC used to get information about the residual radiation from the betatron once -- I mean his first job was with Allis-Chalmers. And 'identifying information redacted', who John and I interviewed personally face-to-face in Wisconsin who since John has talked to a number of times, told us that in the early
days every single Allis-Chalmers betatron
installation was, upon installation by Allis-
Chalmers, or Picker, or whoever was doing the
installation, there are only a few people that
could do those installations, that they made a
formal survey of the betatron facility.

And of course as soon as I heard
that, I said oh, that is fantastic. I said,
so ‘identifying information redacted’ do you
have any of those? And ‘identifying
information redacted’ had said at the
beginning that he bought the access the West
Allis/Allis-Chalmers betatron group when it
went out business and stopped selling and
making betatrons. ‘identifying information
redacted’ said well he had them for a little
while and then because of space limitations
for his filing, he destroyed them. He threw
them all away.

Now that is ‘identifying
information redacted’. That is one person.
That is the copies he had. But what I am
saying is there were dozens and dozens of Allis-Chalmers betatrons scattered around the country, including in hospitals in St. Louis and other places.

And so as far as I am aware, that information was out there. At least the maker of the betatrons thought it was important not to survey the building at the outset. We don't have that data. We don't have that data for any betatron facility, even though there are many.

And the other thing I want to say is that I was not talking about medical betatrons. Some of the papers have to do with medical betatrons back in the days of the industrial betatron used at GSI and similar facilities.

You know, I ran across recently a paper that John had showed me before on decommissioning accelerators and among the five examples there they gave a 22 MeV linac that had been decommissioned. And in the
table that accompanied that, they listed four
betatrons in that dose range and a little bit
higher that had been junked at Los Alamos.

So Los Alamos is a covered site.
It has SECs. There has been extensive
information about it. I'm sure that that
would be a terrific source to go and look for
betatron facility measurements, real-world
measurements. You know, if they didn't do it,
then there is something very, very wrong.

We rely on the Los Alamos betatron
manual for comments about safety, the safety
program at GSI. So I think the data is out
there. I think Dr. Mauro is right. I think
in the early 1950s, the manufacturer realized
that these machines had to be -- the radiation
flux field had to be measured and quantified.

And I think it is a terrible shame that those
data have not been preserved and have not been
found. They must exist.

So yes, the fact that there are
not very many betatrons, the betatron we saw
in 2006 at West Allis crashed to the ground. And so they now have a 6 MeV linac in there now.

But the other point about the industrial betatron that we need to talk about as far as leakage, they were not as well shielded either as our modern or then medical betatron. So you know, that would mean, I think, that the leakage from the columns in the machine itself was probably greater than the medical ones and there was even more need. But as you all well know from dozens of sites, you know, safety precautions gave way to financial expediency and concerns about liabilities that management had at many of these sites. And there was a rush. There was a national urgency to get the job done.

So all of those things figure into the equation but I'm just arguing we do not have all of the data that was available on betatrons, that probably still is available on betatrons, to characterize the radiation field
that it gives off in any other than a very
simplistic way.

So, I'll let it go at that.

CHAIRMAN ZIEMER: Okay, thanks.

MR. RAMSPOTT: Dr. Ziemer?

CHAIRMAN ZIEMER: Yes John, go ahead.

MR. RAMSPOTT: Yes, if I could make a brief comment.

CHAIRMAN ZIEMER: Yes.

MR. RAMSPOTT: We have done a lot of homework on the betatrons and when you start looking at MCNPx and betatrons, the most common names you see is Dan McKeel and John Ramspott, at Los Alamos. There was not much investigation of what a betatron would do. And I totally respect some of these codes. They are very reputable, honorable. You didn't look at a betatron. That is the problem.

And then the second half of this actually lends to what Dr. Mauro was just
talking about he is doing an extensive study
and the big problem you have that I think is
an SEC issue at GSI, betatron. You're right.

You say you know the energy and you know the
spectrum. You don't know what they examined
with it, though. That is the problem. There
is no shot records. You don't know if they
were looking at a piece of uranium or if they
were looking at a massive casting.

And at the meeting in St. Louis
about four years ago, I clarified and I had
members of the Board actually confirm for me
that there are three sources of neutrons when
a betatron fires off. The target, I heard the
target discussed. Dr. Anigstein talked about
the target and that was one. But the casting
itself without neutrons, 15 percent of the
beam is neutrons. And everybody keeps talking
about the target. That is one little piece of
the pie.

But the main thing I think that
causes you problems that you don't have enough
information for sufficient accuracy of any doses is what did they use the betatron on? How much did they use the betatron versus the sources? Those are big issues. We are not just talking about a hardware issue. We are talking about the actual material that was x-rayed. And then what happens?

You don't see much in any literature of the what happens. That is just the quick comment I would like to make. Thank you.

CHAIRMAN ZIEMER: Okay, thanks. And Bob has a comment.

DR. ANIGSTEIN: Yes, I have got a number of comments I have been accumulating while the discussion was going on.

Going back earlier to Dr. McKeel, the use of models in physics. If every calculation had to be validated, then there would be no point in having calculations. There will be no point in doing theoretical physics. As a nuclear physicist, the purpose
of experiments in physics are always to confirm or question an existing theory. Not the other way around. The theory is not there to supplement the experiment. The experiment is there to supplement the theory. Otherwise, all theoretical physicists should retire and only technicians should be working in physics and competent technicians making measurements and recording the data. That is not the way science works. Science is built on theory and the observations and the experiments are there to validate the theory.

If every single prediction had to be validated, if we had to predict -- well I can go on with some trivial examples, which I won't bother.

Secondly, this business about the neutron. There was a mistake in conception of what fraction of the beam is neutrons. The beam is not neutrons. The beam is the bremsstrahlung radiation, which means a high energy electron hits a target and it is
suddenly stopped. And bremsstrahlung is German for braking radiation; braking B-R-A like the brakes on a car. And with that high energy, it is predominantly going forward. So you have an intense beam going to the front but not entirely. It spreads out to the right of the -- you could draw a whole spectrum over the angles. As you get further away and further away from forward direction, it drops off.

Now the neutrons are generated by entirely different mechanisms. They are generated by an activated, briefly activated nucleus of the platinum atoms. And it is essentially isotropic, meaning it goes on all directions. So depending in what orientation you are to the betatron, you will get a different neutron-to-photon ratio. Then in terms of leakage, leakage when it applies to let's say an x-ray tube, which is how in the heavily shielded housing and is supposed to only be going in a forward direction but in
reality internally, x-rays go in all directions. And how well the head is shielded in terms of the leakage, if there is a crack in the lead or the lead is made in more than one piece, and they are not properly drawing together, you will have leakage.

This concept does not apply to the betatron. The betatron is actually extremely simple. Dr. McKeel said simplistic. It is not simplistic. It is simple. It is a very simple matter of a high energy electron, I mean how you get the electrons to get into the beam, how you get them into the electron, how you get them to go into the storage ring and stay, that is very complicated physics. But that does not generate any appreciable external radiation. The external radiation is generated when it hits the target and it goes forward.

And yes, we did not include all of the components but we don't need them. And if we put in other components, there would simply
be additional shielding. By leaving it out, it becomes, we maximize the exposure. We make it more claimant-favorable, if you will, by increasing the exposure rate and a dose rate in various external locations.

Then furthermore, as far as Los Alamos, my colleague Richard Olsher who worked on these MCNP calculations, he was actually my instructor -- I took a course at Los Alamos ten years ago, almost 11 years ago on the MCNP code -- actually and this is documented, it is in my report, he actually was at that point responsible. He was the health physicist responsible for radiation safety and that included the betatron. And he asked to make a measurement inside the betatron room and he was told, well policy is you shouldn't go in for five minutes -- he said for a couple of minutes. He went in five minutes later to check the betatron. He could not measure any radiation in that room five minutes after the betatron was shut off.
So this calls into question Mr. ‘identifying information redacted’'s observation that it took 15 minutes for it to die down. And it was an Allis-Chalmers betatron, maybe slightly lower voltage at that time. Originally their standard model was 22 MeV and then they gradually improved the circuitry by putting a capacitor back or something and they were able to get it up to 25. It was basically the same tube.

So that again contradicts. We have one -- I mean if you want to talk about scientific validity, you have one recollection from Mr. ‘identifying information redacted’ many, many years later. He had no notebooks. He had no data to prove it. It was not confirmed. This was something he recollected. We take it for what it is worth. We don't dispute it but the fact is if there was that kind of radiation, the workers' film badges would have shown it.

CHAIRMAN ZIEMER: Well, stick to
the issue of the model.

   DR. ANIGSTEIN: Okay. But I think
this is as, in my opinion, this is about as
robust a model as you will find. And the fact
that it has not been specifically validated
for an Allis-Chalmers betatron, the opinion of
experts such as my colleagues with the MCNP
specialist does not invalidate it.

   CHAIRMAN ZIEMER: What you are
saying about the neutrons in terms of the way
you modeled it, if you had put samples in the
beam, as John Ramspott suggested, what would
that do to the --

   DR. ANIGSTEIN: Oh. The neutron
emission included the emission of neutrons
from the target because that is one of the
capabilities of the code, which has now been
finally finalized, you would say, word I don’t
like to use. I mean, the code is now in the
public domain.

   Earlier in 2008 we are using an
early version of the code that was still under
development.

Oh yes, and the differences Dr. McKeel pointed out between 2008 and 2012. First of all, we changed -- we had a new drawing. We found a drawing of the new betatron building in this 1968 application for the cobalt-60 -- the 80-curie cobalt-60 source and so these were much more detailed. They were done on the spot by the people doing the radiation safety surveys. They had dimensions. They were hand-drawn. They were not, I wouldn't call it engineering drawings. They were not exactly to scale but the dimensions were listed. The material of the walls was carefully described.

And so we changed it from what we had originally were the FUSRAP reports where they had no interest in those kind of things. And it was simply a scale drawing. They gave no dimension. They say well you put a scale there and I had to go on the computer and calculate well this distance is so many pixels
on my graphics program and that corresponds to so many feet in doing a translation. So it is not surprising that the dimensions would have changed somewhat. There was a wall that wasn't there earlier. I'm just saying earlier in terms of our time, later in terms of when the drawing was produced. They probably, they most likely had knocked down a wall.

CHAIRMAN ZIEMER: Well bottom line on the targets. So let's --

DR. ANIGSTEIN: So on the targets, yes we picked the HY-80 steel, which we were told by the metallurgist that was part of the group of workers who we interviewed back in 2007 and the gentleman is recently deceased, who had a very clear knowledge. He even lent me some datasheets on this HY-80 steel. They had HY-80. They had something called HY-100, which turned out to be mostly the physical characteristics were a little different. The chemical composition was almost identical. He also said that they used I think it was a
high-manganese steel, if I remember correctly, which we also modeled back in 2008 and didn't find very much difference. It is not highly sensitive to the details of what particular alloy. Yes, there are differences. And what at least SC&A has done with the model that SC&A is proposing for the layout man, is a maximizing model. And this is, in our opinion, the highest plausible dose that a person working in that location could get over a period of a year. Not any particular hour or any particular minute. But if you take it over a period of a year, they are not always going to use a casting that would give you the absolute highest possible emission and in the worst possible location and the worker being in the worst possible location. That is just not plausible.

What we have is an upper bound which in all honesty it is probably a way over statement. I don't think anyone would have been in that position all year long with a
casting in that position. But this is an upper bound which is highly unlikely. We are not working at 100 percent certainty. The criteria, like in the IREP code is the 99th percentile and NIOSH has often used like the 95th percentile individual to be sufficient bounding. At that level, it is confident that this would not have been exceeded. Once in a million, maybe, but on the order of one in a 100 or five in a hundred, highly unlikely that the dose that we calculate would have been exceeded.

CHAIRMAN ZIEMER: Okay. Any other comments on that issue? We have Dr. McKeel's concerns. We understand what SC&A has done.

The only other issue on this, I guess, is the differences in the numbers that SC&A generated versus NIOSH. And in both cases, as I understand it you are using that as examples. But is there an agreed-upon -- If you were to use this in dose reconstruction, is there an agreed-upon
distribution such as NIOSH developed with your
what was it called, that optimizing code --

MR. ALLEN: The Solver.

CHAIRMAN ZIEMER: -- the Solver;
the Solver approach. And SC&A look at that
approach. And does that make sense to you
guys?

If one were to accept the modeling
approach, is that Solver --

MR. ALLEN: I think that is where
the disagreement is right now, if I am not
mistaken.

I don't know if SC&A has a problem
with the Solver or not but to put words in
Bob's mouth here, you can correct me if I am
wrong, what he has written is he takes some
issue with the scenarios that I put together
and the -- well I think you mentioned the
location of the badge rack, too.

DR. NETON: It was the modeling of
the badge rack.

DR. ANIGSTEIN: I have -- I mean I
am ready whenever we are ready --

CHAIRMAN ZIEMER: Let me see. Let me see if there is any other question on --

DR. NETON: I think as a basic approach, can we reconcile the exposures using the available film badge data, using Dave's model versus the SC&A model --

CHAIRMAN ZIEMER: Right.

DR. NETON: -- which doesn't take that into account at all and just comes up with a worst-case shot scenario to the layout man regardless of what the badge readings have produced. That is the difference.

So there is no doubt SC&A's model has the higher values.

CHAIRMAN ZIEMER: So your model, you didn't normalize to the value.

DR. ANIGSTEIN: Let me -- can I --

CHAIRMAN ZIEMER: Yes, go ahead.

DR. ANIGSTEIN: It would be easier if I could make my presentation. That will answer the question.

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DR. MAURO: You realize that we are talking about an issue that goes toward what is the best way to do that that is plausible and claimant-favorable.

CHAIRMAN ZIEMER: Right.

DR. MAURO: We are not challenging. This is not an SEC issue. This is purely --

CHAIRMAN ZIEMER: Yes, I understand that.

DR. MAURO: I mean, it is very important because it is so easy to find yourself going down a pathway. We spent a lot of time --

CHAIRMAN ZIEMER: Well it becomes an SEC issue if in fact one concludes that you can't bound. So you have to talk about can you bound the dose.

DR. MAURO: Yes. Okay, I guess I leaped forward. I thought that someplace in this discussion is scientific agreement on what is the best way to bound a dose. But it
is there. It is just a matter of the judgments being made.

CHAIRMAN ZIEMER: Right. But I think both of you have said you believe you can bound the dose. You just have to convince the Work Group that you can bound the dose. And I think we are also listening to the petitioner, who is challenging whether or not this approach bounds the dose.

So I want to get all the parts on the table.

DR. McKEEL: Dr. Ziemer, this is Dan McKeel.

CHAIRMAN ZIEMER: Yes?

DR. McKEEL: A very short thing. I want to put on the record the concluding paragraph to Dr. Anigstein's four-page review of Dave Allen's work. And you know, this is really not the same that I am going to read to you as what he has said in this room today.

It says, "In summary, we conclude that the analyses presented by Allen (2012a
and 2012b) represent a major advance over the betatron studies described by Allen and Glover in 2007. However, we believe that further revisions are required in order for the results to be scientifically correct and claimant-favorable." And we are not hearing that this morning. We are hearing that NIOSH and SC&A agree and that doesn't square with what is written down on this piece of paper.

CHAIRMAN ZIEMER: No, I don't think that is what they said. Both of them said that they agree that it can be bounded but where they disagree is on exactly what you just read and I think Bob is going to go through that now for us.

DR. McKEEL: Okay.

CHAIRMAN ZIEMER: It has to do with the issue of what constitutes a claimant-favorable bounding, if this approach is used.

Bob.

DR. ANIGSTEIN: Okay, thank you.

CHAIRMAN ZIEMER: And just for
those on the phone, Bob has some slides that he is presenting here which I think summarize what is in the paper, I believe.

DR. ANIGSTEIN: Correct. Summarize and amplify.

CHAIRMAN ZIEMER: I suppose after Jenny Lin looks at these, we can probably make these slides available also to the folks on the phone. We can email them at some point.

MR. KATZ: If you send them to me I'll distribute them to everyone, including Dr. McKeel and John Ramspott.

DR. ANIGSTEIN: Well first of all, I want to -- this is reproducing from my previous report and Dave has included that in his report where --

CHAIRMAN ZIEMER: This is, for those on the phone, we are looking at the diagram that also appears on page two of Dave Allen's report. It is the diagram of the new betatron building showing the film badge rack location.
DR. ANIGSTEIN: Right. So this is basic information I got from one of the betatron operators I spoke to. And so this is where, this is the basis of -- I'm really presenting Dave Allen's work. This is the basis of Dave Allen's work.

However, here is the model from the MCNP file that Dave Allen kindly shared with me and the critique I have here is, here is the building. Here are interior walls according to, again, recent information passed on by Dr. McKeel from one of the workers. There is all kinds of equipment here, which I would expect. Even I would assume that without being told specifically. And Dave's model, if he'll forgive me for saying this, is empty space.

There is a wall here which utilize the wall, the density of the concrete from the 2008 SC&A report where we have no knowledge as to what this wall is made of and, therefore, assume the most, what in that aspect, was the
most claimant-favorable. We are taking the betatron being here. We are saying workers, the betatron operators are spending their time in the control room here. So the less shielding there is, the higher their doses would be. That was before we had the film -- before we knew there was a film badge there. We were just modeling. Everything was being calculated on the basis of a model.

So I simply went to the current commercial literature, the internet naturally, and found a building block that was 16 inches wide or long. We were told the wall is 16 inches and that was mostly hollow. And I found the one with the lowest average bulk density. You take all the blocks, put them together, how many pounds per cubic foot do you have. Very light material. Density was like 0.92, which is lighter than the density, was less than the density of water.

Since then we learned from the material in the AEC application that these
walls were mortar-filled, were heavy. As a matter of fact, in some independent modeling of the cobalt-60 source, I started off with some very lightweight material, the same lightweight material here knowing any better, and I got rather high dose rates outside, which were completely inconsistent with the survey results. So I said no, this wasn't light. They used heavy-duty concrete. They used the concrete such as was recommended by Allis Chalmers because they were interested in radiation and they assumed they knew what they were doing.

So here, according to Dave Allen's approach, using Dave Allen's approach, the less shielding there is, the less dose is a sign because the more dose is a sign to this control badge which he assumes is located here at the badge rack.

In my opinion, SC&A's opinion, speaking for SC&A now, this report is just not valid. We just don't know enough about where
the control badges were stored. We don't know anything about it or enough information about the intervening equipment here so that the calculations for any individual shot scenario, the calculation of the exposure rate at the badge rack is not claimant-favorable.

So we propose that this approach not be used when I had a problem with the Excel Solver. I made a comment in my previous report which I would like to retract. I really didn't understand how it was being used at that time. There is nothing wrong in theory with that approach. But in this application, I think it would make more sense to simply say we have -- pick a scenario. It is a little arbitrary but then the NIOSH scenarios are also arbitrary.

Pick a scenario we know happened.

We were told specifically that this particular casting, there it is, photographic evidence it is in the betatron room. This
one, by the way, this particular one is not on
the railroad tracks. It is often in a far
corner of the room, as it should be. My guess
is that the control room is probably off in
this direction and this is shooting away from
the control room in the described manner. But
again, the same betatron operator that
furnished much of the information did say at
the meeting that there were four such axles
and at least one of them was shot on the
railroad track. So it was an occasional
scenario. He also said that he thought of
maybe 15 percent of the shots were in that
location.

So again, we are taking by saying
we are using that to say all of them were
there. It is a bounding and it is less, it is
more robust. It is less of these things well
is it, you know, where is the exact location
of the film badge rack. What is the exact --
how much dose was received by the control
badges? I think that this is a more plausible
bounding.

Then I want go on to what Dr. McKeel didn't mention but passed on at the last minute correspondence we got just before and he said this is pointing out that this is the aerial view of the locations and this is the main part of the betatron building. Here are the offices and also the rail tunnel going into the building is here. Then there is another roofed connection from the betatron -- this is the betatron building proper and here is this little structure which passes right into the Number 10 Finishing Building, and the railcars pass through here into the betatron room.

And this is my model of that shooting scenario that I just described. So this is the betatron itself. If we blew it way up, you would see the detail, however in this scale you don't. This is the casting, these two lines because it is, you know, you are going to have a horizontal cylinder and
you are taking a cut through it so you only see the two sides.

And we put the layout man in different locations. He is not going to be right on the railroad track because then he will be blocking all further traffic into the room. So he is going to be one side of the other. Put him ten feet to allow room for the casting on either side of the railroad track.

It turned out that this location on this side was the much higher, almost a factor of two higher than the other location. So the center location will probably be somewhere in-between.

The reason this is maximizing if you can draw, I wish I could draw on this but I can't, the line of sight. This is the actual betatron target. This layout man, if he could look in, could actually see the betatron tube. Of course, it is encased in a big housing, everything else. But in this simplified model, the radiation goes in all
directions. Now very strongly peaked in a forward direction but there is still some. But he is actually getting direct radiation from the betatron, not even from the casting because he can probably, he may or may not be within line of sight of the casting, probably not. But this is as bad as it can get and still be realistic.

Now the point that was raised was they found another worker who said well, sometimes they were in a hurry to mark up the casting. So they would take this casting which is still sitting on the railcar. The reason they left it on the railcar again is to save time rather than use a crane to move it in and out. And they moved the casting out to here. This is where this legendary ribbon door is. It is not showing on my diagram because it is such a, on this scale, it is really in there but it is one-sixteenth of an inch thick so it just doesn't show up on this scale.
So say they were just past it. Well they wouldn't be leaning against that, press their bodies against the door to be working on a casting which would be out here somewhere. They would be somewhere near that ribbon door. It will be nearer than this position, which is inside the 10 Building. It could be about here. Here is a scale in centimeters. So this distance is just about 1200 centimeters, 12 meters, which is roughly speaking about 40 feet. So he is about 40 feet outside this ribbon door. So they could be maybe ten feet outside the ribbon door. The casting is located near there.

Yes, however, there was a catch to this. They cannot be working on a casting that is on this railroad track and simultaneously have a casting on the railroad track inside the betatron building. The reason for working on this casting in this location would be so they could quickly move it into the betatron building. Well they
can't move it into the betatron building if there is already a railcar there with a casting.

So even though while this layout man is working, say, in this location, layout crew, there would be more than one man doing this at a time, and the betatron operator said well let's not waste time waiting for them; let's do something else. They would be doing a radiography on a casting somewhere in the normal region of the building here.

And here they would be shielded by -- the direct line of sight would be have to pass through these ten-foot thick walls and the radiation here from that source would be far smaller than the radiation in this location. So regardless of this new information, this is still the limiting bounding scenario. And that is about it.

Oh, and I want to answer something else that was raised in an earlier communication which goes back to the radium
use way back prior to 19 -- well prior to mid-'62, they started using cobalt somewhere around May 1962. So from 1962 going backwards, the criticism was, this is taken from my report back in September, I believe, or October I think, and at that time I described the analysis of the radiography room using the radium-226 source, as was described to me by the one worker who actually did that and is still around. And very easily I found him to have a good memory. I talked to him several times, and he was very consistent in what he told me. And he said that building was there. And as a matter of fact they found -- John Ramspott found evidence there as early as 1957. My assumption was that it had been there all along. That it probably was there earlier.

And this drawing which was made, as it turns out by, I looked at the name on the bottom, I didn't bother reproducing the entire drawing because that wasn't my purpose,
the drawing was made by a physicist from the Nuclear Consulting Corporation. He worked for -- Dr. Konneker was the President and this other man worked under him. And so he went there and made the survey and as a good surveyor does, he made a drawing of that room based probably on drawings he got from the plant.

And at that time, and this was confirmed by the radiographer that I talked to, they improved their safety and they put in these steel plates. Apparently they found, either based just on the calculation or maybe based on actual measurement, that they were needed to protect the radiographers who will be spending their time in this room and also people outside this door, which was just a thin, presumably unshielded thin steel door. The purpose there for in order to prevent access.

In my model, there are no steel plates. They would have shown up. The model
is simply -- I simply used this drawing. There were a number of drawings in various parts of this FOIA -- this SEC -- AEC literature, AEC correspondence and this seemed to be the best one. In other words, it had the correct scale. Others didn't have the correct scale. They were distorted. So I used this one. I said this seemed to be the most reliable one. And I simply reproduced the concrete part, not the steel.

Now in terms of there was no information, nothing to indicate that concrete was added. The indication was that they added the steel plate which was a quick-fix solution. In the model of the exposure model to the radium-226, we had the worker, most of his exposure would simply be, it doesn't matter where he was, he would be carrying the source at the end of this fish pole that could be as near as four feet to his body. So I -- he gave me a range of four feet to six feet. I just said let's call it four feet, make it
most claimant-favorable. Let's make it 15 seconds. He said 12 to 15 seconds, let's make it 15 seconds. Fifteen seconds to put the source in, 15 seconds to remove it, ten times a day. And when the exposure was going on, he spent his time in this office, which again had this concrete block shielding. Even as far as the material of the concrete it said sand-filled. He said well I don't know what fraction is sand, what fraction is concrete so I am assuming it is all sand. Because that is again the lower density, the most radiation-permeable and, therefore, the most claimant-favorable.

MEMBER BEACH: Bob, do you know when the steel plates went in, what year?

DR. ANIGSTEIN: Oh yes, exactly. We know they went in like June or July 1962.

MEMBER BEACH: '62.

DR. ANIGSTEIN: After they discontinued the radium and starting using -- so in the radium era, the steel plates were
not there. And the external location was again not outside these relatively thick walls. It will be if you have line of sight, use a thin steel door, a sixteenth of an inch steel, which is essentially transparent to radium radiation. And I put somebody right here. I have got them leaning against the door. I forget how far but nearby. Let's just say for no good reason somebody decided to spend his time outside that door. And he will be getting direct radiation from the radium with only the door intervening. So it doesn't matter how thick the walls are. They were not a factor. They would have insignificant amount -- you had low-level radiation scattered from the walls but that is secondary. That is in the fraction of a percent range.

So the model was not based -- was based on this drawing but not the detail of this drawing and the statement that I used the steel plates in my model is simply incorrect.
And the fact that I left out the name of the man I thought was irrelevant is off here down on this edge of the drawing because I only wanted to illustrate how this model corresponded to this drawing.

CHAIRMAN ZIEMER: That is for clarification then.

DR. ANIGSTEIN: Right.

CHAIRMAN ZIEMER: That is not a part of this paper but just clarification --

DR. ANIGSTEIN: No, no. This was added on when I saw it.

CHAIRMAN ZIEMER: -- on the issue that was raised using that shielding.

DR. ANIGSTEIN: This part was --

CHAIRMAN ZIEMER: Right.

DR. ANIGSTEIN: No, this was done, my report was submitted on last Sunday. We only got Dave's report Friday morning. We turned this around over the weekend and then I subsequent to that I added these additional ones to respond to Dr. McKeel's -- comments.
CHAIRMAN ZIEMER: Okay so as I understand it, on the betatron operations, you haven't normalized anything to the control room but rather have used just the basic output.

DR. ANIGSTEIN: Yes. We used the output of the betatron. We used the shooting schedule which simply being told again from the one betatron operator who furnished the most input, the single most prolific source of information ten percent were the long shots. It took an hour at a six-foot target distance. Ninety percent of them were the short shots. That is 90 percent of the shots. If you looked at the duration of course the long shots took longer so they comprised a higher percentage of time of the betatron. And if you simply say they always work at peak efficiency, which is probably again, just people in organizations just don't work that way, but assuming that the betatron is utilized 100 percent of the time, it was shut
off just long enough to go in, set up the next shot, run back into the control room, start it up. So it was always on the maximum amount of time. We calculated roughly 41 percent duty cycle, which again I am sure in the real-world I mean there is no downtime for maintenance. There is no goofing off, shall we say. There is nothing else. You know, running around the clock 168 hours a week, 41 percent of that time. Again these were all maximizing assumptions.

And with that, let me go back to what I skipped over. Here is how it ends up. So now we are much closer for the layout man, which is all that matters because he is the limiting individual. So now the DCAS is about half, slightly less than half of our exposure rate. So we are not that far apart.

The neutron dose is different because of the different orientation. On the one hand, they actually have a higher, for one of the scenarios, a much higher, instantaneous
dose because it's -- they assume that one of the scenarios I assume only that it's going horizontally perpendicular to the casting and parallel to the floor. They have assumed also a shot which is 45 degrees so it is aimed like halfway out towards that door, in more towards the door, and also aimed 45 degrees up. So you would get a lot of sky shine. I'm not 100 percent sure why that gives -- I mean, I haven't worked it out but it certainly, the instantaneous dose rate is even higher.

So I just took what I thought was a reasonably maximum. But then with his, it is only a fraction of the time. Because it is so high, it is only a fraction of the time. So the neutron flux doesn't change that much with the direction. The photon flux does. So by reducing the frequency of this occurrence, I would assume why he would get a lower neutron dose. But since after all for any particular dose reconstruction, you know, it is not like let's say beta dose which is a
separate quantity because it delivers dose to the skin, so if you are looking at skin cancer, you are really looking at the beta dose where the photon dose is a very small contribution. Here for any particular dose -- organ, the neutron dose and the photon dose, they are different conversion factors but they are basically added, they are additive.

So the photon dose is still by far predominant over the neutron dose and the fact that we were off by a factor of three on the neutron dose, I think I understand why, and I don't think it really makes any difference. Even in our calculation we had 4.483 so it is like what -- this comes out to about five percent. Because of this particular orientation, it comes out to five percent of the --

CHAIRMAN ZIEMER: Okay. So in a sense you have bounded the NIOSH thing by using a single shot.

DR. ANIGSTEIN: Yes.
CHAIRMAN ZIEMER: And, Dave, on yours now, did you -- help me remember. Did you still use all 15 scenarios or just --

MR. ALLEN: Yes. I mean, with Solver it ends up picking essentially two or so.

CHAIRMAN ZIEMER: It only picked two or three though.

DR. NETON: The two highest.

CHAIRMAN ZIEMER: Right.

MR. ALLEN: I think it picked a high and a low to get the total number of hours. And then it was asked to maximize the Number 10 Building dose.

CHAIRMAN ZIEMER: So you have this configuration part of the time but not 100 percent of the time. And then you would normalize I think to the --

MR. ALLEN: Well as Bob said, it is not the exact configuration. It is a railroad track that I have part of the time but it is, as you said, it's 45 degrees over
and 45 degrees up, and Bob's straight on and level.

CHAIRMAN ZIEMER: Right. So those assumptions are a little different. And then you normalize to the control room value based on the film badge value.

MR. ALLEN: In the White Paper and in the addendum normalized to that other film badge rack.

CHAIRMAN ZIEMER: To the location, right. So the numbers are different based on how you are approaching bounding.

DR. MAURO: And I would say if you had a third person come in to look at this, they may come up with something else. These are judgment calls.

CHAIRMAN ZIEMER: Yes, I understand.

DR. MAURO: And so I mean, I keep coming back and in my mind the single most important question we have in front of us is we have two separate scientists looking at a
scenario, a circumstance, doing their best to place a plausible upper bound, which there is judgment based on factual information that has been collected over the last few years.

Then we have claimants and petitioners. And the real question I see is there anything by way of factual information that characterizes what transpired historically that leads us to a place where perhaps we have not captured that bound? That is, is there a scenario that was raised by Dr. McKeel where wait a minute, wait a minute, there was something else going on or you had the drawing wrong or you had the timing wrong?

In other words, when I look at this I keep asking myself the question have we exhausted our understanding as best we could, all of the different positions, thicknesses, operating scenarios in a way that we all agree that we have placed a plausible upper bound? And when I read Dr. McKeel's material, I read the transcript, I keep looking for information
that says is there anything here that is new
that says it wasn't the way we thought it was.
And I have to say I am having trouble finding
it, something that defeats Bob's in a way that
would have a substantive effect on the
outcome.

CHAIRMAN ZIEMER: Right.

DR. MAURO: And I think that is
where we really are.

CHAIRMAN ZIEMER: Okay what I want
to do, we are going to take a break for 15
minutes and then I want to come back and I
want to step through a number of the points
that Dr. McKeel raised and ask you guys to
respond to them. I want to be very specific
on items that he has raised. And I have
written down my questions on each of them and
see how we can respond. So that will help
clarify some of that.

So let's take a 15-minute break
and then come back. So it is now ten after,
so we come back at 25 after.
MEMBER MUNN: Good. And when we get back, I would like to make two general comments that don't bear specifically on the science involved but more on just the general observations about what we seem to be involved with here.

MR. KATZ: Okay. Okay, I am putting the phone on mute for you all on the phone, but the line is not cut. You can keep your phones on the line if you want.

(Whereupon, the foregoing matter went off the record at 10:07 a.m. and went back on the record at 10:26 a.m.)

MR. KATZ: Okay, we are back online. Dan, are you with us?

DR. McKEEL: Yes, I am.

MR. KATZ: Okay, great.

CHAIRMAN ZIEMER: Okay, I want to take a few minutes and go through the document that Dr. McKeel generated called General Comments on GSI Dose Reconstruction. I think
this was the original critique to the White Paper. I just wanted to make sure that we had covered the points that were raised there and then we will look at the other ones that were distributed this week.

So this is called Critique of the NIOSH January 2/12 White Paper Dose Estimates for Betatron Operations. And each of the items on here is numbered. Item number one, general comments and then there are some sub things on there. And I have some questions on these, and others may wish to add to it. But my first question is, and I will maybe ask Dave Allen to clarify for the record, and that is the statement there is zero urine bioassay monitoring data for GSI workers in the covered period. And do you want to comment on that? We don't have that page.

MR. ALLEN: I was going to say, yes, true.

CHAIRMAN ZIEMER: Right. But I think the question that is being raised is why
is bioassay not a concern at this facility? Can you address that?

MR. ALLEN: I don't think there has been a lot of disagreement that the potential for internal dose is pretty small at this facility. They handled the uranium but they didn't mechanically abrade it or forming or machining or fixing of it of any kind. So there is some loose contamination from uranium that could transfer or get into the air.

And we kind of put that in the Appendix with the bounding method based on facilities that handle a lot of uranium.

CHAIRMAN ZIEMER: Appendix BB -- or not Appendix BB.

MR. ALLEN: Yes, Appendix BB. We covered it based on surrogate data from other uranium facilities, based on TBD-6000.

CHAIRMAN ZIEMER: And I don't know if SC&A, I think agrees with that. Right?

DR. MAURO: To what degree did you look at internal dose from either the uranium
that is airborne from the ingot that may be brought around and/or from the scavenging of the activated material and steel that might have been activated? I know you have modeled both those.

DR. ANIGSTEIN: Okay, the uranium was taken from TBD-6000, which you reviewed. So we didn't have any -- we accepted that as being a reasonable model.

And the activated steel I did model the internal dose. Maximum internal dose given maximum permissible dust concentrations in the air, ingestion, and under the worst conditions to a worker that is doing, spending his whole time at the grinders and chippers, who is one of those people preparing the castings shortly after they were irradiated with the betatron. And we end up with an annual dose a fraction of a millirem. So it is just not -- very short-lived nuclides in that.

There was an interesting tradeoff
here. If the nuclides are very short-lived, they build up quickly. You don't need very much betatron exposure to come to equilibrium.

But by the same token, they have negligible biological effect because you take them in and they decay. And if they are long-lived, they don't build up if they have a half-life on the order of a year, it will take years of irradiation of the same piece of steel for them to build up to equilibrium.

CHAIRMAN ZIEMER: Okay, I just wanted to have that in the record.

The other one under Part 1, I'm just going to comment. It is Section E and, Dr. McKeel, I just wanted to mention to you that these are concerns about attribution. And the Work Group is not going to get into that. I think that is between the petitioner and NIOSH in terms of attribution of information. So my comment is that the Work Group is not going to deal with that.

Under E3 on page 2, there is a
comment at about the middle of the paragraph that says to our knowledge NIOSH and DCAS have made no effort to secure possible copies of surveys. He's talking about Allis-Chalmers's survey. And I think this is the issue that Dr. McKeel mentioned earlier, ‘identifying information redacted’ ‘identifying information redacted’'s comment that they always surveyed the facilities after they installed. And just for my benefit, has anyone actually tried to get Allis-Chalmers's records? SC&A?

DR. ANIGSTEIN: No. About these surveys, Allis-Chalmers presumably installed the old betatron. The old betatron, the building was constructed by or under contract to the US Army Corps of Engineers. Allis-Chalmers installed the betatron and it would have been their normal practice they would have conducted a radiation survey.

But as we know, both the Allis-Chalmers records and of course the GSI records
have long, long, long disappeared.

CHAIRMAN ZIEMER: Well that is what I was asking. Has anybody gone to Allis-Chalmers for those records?

DR. ANIGSTEIN: Have we? No. Well Allis-Chalmers does not exist. And the only descendent, Allis-Chalmers went out of business, went out of the betatron business. They formed or sold their service business to another company I don't remember the name now, so for a number of years they were no longer in the business of installing or building new betatrons. However, they would service them and they would, I think, continue buying tubes from Machlett was one of the tube manufacturers and they would replace the tubes as they burned out.

However, that business dissolved, and it was passed on to identifying information redacted' identifying information redacted'. I think he had a partner at one time. And identifying
information redacted’ said he only kept the records that would be useful, you know, he probably was working out of his home. He wasn't going to take up a lot of space so he destroyed -- everything was destroyed except the records that he thought might be useful for him to continue servicing existing customers with the installation.

Now that was the second installation when they were more concerned with the new betatron was not even done by Allis-Chalmers. The GSI when they shut down the Eddystone facility which had the betatron, they simply moved the betatron from Eddystone, Pennsylvania, outside of Philadelphia, to Granite City. They themselves, or their contractors, built the building and installed the betatron. And ‘identifying information redacted’ ‘identifying information redacted’ told me that he never, ever visited the new betatron. So there was presumably they did
not do a radiation survey. And since the betatron, they might have because by this time the state of Illinois got into the radiation control business. By 1963 the Department of Public Health within the State of Illinois was involved with radiation. The Atomic Energy Commission -- well, I'm not sure about the Atomic Energy Commission because I think that once there is a license, perhaps, Paul, you are much better on the knowledge of that, do they look at all radiation sources, including electronic machine, electrical machines or do they still look only at radioactive material? In other words, would they have been concerned about -- would the AEC have been concerned with the betatron exposure?

CHAIRMAN ZIEMER: No.

DR. ANIGSTEIN: Even though they had a license for cobalt sources?

CHAIRMAN ZIEMER: Well that all depends. Under an AEC license, if a worker is exposed to both, they do exercise control over
non-licensed material. For example --

    DR. ANIGSTEIN: Including electrical equipment.

    CHAIRMAN ZIEMER: Yes, they would have included that. If they determined that there was not a clear delineation. In other words, the worker's dose limits would not be just limited to the AEC material.

    DR. ANIGSTEIN: Oh, sure. Yes, but if all the workers handling the AEC material, meaning the small cobalt-60 sources were monitored with film badges and the ones doing the betatrons were also monitored, so if some of the betatron operators were also isotope workers or in some cases they tended to be assisting the isotope workers, they themselves were not the licensee, then the whole population of workers that could possibly be exposed to radiation would have been monitored. And that is all that would matter. Right? They had the weekly film badge data.
DR. MAURO: I could speak --

CHAIRMAN ZIEMER: I'm not sure about that.

DR. MAURO: Yes, I can speak about what is going on in the last ten years because I am doing a lot of work right now with the NRC on this very subject.

The TLDs, records that are being maintained, the NRC when it collects that data keeps a database, even though it would say hospital, has an NRC license and is registered as a state licensee also because workers are always being exposed. Very often some workers are exposed to both licensed NRC or agreement state sources and also electronic devices.

I just want to tease out from the TLD readouts what fraction of the dose is missing. That's a done deal.

CHAIRMAN ZIEMER: No, I think the issue would be do they regulate --

DR. MAURO: No.

CHAIRMAN ZIEMER: -- on the other
stuff. The answer is no.

DR. MAURO: I'll tell you right now, I am very close to the State of New Jersey. I work with the Commission on Radiation Programs in the state. Very aggressive program on electronic devices, x-ray machines, accelerators, and they have a very comprehensive set of regulations requiring annual surveys of accelerators that are used for therapeutic purposes.

CHAIRMAN ZIEMER: Yes.

DR. MAURO: NRC has no role whatsoever there. It is solely controlled by the state.

Now the question is well placed in that at that time to what degree --

MR. KATZ: Hold on a second. Someone has kicked the phone and there is no connection.

(Off the record comments.)

MR. KATZ: Folks on the phone, we just -- hello? We have someone's fax machine
on there. Hello? Dan McKeel, are you still on?

MR. RAMSPOTT: Hey, Ted. I just redialed in. Everybody went dead.

MR. KATZ: Okay. Yes, the phone got disconnected here about a minute ago. So we stopped.

MR. RAMSPOTT: We were just starting to hear Dr. Mauro.

MR. KATZ: Okay.

DR. MAURO: I'll briefly reiterate. At a facility that has both Atomic Energy Act license material under the NRC and/or an agreement state and also has electronic devices that are regulated by the state agencies, the folks that are wearing this -- TLDs, those TLDs are recorded and do not make a distinction between how much is due to what.

CHAIRMAN ZIEMER: Sure.

DR. MAURO: And the state, agreement state is held accountable for making
sure that those workers meet their five rem per year limit. So there is no way to tease those two out.

The second point regarding surveys, the state authority that issues its permit or license to the use of x-ray machines or any other electronic devices has full and sole responsibility over the -- and has a very, at least currently, comprehensive set of state regulations holding the permittee or licensee accountable for meeting all of these requirements, but that is in force by the state, not by the Nuclear Regulatory Commission.

To bring it back to this circumstance as I understand, the second betatron came in place at a time when I believe there was some degree of state regulatory oversight. And one would expect, although I can't say for certain, that if there is any way it is today, they would take on that responsibility very seriously.
DR. ANIGSTEIN: And as we were talking, I recall now that in the application to the AEC for the 80-curie source in 1968, they did mention the betatron and they did mention that it was regulated by the state of Illinois and that they fulfilled, that they were good boys and they fulfilled all the state requirements and they passed the test.

And as a matter of fact, there was one case on record but that corresponded. The file is not complete, despite the fact that it is over a thousand pages, many of which are redundant and repetitive. But there was one time that there is actually a letter from the state of Illinois saying thank you very much for allowing us, you know, cooperating with us, and they mentioned a name, a state official who met an AEC official and they conducted a survey, they jointly conducted it.

So there was state oversight, and there may very well have been irradiations. You know, if they were able to make radiation
survey for the cobalt source, they might very well have done a radiation survey for the betatron.

Now the betatron is a little more complicated to conduct a survey because, unlike a radioactive source which has essentially a uniform rate of radiation emission, the betatron acts in bursts. And the instrument would have to be an instrument that would average out over a period of time. That period of time would be maybe a few seconds. But if you had something -- like a Geiger counter would not be a good instrument. It is not a good instrument anyway for a radiation survey but would not be a good instrument for this. But a ionization chamber certainly would be. That is just --

CHAIRMAN ZIEMER: Well --

DR. ANIGSTEIN: The fact is that we wouldn't even -- did we ask, did we try to find those records? We did not because we wouldn't have even known where to begin to
look. I mean, there is no records -- it is like trying to find a lake in the desert. It is not there.

CHAIRMAN ZIEMER: Well I just wanted to clarify that for my own information.

DR. McKEEL: Dr. Ziemer, may I make a comment?

CHAIRMAN ZIEMER: Dr. McKeel, a comment on that?

DR. McKEEL: Yes. Well the obvious place to start, it seems to me, is with the Illinois Department of Health. And so I did that and sent an open records request to them for all the records that they might have of the GSI -- that would cover the GSI betatron operational period. And what I got back from them is about two pages, one of which had really nothing on it except the mention of the word betatron.

So I felt like, yes, there probably were records with the State of Illinois, but I certainly didn't get them with
that open records request, but I did try.

DR. ANIGSTEIN: Can I comment on that?

CHAIRMAN ZIEMER: Yes.

DR. ANIGSTEIN: We made a very extensive effort with the State of Illinois. One of our associates, Joseph Zlotnicki, who lives in Illinois in the Chicago area, and the formerly an official and scientist working with Landauer, so he was very familiar with the State of Illinois. And he made a request. He actually knew individual people there. I independently made a request for anything about General Steel Industries, General Steel Castings, the answer was I have a letter and not with me, simply saying we have searched our records, we have nothing.

CHAIRMAN ZIEMER: Okay, thank you.

I want to move on then. The item 2A and B on Dr. McKeel's sheet are items we discussed last time, the use of the 80-curie source to establish information about the shielding and
the dimensions of the rooms, we discussed that in some detail. We also talked about the photon-to-neutron ratio issues, and the only question I wanted to ask under that main -- under item C, it really is a question of the ingots and dingots, those shots in addition to the uranium slices. The question that is being raised here is does that affect the output of the model. In essence that is the question.

If you are shooting at the -- and I think on the ingots or dingots, those are the angular shots, I believe, Dave, were they not?

MR. ALLEN: I think they were. The operators described that they had to shoot some shots with the uranium, I think it said obliquely was the term which, you know, angular. And that makes sense with a top crop trying to put --

CHAIRMAN ZIEMER: Well my general question is, is that taken into consideration
in the model?

            DR. ANIGSTEIN: Yes. The actual
original characterization of the uranium, we
originally characterized the uranium as a
dingot. And the dingot actually, the purer,
first I thought it was something like some
mixture of uranium. The dingot is actually
purer uranium than the specifications for the
-- obviously the desire is to have pure
uranium but -- and there were specifications
on the dingot, there was a whole report on
dingots which actually John Ramspott had
furnished to us back in about 2007. And the
chemical, the elemental composition of the
uranium we used in the model was that of the
dingot. And we believe that this were where
the uranium slices were made from.

            And also I want to comment on the
-- angular shots. In the earlier information,
I know there have been many repeat interviews,
many comments, in my discussion with the
workers, you are in Collinsville and knew
about the betatron sites. And I said, is this what you recall, something like up to 18 inches in diameter, about four-inch thickness slice? And they agreed, yes, that sounds right. That sounds like what we would always get.

Later, in one interview of a worker that I conducted on the telephone, he reported, he worked on the day shift, he reported coming in on a Monday morning and talking to the workers that were just going off the shift, the weekend night shift. And they discussed doing the corner shots. And he even drew me a diagram on a letter that I sent him, or I drew the diagram and he confirmed it, saying that they would shoot just the four corners. They would take mind you a round shape so he could turn it everywhere but they just took four corners.

And the only purpose of such a shot would be to establish how would the defective material at either end to crop it.
They did not take shots all around, and it
didn't sound like a very frequent thing. He
just said, oh yes, that happened. There was
one occurrence that was reported.

So shooting the slices we know
from the Mallinckrodt records was a common
practice.

CHAIRMAN ZIEMER: Okay.

MR. ALLEN: I was going to say in
any case essentially the model used was to
have a thick enough slice of uranium that
absorbed a great deal of the betatron beam and
was large enough in area to get the high
intensity part of the beam. And that is what
we used in our original appendix and then in
what we had done more recently was the
realization that those top crops the
discussion was that if they did 100 percent
they had a lot of overlap. So essentially we
had to hit at the same spots four times,
which can make a bit of a difference. So that
is where we are at in the White Paper right
now. And that should account for, conservatively account for virtually anything --

DR. ANIGSTEIN: Also, there were two different analyses for two different purposes. One of them was to get the scattered radiation -- maximum --

CHAIRMAN ZIEMER: Right.

DR. ANIGSTEIN: The other analysis -- and that was also to get what we called the prompt gammas. I shouldn't have said scattered radiation. Cancel that. The prompt gammas and prompt neutrons.

What happens just after you shut off the betatron beam, five seconds later which, of course, is a very optimistic time, five seconds later somebody comes into the room to set up the next shot. And what radiation are they being exposed to?

So these were the delayed neutrons, the delayed gammas, and so the bigger the slice is, the more there is because
of MCNP reports the total amount.

Then there was a second consideration of skin dose. What are the short-lived beta emitters? And there we took a very thin slice. We took a small circle, very thin, so as to maximize the concentration. And this would be the most you would get per gram of uranium. And so we did that analysis.

That is not to be a robust analysis because we looked at it again in 2012 using -- and turned out to be actually slightly less than what we had gotten in 2008.

So we figure we will stick with the 2008 results. Number one is they are not that different. Second of all, it turned out that the short-lived isotopes make a very small contribution to the skin dose. In other words, the unirradiated uranium accounts for by far the bulk of the skin dose.

CHAIRMAN ZIEMER: Okay, thank you.

DR. McKEEL: Dr. Ziemer, may I
make a comment?

CHAIRMAN ZIEMER: You bet.

DR. McKEEL: I guess my comment is, although I appreciate Dr. Anigstein's comment about this, you know, to me what is the SEC issue and the Appendix BB issue, and I don't want to revisit our conversation of last meeting, but you know he is telling about how SC&A modeled all of this when really for the SEC issue, the issue is can NIOSH do the modeling, and all these various modelings that were done were done by SC&A. So it seems to me we are getting -- I mean, that is interesting. And I understand from Ted and everybody that the job of SC&A is to do evaluations, but you know, they are actually doing -- my question was directed at the SEC issue. And the SEC issue is did David Allen and DCAS do all of that modeling, which I assume if SC&A did it, then they must have thought it was necessary and useful to do that. My question is did NIOSH do it?
And so I would be very much interested in all of these things to hear what NIOSH did. I think that is what the Work Group has got to decide on. Can NIOSH do this calculation, and can they bound the dose with sufficient accuracy for SEC purposes?

And honestly, whether SC&A can do it is interesting, but it is not directly relevant.

CHAIRMAN ZIEMER: Well I guess the point here is that one of the things SC&A would do would be to determine whether or not NIOSH had omitted something significant in their bounding. And I think in answering that question they have checked this particular parameter and have decided that was not a significant issue and, therefore, did not need to be specifically included.

Wanda has a comment.

MEMBER MUNN: Is this not material we are going to cover as we go through the matrix?
CHAIRMAN ZIEMER: We may. I'm just trying to --

MEMBER MUNN: It is my --

CHAIRMAN ZIEMER: I'm trying to deal with the petitioner's questions. I think that was one of the questions.

MEMBER MUNN: Right. Right but I think it is dealt with in the matrix response.

DR. ANIGSTEIN: Okay, my comment just occurred to me. I think there is a confusion here. Under the -- my understanding, and please, Dave or Jim or Ted, correct me, under the statute NIOSH does dose reconstructions. That is the ultimate. That is the ultimate thing that they do. NIOSH or its contractors, ORAU and its associated ORAU team do the dose reconstructions.

What we are dealing with here is what directions are going to be given to the dose reconstructor. If you get a case from GSI or you redo a case from GSI, these are the assumptions you are directed to use. These
are the doses we are directed to assign and so forth.

Whether these assumptions are developed independently, say by Dave Allen, or whether they are developed jointly where SC&A has input and NIOSH looks at the input and says yes, we agree with this. We don't disagree with that. We adopt this part of it. And there was some consensus reached. The main thing is that there be a set of instructions, at the bottom line there be a set of instructions that NIOSH has determined and SC&A agrees with as the contractor to the Board and basically that the Board agrees with, the Work Group agrees with. And after that, the dose, the individual 300 odd and one time I heard health physicists doing the individual dose reconstructions are the ones who are given that job.

And can they do that? Yes, if given the right instruction of course they can do that. They do it day in and day out.
So whether -- who did the original model and who did -- that is not the issue. The issue is can, in the end, NIOSH do the dose reconstructions. And it seemed pretty obvious that once given the right dose assignments for the right periods, the answer is that they can.

CHAIRMAN ZIEMER: Okay, I don't want to spend a lot of time on debating that philosophical issue.

A couple other items under this main thing. The petitioners, another concern toward the end of that page, NIOSH has failed to calculate exposures to many unbadged workers who handled uranium during transport loading and unloading and so on.

My understanding is that NIOSH's intent here would be to assign these doses that arise out of the model to all the unbadged workers. Is that not correct?

MR. ALLEN: Yes, the betatron, the White Paper, the last paragraph or two
mentioned two estimates in the White Paper where the radiographers, the betatron operators, and the layout man the reconstructor be instructed to assign the most favorable.

CHAIRMAN ZIEMER: No, as I understand it, you could, in principle take individual jobs such as loading and unloading and try to fraction out what people did. But the worst case, bounding case if they spent all their time, basically, doing the layout stuff that maximizes the assigned dose. Is that not --

MR. ALLEN: Yes, that was the intent was that there was probably multiple, more than one maximizing or more than one working scenario that we reported in the White Paper came down to those two.

CHAIRMAN ZIEMER: That's right.

MR. ALLEN: And the reason it says the most favorable is even though the photons, you know, in the White Paper the photon dose
for the layout man is the one that we would be
maximizing for everybody but that is not true.
The beta dose.

CHAIRMAN ZIEMER: Right.

MR. ALLEN: So probably for a skin
cancer, the most favorable would end up being
the radiographer dose, and the dose
reconstructor is instructed to try both.

CHAIRMAN ZIEMER: But what you are
saying is that these other jobs, such as
transporting and loading, would not --

MR. ALLEN: Be encompassed in --

CHAIRMAN ZIEMER: -- have higher
doses than you have already bounded by the
layout men. I just wanted to make sure that
was the understanding.

And then could you also speak to
the issue of what is the concern -- the
concern is raised that you have identified the
wrong peak years where the uranium amounts
were the greatest. How does that impact on
your bottom line?
The statement is that peak uranium volume for the betatron you stated was in '64 to '66 where the purchase orders indicate that it was '62 and declined or '64 and '66. My question is what is the role of that information in terms of the model?

MR. ALLEN: Well there is a little bit of misconception there or reading it wrong. And it was the peak operations of the betatron '64 to '66, which was -- or '63 to '66 I think is what we were told --

CHAIRMAN ZIEMER: What you are modeling, not the uranium shipments per se.

MR. ALLEN: Right. And there is a table in there with the uranium work that was done. And that is true, that wasn't '63 to '66. It was mostly steel work. But the argument in the White Paper used before is '63 to '66 was what we were told routinely and this seems to work with some of the ancillary facts was the peak operations of the betatron.

We used that in the White Paper to say that
the betatron operations that we model for the new betatron would be bounding on the old betatron, since it was lower intensity and pre-new betatron it would have been a lighter workload from what we are told.

CHAIRMAN ZIEMER: Okay.

DR. MAURO: Paul, in the interest of keeping the record as complete as we can, when you were talking about the beta dose, this is a question I raised, and I guess I don't recollect the answer.

I know that all of us modeled the slice and on the outside of the slice is this crust and the outside crust is where this Puzier thing might or might not occur on some occasions.

What I am not sure is when doing the beta dose, to what extent was consideration given that on occasion a full dingot or ingot was in fact brought in for the reasons we discussed earlier. Perhaps not to go through the whole thing but look at the
edges.

In a circumstance like that, what you now have is a much larger surface area with crust, which means that the potential for beta exposure from the Puzier effect might increase. And that is an area where I guess I never got a good sense of the degree to which the beta dose that is being reconstructed here has taken that into consideration.

CHAIRMAN ZIEMER: I thought we had put the Puzier effect thing to bed --

DR. MAURO: We may have, and I apologize if we have.

CHAIRMAN ZIEMER: -- and in fact had agreed to modify TBD-6000 to include the discussion of that.

DR. MAURO: Okay.

CHAIRMAN ZIEMER: That issue has in fact been discussed.

DR. ANIGSTEIN: But for GSI, I would not go back and redo it. We did assume with the slice 50 percent of the skin dose
that would either with handling the face of it
where you would not have the Puzier effect or
you were handling the edge and we are just
50/50.

So if it was entirely -- yes, it
could elevate. I mean, it could be a higher
percentage of the time handling the crust. So
conceptually it would -- the maximum it could
do is double. It would actually less than
double it. There would be some increase. And
that these were doable. I mean, all we had to
do was switch the ratio and increase, you
know, this was significant amount of handling
the whole ingots. But, again, the information
was that mostly it was the slices.

MR. RAMSPOTT: Dr. Ziemer, this is
John Ramspott, if I could make a comment.

CHAIRMAN ZIEMER: Sure, John.

MR. RAMSPOTT: Actually, I
disagree with Dr. Anigstein's analysis, his
last sentence.

CHAIRMAN ZIEMER: Okay.
MR. RAMSPOTT: We have absolutely no information, none, zero, no inventory of what went to GSI. We have some hour notations, and they didn't start until '58, so there is five years that is totally missing. And most of the workers that we have all worked with and interviewed started at GSI in about 1963 or '64. And the individuals that actually mentioned slices or dingots or ingots, those people I know started in '64.

So talk about what happened at GSI pre-'64 is purely speculation. And I definitely agree with Dr. Mauro. You have five times the mass with an ingot and information I have actually forwarded to the Board, SC&A, and NIOSH from Mallinckrodt. The main intention of what went to GSI was dingots and ingots. And if we all review the DOE, DOL, FUSRAP cleanup reports, they really mention ingots and dingots and the DOE actually revised theirs to show that. That is just fact.
So to try and go to slices, there is another piece to that. It is the handling of anything, whether it is a slice or an ingot or a dingot. You shoot it four times. There is four handlings. There is four chainings. There is four movings. Even a slice of a 3300-pound something, if it is cut in one-fifth isn't like picking up a piece of paper. They actually had to chain it and move it. So there is a lot more activity there than I think is being given credit.

Thanks for your time.

CHAIRMAN ZIEMER: Okay, thank you.

Now --

DR. ANIGSTEIN: Can I just briefly respond to that?

CHAIRMAN ZIEMER: Oh, comment on that? Yes.

DR. ANIGSTEIN: The exposure we were just discussing a minute ago, John, before your comment, was we took the number of hours from the purchase orders from
Mallinckrodt, allowed them so many hours of uranium. So part of that time, they were handling the uranium. We assigned the skin doses very, very claimant favorable, as if half the time they actually had their hands on the uranium. Bare hands, mind you. No gloves. Just bare hands. This is about as bad as you can get.

The chain men would have been near the uranium. I doubt that they would have spent more time with — any individual chain man would have spent more time with the uranium than the betatron operators. If there is evidence to the contrary, we certainly would look at that, but it would seem to me that hooking up the chain and putting it on the rail car would involve less personal contact than the betatron operator in the room positioning the film, guiding where it comes in and so forth.

But the only difference will be the skin dose. The skin dose needs to be
increased. It can be easily, you know, reason to believe that that can be easily accommodated.

DR. MAURO: I think this is important. I mean we just hit on an area with a little softness because of the Puzier effect and the fact that maybe there were these full dingots being handled on occasion. Right now, the models do not explicitly address that.

You know, I think it is important it is clear that this, you know, I think the reason we are going through this list, is are there places where there might be some softness in the model that we did not explicitly address, I think it is important that we tabulate them and then decide what needs to be done to deal with those. And I think this is one.

I think this is one where something needs to be done to improve the way in which the doses are being calculated or at least evaluate it to see if it's going to
change very much. I understand you made a lot of conservative assumptions in the way you handled the slice. That may very well cover the problem, but what I am hearing is that there is still a little bit of uncertainty here on whether or not it is possible the current method may underestimate the skin dose.

CHAIRMAN ZIEMER: Thank you. Other comments on that, Dave?

MR. ALLEN: No.

CHAIRMAN ZIEMER: But I think what Bob is referring to is that percentage distribution. That is part of it.

DR. MAURO: Yes.

CHAIRMAN ZIEMER: I think John Ramspott was questioning whether or not we had confidence in actually what forms were being handled prior to -- what is the earliest we have the records on the orders?

DR. ANIGSTEIN: Yes.

MR. RAMSPOTT: Dr. Ziemer?

CHAIRMAN ZIEMER: Yes.

MR. RAMSPOTT: You are partially correct. My concern is the quantity and what the actual material was. It is both.

CHAIRMAN ZIEMER: Yes, thank you.

DR. McKEEL: And, Dr. Ziemer, my comment, this is Dan McKeel, would be you don't have that information for any time period. You have purchase orders, but it doesn't say explicitly whether they were betatron slices, ingots, or dingots, whether they were pure ingots, whether they were ingots that were alloyed, which we know were produced at Weldon Spring and Mallinckrodt, et cetera. You really do not know the details of the source term at GSI, and you don't know it at all up until the time that we have zero purchase orders.

CHAIRMAN ZIEMER: Thank you. I'm making a note of that.
Let me go on here to another item, and that is the question that is raised by the petitioners of using basically the modeling of the new betatron to cover the old betatron activities. Issue 4 on Dr. McKeel's list.

So from NIOSH's point of view, how do you look at that?

MR. ALLEN: The argument I made was in the White Paper, a paragraph towards the end.

CHAIRMAN ZIEMER: Right.

MR. ALLEN: And essentially what it came down to was the workers on more than one occasion mentioned that the intensity of the old betatron was less than the new betatron. They mentioned that shots take longer there. They even gave us numbers the best that they could recall at one point. And then we also had information from more than one worker, as I mentioned earlier, that the workload in 1963 jumped up and essentially was responding I believe to the shutdown on the
Eddystone plant. And I think some of the other ones had corresponded to the sinking of the Thresher and they had to do a lot more QA on some of the materials they were making.

Between the two, the higher intensity of the new betatron and the more workload in that time frame I thought that the model of the exposures at the new betatron would be bounding on the previous years and that those years also for the old betatron.

CHAIRMAN ZIEMER: And I assumed that was the case but just for the record, I wanted to get that out.

DR. ANIGSTEIN: I have a comment, too, a further comment further on what David just said.

This maximally exposed individual, this layout man who was working in the 10 Building right outside the entrance to the new betatron wouldn't have been there. The old betatron was way out in the weeds, about 400 yards away and there was no, I was told, you
know, there may have been people going back
and forth, but there was no one who was
stationed eight hours a day outside the door
of the old betatron. So that exposure
scenario just didn't exist. And the fact that
again it had a lower energy, it had a lower
output so the new betatron is limiting.

You don't have to consider a
weaker source if you have a stronger source
and assign that exposure to everyone.

CHAIRMAN ZIEMER: Okay, thank you.

MR. RAMSPOTT: Dr. Ziemer?

DR. McKEEL: May I?

CHAIRMAN ZIEMER: John, go ahead.

John Ramspott.

MR. RAMSPOTT: First off, the old
betatron wasn't 400 yards away. It was 300
feet.

CHAIRMAN ZIEMER: Right.

MR. RAMSPOTT: That is a
significant difference.

DR. ANIGSTEIN: Correct.
MR. RAMSPOTT: And we have worker testimony, people definitely were right outside the betatron door; yard workers and when I say yard I mean railroad yard, laborers, people who had to load and unload those cars, pick up castings. All of the material we showed in a photograph something called a flask or a framework for castings sat out there. So they were definitely right in the area. That is just for the record.

CHAIRMAN ZIEMER: Okay, thank you.

DR. McKEEL: Dr. Ziemer, this is Dan McKeel.

CHAIRMAN ZIEMER: Yes, Dr. McKeel?

DR. McKEEL: Really my real point is about the differences between the old betatron facility and the new betatron once again are being skipped over.

My concern is that let's just take the buildings themselves. They are not comparable. Their siting is not comparable. The new betatron building was built ten years
after the old betatron building by a different contractor. There is no complete list of engineering drawings or engineering materials that went into those buildings. They weren't the same physical dimensions and the walls, the metal part of the walls didn't go up to the same height. So there were many differences between the building structures themselves, and nobody is able to define those with any degree of clarity. That is number one.

Number two, the machines. You know, I think for SEC purposes you certainly can argue that a high dose might be bounding for a lower dose. But the point that I have tried to make since commenting on Appendix BB that has been totally ignored is that under OCAS-IG-003, I believe what you have to do first is you have to calculate, and I am not talking about you, I am talking about NIOSH, needed to calculate the doses from the various sources and show that the doses from, for
example, the old betatron machine were lower than the doses from the new betatron machine.

Now that could be modified by a number of factors. For example, let's say -- and I agree, 'identifying information redacted' 'identifying information redacted' had detailed records from being at GSI. And although he said he had never been in the new betatron building, we have records that show he was installing doughnut tubes in the GSI machines as late as 1973. And he did have a notebook and he produced those figures for us when we were up in West Allis. And I believe he put those in his report to NIOSH under his contract.

So let's say that I think that is true. The old betatron's doughnut tube put out less R per minute than the new betatron building, the new betatron machine, that is true. However, suppose the materials shielding the control room were different. And let's say that it admitted more x-rays,
than did -- x-ray photons and neutrons, than did the material shielding the new betatron control room. You haven't shown that one way or the other.

And so that is a level -- Dr. Anigstein made a comment earlier today that the models were not 100 percent. Well I would suggest that in the absence of a formal uncertainty analysis, you can't say whether the models were within five percent, ten percent, 100 percent or 1000 percent of the real situations that existed in those rooms.

And so I think when you couple that with the fact that in October 2010 I tried to point out that DCAS came out with a schedule that Dr. Ziemer distributed of what work products they were going to produce under the path forward for GSI. And one of them was a new exposure model for the old betatron facility. And that model was not produced.

So I think that becomes an SEC issue, and I think the SEC issue is it just is
not enough to say oh yes, we can do that. They have had 18 months since that time when the schedule was announced to produce a new old betatron model, and they haven't done that. And so that will apply to many of the other issues that I brought about sources at GSI. I think they are all SEC issues. I don't think -- anyway we will go on to that. I am supposed to have a time to make my statements. So while we are on this subject, I just wanted to make that comment. I don't think the buildings or the machines have been proven to be comparable. I definitely don't think it has been shown, except for the output tube of the betatron doughnut tubes, if there was a difference in the output of the machines, and there certainly has not been shown a difference in the exposure or to put it another way, what you are suggesting is that the exposures were the same or lower in the old betatron building and, therefore, bounded by the new betatron exposures. I just
don't think that has been proved.

Thank you.

CHAIRMAN ZIEMER: Thanks, Dan.

MR. RAMSPOTT: Dr. Zieme, John Ramspott. If I could make one more quick comment on this.

CHAIRMAN ZIEMER: You bet.

MR. RAMSPOTT: I guess the SEC issue that I see or one of them, there is no badge information for the old betatron. The badges started essentially in 1964, if I understand correctly.

Now there might be, and there is one individual who was a part-time worker that had an early badge. We don't know if his badge readings are from isotope work which he did part-time. He was a chem lab guy. He worked ten percent or 13 percent I think to be exact as a radiographer on the weekend. We don't know if he worked Saturday and Sunday, but we have one person. And in those early days, they were actually the highest
employment years at GSI. That has been documented. That is Wikipedia, annual reports, whatever. The early years were the highest employment at GSI. So to say that was more of a slack time, actually it wasn't. They were making more tank turrets and hulls than they ever were the big steam chest.

But no badges essentially for those ten years prior to the new betatron? That is a pretty serious issue if the badges are what is being used to do some bounding. Thank you.

CHAIRMAN ZIEMER: Thank you, John.

DR. McKEEL: And, Dr. Ziemer, I guess I have to comment something that I left out of that to be complete about why it is important to have an explicit model for the old betatron building that's as good as possible is that the whole reason that GSI is even being considered as an AWE site was because they had an AEC contract to do NDT work on Mallinckrodt AEC uranium.
And the first ten years of that contract was carried out at the old betatron building. There was no new betatron building until 1963.

So to not model the old betatron building 1953 to '63 is a serious omission. And in my opinion it is enough, after all the time that has passed by, to recommend that SEC-105 be approved.

CHAIRMAN ZIEMER: Okay, thanks.

DR. ANIGSTEIN: I have two comments.

CHAIRMAN ZIEMER: You want to comment here, Bob?

DR. ANIGSTEIN: Yes. First of all, in 2008 report SC&A did explicitly model the old betatron building. We found the doses in the control room to be lower. We modeled a couple of the locations. And the one difference besides the fact that the building, and we say we know nothing about the building, no, we have, first of all the building was
built under the direction of Allis-Chalmers so we have their typical, the Allis-Chalmers betatron manual specifies an example of a building structure. And that building structure in that manual seems to be very close to the building structure in the FUSRAP reports that did investigate the old betatron building. And most likely, that building had not been modified because my understanding is that it has essentially been not ever used after the shutdown of GSI.

Secondly, the major source of exposure which is modeled now by NIOSH and by SC&A, the layout man from the new betatron building was, because of this practice that was introduced in I believe 1965 when a new supervisor or manager took over and instructed the workers you flip the head so that we can override the limit switches and radiograph castings right on the railroad track.

The previous supervisor who was present at the meeting in Collinsville who is
now deceased agreed with the workers. No, he
never would have. They said he wouldn't have
allowed that practice. And he agreed. No,
that practice was never allowed in those days.
And he was in charge then.

So the practice that would have
been allowed is one I showed here on the
diagram on the last meeting was the betatron
would normally point away from the control
room. It could go as much as a 110 degrees in
either direction so it could point towards the
walls perpendicular. It could not point at
the control room wall directly, and it
definitely could not point towards the door
leading to the railroad track. That is why
Allis-Chalmers that obviously was safety
conscious -- they specified ten-foot. I don't
know how much more safety conscious you can be
than to specify ten-foot thick walls -- didn't
bother. I asked my last conversation with ‘
identifying information redacted’,
identifying information redacted’, did you
specify any metal shielding. He said no, just a light aluminum, they used aluminum, just to keep people out. Because he said we relied on the shape of the limit switches and the L-shaped geometry of the room to make sure that there was no significant amount of radiation escaping out of that building through that door.

So by every measure, the new betatron is limiting. You don't need a -- you don't have to analyze it. You have to consider radiation, but you don't have to do a detailed calculation of every single possible. You know to get silly, suppose somebody in those days were wearing a watch with a radium dial. Do you consider that radiation? I mean, it is on-site radiation.

DR. McKEEL: No, that is a not a covered source.

DR. ANIGSTEIN: It is not a covered source. The betatron, of course it would be -- well, okay. It will be a source
of radiation. The point is -- okay, I am
giving a silly example.

You only have to consider sources
if there is a possibility that they could
exceed the limits that you get from other
sources. If you can prove that it cannot be
greater, then you don't have to do a detailed
calculation. It is just a waste of effort.

DR. McKEEL: This is Dan McKeel
again. I really don't think that OCAS-IG-003
has language in there that supports what you
just said at all.

DR. NETON: This is Jim Neton. I
can read you exactly what it says in IG-003,
section 3.1. It says, "For exposures that
were incurred during the designated DOE
contract period, all occupationally-derived
source radiation exposures at covered
facilities must be included in dose
reconstruction." It doesn't have any specific
description as to how that exposure analysis
is performed.
And I agree with Bob. If you can come up with a limiting case and include that exposure in there and say it is limiting, then that fulfills the criteria of IG-003.

DR. McKEEL: Well, I am still saying -- this is Dan McKeel again. With all due respect to both of you gentlemen, you just read me the language of Section 3.1 of OCAS-IG-003 and it did not say. You all are putting words in that document's mouth.

DR. NETON: No, I think this document --

DR. McKEEL: I mean, that is your interpretation. That may be NIOSH's derived policy now but it is not what that document says.

DR. NETON: Well, I was the author of IG-003 and I pretty much know what I said.

DR. McKEEL: Well then, it is like laws. Today, people are at the Supreme Court arguing because of a law that is being written that is going to affect all of us in America.
And what they are arguing about is how explicit is the language. And that law is going to be tossed out.

DR. NETON: Well, let's go back to the law. The law says that dose reconstructions must be done. And it says if we can reconstruct them with sufficient accuracy -- it becomes an SEC if you can't reconstruct them with sufficient accuracy.

And the intent of IG-003 was merely to state that all exposures had to be considered above and beyond any DOE-derived exposures.

DR. McKEEL: I agree. I think it is a great document.

DR. NETON: It was not speaking to the degree of sufficient accuracy of a dose reconstruction. That is a very separate issue.

DR. McKEEL: I understand that.

DR. NETON: And what we need to debate is if using another betatron to bound
exposures at the old betatron, is that sufficiently accurate. That is really the question.

DR. McKEEL: I say no. And you all obviously say yes.

DR. NETON: Well, that's in issue here. But I don't think that it hinges upon an interpretation of IG-003 at all.

DR. McKEEL: Okay.

CHAIRMAN ZIEMER: Okay, let's move on. Under Issue 5, I mainly have a question and this is for you, Dan. You indicate that there is evidence that the GSI film badge retraction letters signatures by individuals with the highest film badge readings were forged by GSI supervisors. And I am not certain -- is there evidence that that has occurred? I mean, what evidence --

DR. McKEEL: Is that exactly what I said, Dr. Ziemer?

CHAIRMAN ZIEMER: I'm reading from it. It says: "There is evidence that the
retraction letter signatures were forged."

DR. McKEEL: Well, let me tell you -- yes, sir. I understand.

Well, let me tell you what the evidence is. The evidence is: first, the background is that although we asked and although we think it is highly necessary, if you remember, you acted as an arbiter to verify and ascertain whose signatures they were on the letter, the retraction letters to Landauer. However, we never actually saw the names. We know all the people involved, but we can't be sure whose names were on those letters. But we are very certain of who one of the two people with the highest film badge data was, and that individual has been interviewed by a worker who is on the phone this morning. And that particular worker said he never was told that he had a high film badge reading.

And so the scenario that Dr. Anigstein developed with his colleague, Dr.
Zlotnicki, who was a former Landauer employer and now is an SC&A employee was that the worker apparently agreed with his supervisor and the supervisor wrote a letter on his behalf to Landauer retracting the film badge readings as being -- I'm not sure what word was used, because I really haven't seen a wording of those letters -- but retracted the information. And my point is, if the man asked the worker whose badge had the higher reading didn't even know about that reading, how could he possibly have had a conversation with his supervisor that admitted that it was bogus and not a real value and that it should be retracted?

The other reason that I have my serious doubts about the whole matter is that I talked to Landauer a full 13 months before NIOSH got their more complete data set from Landauer on the GSI film badge program 2084.

And when I talked to those folks, I talked to two individuals several times,
wrote them, corresponded with them, sent them worker releases and so forth. And they never mentioned any retraction notices being present.

So you know, it is not that I doubt Dr. Anigstein at all. I'm sure he saw that. But all I can say is that information when I alone had talked to them, well before SC&A had gotten involved in anything, well before NIOSH had gotten their data, a year before, nobody mentioned anything about the high film badge readings being retracted. And in fact, and I have all this correspondence, one of the ladies at Landauer who was extremely helpful pointed out for me, flagged for me, if you will, the highest film badge reading of all and said, you know, I just wanted to bring this to your attention because it looks like this person received this badge reading in a single quarter.

Now it turns out that that highest film badge reading was outside the covered
period. You know, people can argue that, well, maybe that is irrelevant but it wasn't irrelevant because NIOSH and SC&A and the Board, this Work Group made a big deal out of it.

And so, I guess that is what I would say. This lady never mentioned that that film badge reading had been retracted. And I can't imagine that she was unaware that that had happened. If these letters that are supposedly transpired, all transpired, I assume, back in the time period when the film badges program was ongoing, that is, prior to 1973, then those letters should have been in the Landauer files for what, you know, I contacted them 30 years later. So all of those records should have been in their file. And she would have, I'm sure, mentioned to me that, oh, by the way, those very high readings have been retracted, so you should disregard them. She didn't say that.

So you know, I can't, in all of my
dealings with this Work Group, I have tried to report what various workers tell me. Sometimes they corroborate each other, sometimes they don't. I can't really judge. I'm not making judgment on who is telling the truth and who is not because, you know, everybody, I am certain, is trying to do their best at recollecting what happened decades ago and that is very, very hard to do for any of us.

CHAIRMAN ZIEMER: Okay, I thought --

DR. McKEEL: So that's it.

CHAIRMAN ZIEMER: I understand because we have had that discussion before. I thought maybe there was some new direct evidence that you had of forgery that I wasn't aware of.

MR. RAMSPOTT: Dr. Ziemer?

CHAIRMAN ZIEMER: Yes?

DR. McKEEL: Well, actually, the reason I keep bringing it up, Dr. Ziemer, is
because until today, until today that basic information has not been acknowledged. No, you are right. We have had this discussion before. I have to keep on making the point because they don't seem to be recognized and I want them to be recognized.

CHAIRMAN ZIEMER: Okay, thank you. Bob has a comment and then we will get to you, John.

MR. RAMSPOTT: Okay, sir. Thank you.

DR. ANIGSTEIN: Can I comment?

CHAIRMAN ZIEMER: Yes, go ahead.

DR. ANIGSTEIN: Can I go first?

CHAIRMAN ZIEMER: Yes.

DR. ANIGSTEIN: All right. Dr. McKeel obtained, because he had to pay for this information and Landauer charges for its time, he obtained year-end summaries. A single report at the end of each year that summarizes the entire dose records for that year of workers who are still employed at that
time. If somebody quits in the middle of the year, it doesn't show up on the year-end summary or in October.

The year-end -- so he was given, this lady looks at the year-end summaries and gave him that information. Both NIOSH and myself, we went through every single record for the two and a half years of the covered period and then I went through the quarterly records and many of the individual records for the later years that were not covered and were not part of this, but nevertheless we looked at them.

Therefore, she correctly said at the end of the year, and this happened very late in the year, I think in November, it was reported in December, yes, there was this very high exposure.

It was not retracted until the following year, but it took time for the correspondence to take place and it took time to get that letter out back to Landauer and it
took time for them to make that correction. If I remember correctly, the correction was made the following February that the dose was subtracted. And there was a notation, DS. And we went to Mr. Zlotnicki, went back to his contact at Landauer. He is on very close terms with the current vice president of Landauer, who is in his own right eminent. He was formerly with Pacific Northwest Laboratory, has publications, a respected health physicist and scientist. And they dug up and went into those files and dug up those letters.

The lady that Dr. McKeel talked to would not have had that, would have had no reason to go into that. She did not examine. He did not pay what NIOSH paid. I have no idea what the order number, they gave him a purchase order to dig out every single record for a period starting with January '64, which implicitly covered the previous six weeks because it said here the total starting with
middle of November '63 through the end of the program in '73.

They purchased those ten years' worth of records, thousands of records and we went through them. And we found the DS and I said, "What does "DS" mean?" I asked Joe Zlotnicki, "What does DS mean?" He found out it means dose subtracted and he found that correspondence. And the correspondence was released. The names were taken out but the wording of the letters, everything else was released, my understanding, to the petitioners. I was specifically asked to give the redacted version and Ted Katz passed them on. So number one is the fact that the lady that Dan McKeel spoke with did not know that on the basis of the year-end records does not mean it wasn't there. And we have that. We got it from Landauer. So any implication that this is not valid information is simply wrong.

And second of all, those incidents happened well after the covered period. It
happened in '69 and there were other sources. The 80-curie source, the cobalt-60 source was in use at that time and there may very well have been potential for exposure or potential for accidental exposure of the film badges.

So the fact that one of the film badges had been something like 26 rem, if I recall correctly, even one of the workers who have been recently, currently in touch with the Board, participated in the meeting, said oh yes, he knew. He knew that this -- I interviewed him and it is in the record. He said this man got very upset. He said, "I lost my film badge and I guess you are going to have to fire me because I left my film badge near a radioactive source." There were different details.

So it was admitted that no, a human being did not get that dose of 26 rem. And when she said it was in one quarter, to be more specific it was in one week on a single weekly film badge. And the same person who
had that exposure had no significant exposures
or no exposures all the rest of his time. It
was an accident to the film badge.

MEMBER MUNN: In any case, none of
it has any bearing on the period that we are
concerned with.

DR. ANIGSTEIN: It was completely
outside.

MEMBER MUNN: There is no bearing.

DR. McKEEL: No, but what it does
-- this is Dan McKeel again. What it does
have a bearing on is, I just sent the Board a
snippet from one of the two workers who sent
me their complete film badge records that they
got as part of the NIOSH dose reconstruction
program, and I sent all Members of the Board
and NIOSH and SC&A, everybody in the room and
on the phone a copy of two records that were
shown from 4/25/66 and 5/29/66, within the
covered period, where a reading that was not
on the April report shows up in May, at the
end of May as 300 millirems. Now that is not
a gigantic, high reading, but it is one where
a new reading appears on the badges.

So yes, I am aware of the phenomenon you are talking about. You will
also see in my extracted record that I have in that report that there is one reading on that list of 2,470 millirems cumulative dose.

So you know, there were other higher doses. The particular gentleman that I am talking about is not the one with the highest 30 rem dose but the other one. And that gentleman, no matter what you all have said, I understand everything that Bob has said. I believe it. I have no problem with it. But I am telling you that one gentlemen whose dose was apparently retracted said he was never told about that high dose.

So all it means is that his supervisor -- it is doubtful whether his supervisor ever talked to him about it. Now, if the supervisor just wrote it on his own, retracted the dose without telling the worker,
well, that is another matter.

MR. DUTKO: Dr. Ziemer?

CHAIRMAN ZIEMER: Yes.

MR. DUTKO: John Dutko. Comment, please.

CHAIRMAN ZIEMER: Yes.

MR. DUTKO: I was the person that interviewed this individual, talked to him by phone. He told me that he was never at all informed of any high exposure. And that after he had left their employment, they continually tried to get him to take a physical exam. He never could understand why.

After that conversation with him, sir, he would not answer the phone. He would not answer an email. The only thing I have got to say about the situation, you can take it to the bank that we weren't dealing with any Girl Scout troop.

CHAIRMAN ZIEMER: Okay. A couple other items.

MR. RAMSPOTT: Dr. Ziemer?
CHAIRMAN ZIEMER: Yes, John.

MR. RAMSPOTT: I had a comment, if I may.

CHAIRMAN ZIEMER: Yes.

MR. RAMSPOTT: It had to deal with this past conversation before Mr. Dutko. And Dr. Anigstein just confirmed for me that I wasn't dreaming this up.

There was a conversation between a supervisor who has frequently called in and added information, 'identifying information redacted', which you all know. He was actually interviewed, I thought by yourself, Paul, Dan McKeel, and now I know Bob Anigstein. I wasn't on the interview, but Mr. Dutko and myself had met with this gentleman prior to this interview and if I am not mistaken, and you guys can help me and it sounds like Bob has already started to, he recanted a story about an exposure.

It was in 6 Building. The film was misplaced, lost, the badge was lost. He
panicked, he went home, he came back the next day, cleaned out his locker, figured he was fired. And the supervisor just mentioned he went in to his boss, told him what happened, and then I believe some sort of letter was concocted to cover that issue.

And you guys talked to . So I think you probably -- hopefully this refreshes some memories on that conversation. So somebody did something. You know, forged is a nasty word, but somebody did something, apparently, and feel free to re-interview that supervisor. I think he would have no problem telling you. He told it to you once. Did I miss that or -- I wasn't there on the interview. You guys did it on your own.

Does anybody have a comment on that?

CHAIRMAN ZIEMER: Well, I don't know that we need to pursue that here today. I think we got the information we needed.

MR. RAMSPOTT: Well, it was just
in answer to your question about --

CHAIRMAN ZIEMER: Yes, I was just trying to clarify.

MR. RAMSPOTT: -- some things that were jockeyed around.

CHAIRMAN ZIEMER: Yes.

MR. RAMSPOTT: Hope it helps.

CHAIRMAN ZIEMER: A couple other items. Under Issue 6, the issue of whether guards and electricians and so on could have had higher doses than layout workers. I think that we have pretty well established that the layout worker's contacts had to exceed virtually any other job there. I don't know if anyone has any questions on that.

But under issue 6, a couple other things I just wanted to comment on. Dr. McKeel, you raised a concern that NIOSH has not done a breakdown of gender in the dose reconstructions. And let me just tell you that typically gender is not an issue in dose reconstructions. NIOSH uses the National
Cancer Institute risk values, which pretty much are gender-neutral with an exception or two. Breast cancer sometimes is an issue, and that is taken into consideration but the assignment of dose as it is in the models certainly is gender-free and there is no either SECs or dose reconstructions that look at gender specifically, except for the case where if a woman gets breast cancer. Then, I am trying to remember, Dr. Neton, is there a different risk value used for the women for breast cancer?

DR. NETON: Actually, male and women's breast cancer have the same graph, but it is based on the women's.

CHAIRMAN ZIEMER: It is based on the women's, right.

MR. ALLEN: The background rate is drastically different.

DR. NETON: Yes, actually.

CHAIRMAN ZIEMER: Right. And that shows up in the calculation as far as the risk
calculation is concerned.

DR. NETON: Correct.

CHAIRMAN ZIEMER: So that if a woman gets breast cancer, that actually shows up in the determination.

DR. NETON: Correct.

CHAIRMAN ZIEMER: So I just wanted to mention that for the record, that there is not a need for a breakdown of gender in terms of the front-end of the dose reconstruction process.

DR. McKEEL: The reason I think -- Dr. Ziemer, this is Dan McKeel again. I think the reason I put that in there is I wanted to call your attention to a new epidemiologic study that had shown a difference between cancers in women and men. And it was just to point out a general finding.

I understand about IREP being gender-neutral and so forth. The other issue that comes up that is a gender issue and I believe it is an SEC issue has to do with the
film badge records from General Steel, which are on a very small subset of people, none of whom are women.

So not only is that badge data not representative as far as jobs or years, it is also not representative as far as gender. There are no women represented. So that was a very small point.

CHAIRMAN ZIEMER: Yes, I just wanted to clarify that. Okay.

MR. CHUROVICH: Dr. Ziemer?

CHAIRMAN ZIEMER: Yes.

MR. CHUROVICH: My name is Dan Churovich and I would like to have one comment about the safety issues at the Commonwealth. From 1951 to 1961 I worked there and I can tell you the safety issues and state oversight, and any other kind of oversight are almost nonexistent, except for taking care of your eyes wearing your safety glasses.

Harry Truman, his comment was that if you -- he made a statement once and said at
the end that a certain statement somebody else
had made was horse manure. And you are
talking about the safety at the Commonwealth
and oversight, that is basically what you are
talking about because it did not happen.

CHAIRMAN ZIEMER: Okay, thank you.

Let's see. Other items on Dr.
McKeel's document here we have already
discussed. It has been agreed that the double
leaf or the lead shields weren't there during
this period.

DR. McKEEL: Dr. Ziemer?

CHAIRMAN ZIEMER: Yes.

DR. McKEEL: No. Both SC&A and
NIOSH and now you have missed my main point.
My main point was I understand that the lead
is not being used in the model. That is good.
But Dave Allen's model and what he says in his
latest report, Addendum 3, is that he still is
using a double leaf door in his model. And we
have shown you that that double leaf door was
not the door that was present in 1966.
Now what I think what is the practical matter of that, you know, does it matter. I think it does, because as everybody has said this morning, you know, what we are talking about is sky shine, radiation going down the tunnel. And possibly -- let's just talk about the new betatron building -- and possibly affecting layout men doing layout work in the tunnel or in Building 10. If that radiation has to pass through two doors, let's call them double leaf and ribbon steel, it does matter what that material is.

Now I understand that it may or may not retard photons and/or neutrons but it does, the door, the material of which the door is composed does affect the MCNPX model quantitatively speaking. And it matters which door you have in the model. And I am saying that the door that should be in the model is the ribbon steel door. And I believe Dr. Anigstein mentioned this morning and that he has said before that in his earlier model of
the old betatron building in 2008, you know, he has referred to that door as one-sixteenth inch steel.

Now that may be true. You can't tell from the pictures exactly what material the double leaf door was but, you know, it had a discrete thickness. It was made of a discrete type of metal, which we don't know what it was. We call it steel and we call it metal but we don't really know what either one of those doors, what kind of steel it was, or what kind of metal the double leaf door was. So I guess that is my point.

You know, if we want the model to be as precise as possible, then we should use the correct type of door material and it was a ribbon steel roll-up door.

CHAIRMAN ZIEMER: Okay. We'll so note that. I suspect that is fairly easy for NIOSH to take a look at that and see if that makes any difference. It may make a slight difference.
MR. ALLEN: Yes, we got a steel door there now. And all I did was remove the lead from what I had before. I don't recall the thickness of it. It is less than an inch but it might be a little too thick right now.

CHAIRMAN ZIEMER: Okay, we will take a look at that. Okay, thank you.

I think the other items on this document we have already discussed. We are going to take a lunch break here in a minute.

DR. McKEEL: Dr. Ziemer, may I ask a question --

CHAIRMAN ZIEMER: Yes.

DR. McKEEL: -- that I am unclear about?

You know, I think I appreciate your going through the issues that concern you about what I wrote. But there is an issue on here about petitioner's comments on NIOSH White Paper update, Dan McKeel, number five. Am I going to get to talk about those things?

CHAIRMAN ZIEMER: Yes.
DR. McKEEL: Okay, good.

CHAIRMAN ZIEMER: Number five on which document, the one I was just looking at?

DR. McKEEL: No, I'm talking about the fifth item on the agenda.

CHAIRMAN ZIEMER: Oh, yes. Oh, yes, yes, right.

DR. McKEEL: Okay.

CHAIRMAN ZIEMER: Your comments.

DR. McKEEL: Can we do that after lunch?

CHAIRMAN ZIEMER: We can do that after lunch.

Wanda had some comments she wanted to make earlier and let's do that before we leave. Wanda? Or do you want to wait?

MEMBER MUNN: They were only very general comments and really don't have any bearing on our technical discussion here. It was just I think as the discussion goes on, it is more and more clear to anyone who is listening to it that different people infer
different positions on what any fact that is put before them seems to say. And we hear that continually around this table. I'm not sure how we can get past that. It seems to occur everywhere, but it seems to be very bad here.

We have people with different backgrounds who infer something from the same set of information that we have, and it is disturbing that we don't have a way to get past that. It is just an observation on the human condition, I suppose. I do wish that we had some mechanism other than what we are doing here to try to get around that. But I throw that out simply because if anyone has any thought on how we might move forward more succinctly on the differences that people have and implications that they see in the same information that we have, it would be extremely helpful to all concerned.

I have no words of wisdom in that regard, but I guess we have to slog through
it. That's just -- I only comment.

CHAIRMAN ZIEMER: Well, I'm not sure that the goal is to get everybody to agree on things.

MEMBER MUNN: No, it isn't.

CHAIRMAN ZIEMER: The goal is to get everybody's issues on the table. Insofar as there are facts that we can agree on, that is good. The implications of those facts and anything derived from them, it goes from data to perhaps models to some other level of characterization, we will have to make our individual judgment about that. The petitioners I mean certainly have a different view than -- or may not, than NIOSH. SC&A may or may not agree with NIOSH. There will be points of, perhaps, disagreement.

Ultimately, I think it will fall on the Work Group Members to take this information and make a judgment on whether or not we are prepared to recommend an SEC for all or part of the time periods in question.
MEMBER MUNN: I agree. My concern is the fact that we seem to be working toward different goals. And sometimes it is helpful to reinforce the idea that the goal, I believe I am stating this correctly, of the Board and certainly the goal of this Work Group is to identify the best possible science in relationship to ability to do dose reconstruction for this specific site.

CHAIRMAN ZIEMER: Right.

MEMBER MUNN: And if that is the same goal that we are all working toward, then it is helpful to restate it once in a while.

DR. MAURO: To add to that very quickly. What I am doing is there is a lot of material to go through. What I am doing is I am writing down the essence of which items that Dr. McKeel brought up that I believe need to be answered that have not yet been answered. And I have two. And quite frankly I was surprised by the second one, namely the thickness of the ribbon door. It is my
understanding that whichever assumption you use regarding -- once you get rid of the lead, you are not going to change anything. Now I was hoping --

CHAIRMAN ZIEMER: Well, we don't know for sure. But it is easily checked.

DR. MAURO: Yes, there's a difference -- the difference between --

DR. ANIGSTEIN: The lead or the --

DR. MAURO: No, no not the lead. Take the lead out.

CHAIRMAN ZIEMER: The lead is out anyway.

DR. MAURO: Dr. McKeel had mentioned that once the lead is out, we still have a question about whether the ribbon is a double ribbon or a single ribbon, which changes the thickness.

DR. ANIGSTEIN: The thickness -- again, we had a disagreement. It was an inadvertent aspect of his model where you put in a thick steel. And the thin steel, it is
not going to be anything less than a sixteenth of an inch. This is a typical stiff sheet metal and we use a typical alloy. Steel is basically iron with a little bit of carbon added, some trace elements, some trace amounts of other metals, unless you are looking for stainless steel or some special purpose steel, but ordinary steel. We took a typical alloy and changing the alloy composition, you know, on the level of significance that we are operating, is it going to change it in the fifth decimal place? Probably.

DR. MAURO: That is what I wanted to get on the record. We didn't get that on the record.

You see, right now I have, as we left it up to this moment, this was item number two. I don't think it deserves to be an item number two for the reasons Bob just said.

MEMBER BEACH: Well, and just for me, I am looking for, once all the
recommendations come out, all the questions, then I am looking to NIOSH to see what they are going to do with all that information. So we still don't know that at this point completely.

CHAIRMAN ZIEMER: Okay, let's break for lunch. Try to get back by 1:00. We are a little bit after 12:00 but let's get back here by 1:00, and we will hear from Dr. McKeel and then we want to go through the matrix.

(Whereupon, the above-entitled matter went off the record at 12:05 p.m. and resumed at 1:05 p.m.)
MR. KATZ: Okay, we are back. This is the Advisory Board of Radiation Worker Health, TBD-6000 Work Group. Let me just check on the line. Dan and John, are you with us again?

DR. McKEEL: Yes, this is Dan McKeel. I'm here.

MR. RAMSPOTT: John Ramspott. I'm here.

MR. KATZ: Super. And Mr. Dutko, too?

MR. DUTKO: Yes, sir.

MR. KATZ: Great.

CHAIRMAN ZIEMER: Okay, let's begin now with comments from Dr. McKeel. And Dan, we do have the materials that you distributed this past week and if you need to refer to those, that is fine but I will let you proceed as you wish.

DR. McKEEL: Okay. Thank you very
much for giving me the opportunity. I am
going to try to keep my remarks very focused
in the spirit of what Wanda Munn was asking
for this morning.

   My time today is pretty limited
and the Work Group has a lot more to get
through. So I am going to try to focus on the
two Allen/NIOSH Path Forward White Papers, but
also I want to raise SEC-105 issues, so
everybody can have time to discuss the SEC
matrix.

   And hopefully, at the end of this
I hope Dr. Mauro has added to his list of
issues that need to be resolved for the SEC.

   First I have a comment regarding
David Allen's addendum number three. We went
over this briefly this morning. I agree with
SC&A that the new betatron model is still not
correct. A) is: the modeled new betatron
tunnel door was not double leaf, even though
it was minus lead shielding. It was a thinner
driven-steel roll-up door, the exact physical
characteristics of which, including the thickness and the type of steel are not known. There was no lead shield.

I think not incorporating this into the model already indicates that my presentation on 3/15 was ignored on this point.

Point B is that David Allen did not model the badge position number two for GSI. And the new betatron film badge rack when it was moved farther away from the betatron source during 1964-1966.

The Landauer GSI film badge program number 2084 data has been analyzed thoroughly and accurately, nor has it been presented in entirety to the TBD-6000 Work Group or the petitioner.

McKeel's most recent White Paper to the Board on 3/27/12 showed evidence of an exposure of 300 millirem that newly appeared on a worker record between April 25th and May 29th, '66 of the covered period. McKeel
interprets this as a previously unreported overexposure incident that was apparent from a detailed temporal analysis of film badge records that NIOSH has possessed for several years.

The replicated records showed 33 records on one page. There were 21 instances of cumulative photon dose marked M and 12 instances of photon doses ranging between 10 and 2,470 millirem, 2,470 millirem with several 20 millirem and a 40 millirem dose. No sheets had any beta or neutron doses recording.

Point D under one, McKeel introduced a new real-world betatron layout worker shooting scenario attested to by former GSI betatron employees and contained in one of his four recent communications to this Work Group following the 3/15 Work Group meeting.

What he showed was that layout men worked on castings that required a quick
turnaround, referred to as hot, rushed or urgent nondestructive testing jobs in the rail tunnel just outside of the thin roll-up steel door while shooting was ongoing.

Two workers who are known to the Work Group and SC&A offered this new affidavit information. Dr. Anigstein mentioned that he didn't think that scenario would add to the dose because it wouldn't be possible to have gotten another casting into the beta room to be worked on while the layout men were doing their job outside. And I think that is just wrong.

I think it would be easy to imagine a scenario where a smaller casting had already been brought into the betatron shooting room and then suddenly men found or discovered a defect and maybe they fixed it and then it had to be turned around quickly and they did that just outside the tunnel area.

In any case, the SEC issue
regarding GSI film badges is the pedigree of these data. It is limited to males. It is limited to one job Class, which is betatron employees that itself is heterogeneous and includes clerks and photography technicians. And badge data is available for only three years, 1964 to `66, out of a 13-year covered period. There are no measurements of beta dose or neutrons available on only 89 individuals out of a work force of 3,000 to 4,000 persons.

There is no reasonable scientific basis to construe these very limited badge data as being representative of the entire work force. Nor should they be extrapolated to cover all workers during the entire 13-year covered period of 1953 to 1966, as NIOSH suggests.

These were very limited film badge data and they are not even bounding for betatron employees who only wore them part-time. Badges were not worn, for example, by
betatron employees doing layouts in the new betatron tunnel on urgent, hot or rushed casting jobs. Those unbadged layout employees would be expected to have the highest exposures of any employees. And I say this.

Of course, that has to be proven by the model. These doses have not yet been modeled by NIOSH or SC&A during the Path Forward time period from October 2010 until today.

Main point two. Petitioner challenges the validation of a 25 MeV new betatron source using a post-1968 GSI cobalt-60 source which was 54, not 80, curies, that had a beam geometry that was very different. The Co-60 sources does not model neutrons that were a significant portion of the betatron output. And GSI workforce measured data from 1971, which is outside the covered period.

Item three, the petitioner objects to NIOSH and SC&A passing off betatron residual radiation that was measured as quote,
"magnetic interference,", unquote. This is their unproven construct but it was measured by a paid CDC NIOSH consultant. In fact, because setup workers were exposed to the distance of one to two feet rather than six feet from the betatron nose cone while the machine power was turned off, the inverse square law indicates a dose of 60 millirems rather than five millirems should be assigned. NIOSH has ignored more recent testimony replicated in my post-3/15 White Papers that ‘identifying information redacted’ ‘identifying information redacted’ was re-interviewed and said that the had measured residual radiation emanating from the doughnut tube of the betatron within seconds after removing it from an Allis-Chalmers betatron that was similar to the one used at GSI.

Point number four. SC&A in 2008 modeled an 80-curie source at GSI. Dr. Anigstein recently pointed out correctly that the Allen Co-60 model assumed the source was
80-curies, when in actuality it was only 54-curies in 1971. This source was not factored into the 2008 model of the same GSI source term.

The Path Forward documents have stated that GSI obtained the 80-curie source after 1966, a point that at least six GSI workers still dispute. They testify the large source was present during the 1964 to `66 time period. Petitioner believes that NIOSH, in the spirit of being claimant-favorable, should model the Co-60 80-curie source to comply with OCAS-IG-003 guidance. This is an SEC issue because the NIOSH Path Forward White Papers have not modeled this very important source.

Point number five. No direct measured monitoring data exists for either operating betatron for any portion of the covered 1953-1966 time period. This includes air monitoring or neutron flux, plausible coworker data or surrogate data. There are no valid computer models for this because there
is no real data to validate the model. MCNPX alone is not sufficient.

Point number six. No new old-betatron model was introduced by NIOSH and Mr. Allen in either recent White Paper for the Path Forward GSI Initiative. This is despite the fact that SC&A modeled the facility back in two thousand -- well, a while back. The old betatron facility was built ten years earlier than the new betatron building by a different contractor using different materials.

The new betatron building was a short distance away from a heavily populated work area in Building 10. The old betatron was located in a field 300 feet away from the new betatron facility with heavy outside traffic around it.

The old betatron building had different physical characteristics that are not completely defined. Engineering drawings do not exist for either betatron facility.
Only sketches that are not to scale and are not accompanied by any certified list of construction materials. The Allis-Chalmers manual may apply or it may not apply.

E. All of the Mallinckrodt AEC-contracted uranium NDT work between 1953 and 1963, including the peak production year of 1962 was done in an old betatron facility. The new betatron facility was not built until 1963. This is also an SEC issue. Betatron Path Forward progress to date after 18 months, NIOSH has not been able to develop and validate an updated old betatron exposure model using the production code of MCNPX together with the real-world measured data.

Point seven, NIOSH has not modeled the two GSI radium-226 sources correctly. The sources were used inside the 6 Building radiography facility pre-1962, as well as in other GSI buildings, as testified to by workers.

Petitioners have shown at the 3/15
Work Group meeting that the radiograph room in building 6 facility existed as indicated on a January 29, 1957 GSI plan engineering drawing.

This is also an SEC issue.

Point number eight. The GSI-owned iridium-192 NDT source was not modeled at all in the Path Forward White Papers. In the 3/15 meeting, petitioners reviewed five pieces of evidence that such a source was used to inspect pipe wells in Buildings 9 and 10 and rail transit cart trucks in the Building 6 radiography facility.

We don't know the way it was used. We don't know the nominal when new size, although one worker testifies it was 20-curies. Nothing is known exactly when it was used. The best estimate from testimony is the late 1950s and possibly into the early 1960s before St. Louis Testing Company entered the picture with their own iridium-192 and cobalt-60 sources.

The half-life of radioactive
iridium-192 is 73.83 days. Therefore, knowing the exact curies when the source was brand new and the time passed since use are both critical for accurate modeling of this source. None of these factors are known for the GSI-owned iridium-192 source, or for the St. Louis Testing Ir-192 source for that matter.

To my knowledge, the St. Louis Testing Company iridium-192 and cobalt-60 AEC source license was never obtained and examined by either NIOSH or by SC&A.

Point number nine, next to the last point. NIOSH has not modeled the two GSI portable 250 kVp x-ray machines correctly. No doses have been assigned to these sources by Dave Allen in his August 2011 Path Forward White Paper on portable GSI sources.

NIOSH knows practically nothing of where the units were used, what they were used for, what were the NDT inspection targets, how frequently they were used and by what workers. What were the exposure conditions, dose rate,
time, et cetera? These units were not equipped with safety interlock. OCAS-IG-003 mandates doses from these sources must be determined. This is an SEC issue because NIOSH has not demonstrated it can model these two sources with sufficient accuracy.

Final point ten. The petitioners challenge the NIOSH dose model for the two small nominally 500 millicurie Co-60 sources used in the 6 Building radiography building at GSI. These data are based on Nuclear Consultants Corporation's measured data from 1962, during and before the date which was July and June 1962 that D. Carr indicated was when added steel plate and concrete shielding was added to the Building 6 radiography facility. And the drawing that I showed on 3/15 did show that new concrete wall material was added to that facility on those dates.

One set of NCC measurements, according to NRC FOIA 2010-0012 documents was obtained in January of 1962 before the
shielding was added and the other set were made during the period the extra shielding was being installed.

On 3/15 the petitioner offered an analysis of the geometry of the Building 6 overhead crane and catwalk which suggests it might have blocked some of the Co-60 source radiation from below.

The accuracy of the NCC Building 6 radiography facility measured data was not checked using MCNPX code, which seems to the petitioner to be an obvious thing to do for two reasons. A) the NCC data accuracy could be established on a firmer scientific basis; and B) the NCC-measured data could serve to validate the MCNPX model. This too is an SEC issue. NIOSH cannot assign doses from the small 0.5-curie Co-60 sources because complete information is not known how these sources were used and because workers testify that some of the enumerated safety procedures, the

GSI 1962 AEC license application had stated to
be in place were not followed according to worker testimony.

So that ends my remarks and I will try to keep my input into the matrix issues minimal because I think I have covered those, hopefully, in these remarks.

Thank you very much.

CHAIRMAN ZIEMER: Okay, thank you.

Let me see if there is questions or comments on any of these items. Okay, Bob?

DR. ANIGSTEIN: Okay, going down the list, about the castings being radiographed on the railroad and it was a layout man working near the ribbon door. As I said, you cannot have another casting -- not talking about the side of the casting. Two railcars cannot pass each other when they are on a single track. Therefore, there would have been no point in having a casting on the railcar inside the shooting room and another railcar blocking the exit because the whole point of it was to make this whole thing
quick. And this would have made it take much more longer.

DR. McKEEL: Bob? Dr. Anigstein, please let me explain. I understand what you are saying but here is the scenario that I think happened.

They brought casting number one on a transfer car into the new betatron building. The crane picked it up and set it on the place where it would be imaged by the betatron. That car was then removed from the building.

Then a new transfer car was rolled up to the door on a urgent rush basis and things were imaged that way. And then that casting was laid out. The casting was brought into the betatron room. The other casting in this scenario would have to accommodate the shooting room in addition to the rush castings. But it was a big room and that could easily be done.

So I am suggesting that they brought the new casting in, they imaged it,
they took it out on the railroad transfer car
and then at a more leisurely pace, they then
went ahead and imaged casting number one and
took it out on a railroad car. And that would
be how you got to do that.

DR. ANIGSTEIN: Dr. McKeel, I
understand that. And all I am saying is that
the casting that is already in the betatron
building would not have been on the railroad
track. It would have been shot elsewhere in
the room, where the exposure in the railcar
would have been much less.

MR. DUTKO: Dr. Ziemer?

DR. McKEEL: Dr. Anigstein, I'm
sorry. I really have to interrupt you here
because I want to finish my line of talking
here, please.

I understand what you are saying
but once again, you can't presuppose modeling
results without actually doing the work. And
what I am saying is that specific situation
has not been modeled. We do not know the
results of it, and you can't just state a priori I know what the results will be. You have to do the modeling.

Okay, that's it.

CHAIRMAN ZIEMER: Somebody else had a comment there?

MR. DUTKO: Yes, sir.

CHAIRMAN ZIEMER: Yes, go ahead.

MR. KATZ: Mr. Dutko, go ahead.

DR. McKEEL: Terry, go ahead.

CHAIRMAN ZIEMER: I wonder is he pushed the mute button or something.

DR. McKEEL: He might have a problem with his phone.

CHAIRMAN ZIEMER: Well, we will go ahead here and then if he comes back.

DR. ANIGSTEIN: I would like to go down the list.

CHAIRMAN ZIEMER: Go ahead, Bob.

DR. ANIGSTEIN: The second comment was that those doses of 2,470 millirem, 300 millirem, this is the first we have heard of
them. In the SC&A report, my report dated November 8, 2008 explicitly listed all of the doses during the covered period that were in excess of M, meaning minimal. There were about 27 such doses. Most of them were just ten millirem and there was 40, a 300, a 2470. This was reported to NIOSH and to the Board.

If I remember correctly, at that time, OGC would not allow those numbers to be left in the redacted, PA-cleared copy. So it may very well be that the petitioner, the others never saw those numbers in that report.

MR. DUTKO: Dr. Ziemer?

DR. McKEEL: Well, wait. Terry, I have got to finish this. Dr. Anigstein is asking me questions --

MR. DUTKO: I'm sorry, sir.

DR. McKEEL: -- and I need to answer this.

MR. DUTKO: I had something important to say.

DR. McKEEL: All right.

DR. ANIGSTEIN: All right.

DR. McKEEL: Well, I would say he said you have never seen that before but this is a report that a worker obtained by asking for his case file and specifically his NIOSH dose reports.

DR. ANIGSTEIN: And those numbers, Dr. McKeel, those numbers are in the data that we have and they are in my report from November 8, 2008. Our job is to report to NIOSH and to the Board, NIOSH makes the -- The rest of the Agency makes a decision of what to release to the petitioners.

DR. McKEEL: I just want to remind everybody that in the sample that I saw --

DR. ANIGSTEIN: I have that report.

DR. McKEEL: Well, I know you do.

DR. ANIGSTEIN: I have that report and I have reported it to the Board.
DR. McKEEL: I am trying to show you that in the -- and I showed you the actual report in my report. You know, there is a value on that page of 2,470 millirem --

DR. ANIGSTEIN: And that data was reported to the Board back in November 2008. This is not new information.

DR. McKEEL: Well, I'm sorry then, if I am going over old information. I'm trying to summarize four years of information that we have given to this Work Group and still we have not gotten a vote on a recommendation for the SEC. So I think it is perfectly okay to do that.

You know, I pointed out the temporal relationship. I don't want to go into a long thing about it and I really don't think I am being cross-examined here. That is not what is going on here. What is going on here is that that data, what my comment was, that data was never completely reported to me.

I personally think that OGC made an error in
that. You know, I think they can redact names but I don't think they should redact doses. That is absolutely ridiculous.

And I do point out that this has been a recurring theme in my interaction with the NIOSH and the Board. The Privacy Act doesn't cover dead people. And a lot of the doses that we were talking about were deceased people.

So anyway, I apologize if I belabored old data that everybody knew about. But when I keep on hearing that the vast majority of these numbers were M, then all I can say is from a simple spot check, I wanted to put some perspective on that observation and I believe I did.

CHAIRMAN ZIEMER: Dan, we appreciate that. And actually I wasn't aware that these numbers got redacted. If they were, I am not personally sure why they would have redacted numbers.

DR. McKEEL: They did.
DR. ANIGSTEIN: They were redacted.

DR. McKEEL: I thought it was improper at the time and I still do.

MS. LIN: I'm not quite sure, I think I haven't seen a copy of --

DR. ANIGSTEIN: It was long before Jenny was on the team.

CHAIRMAN ZIEMER: Our current counsel here wasn't aware of that. But we will anyway, just so you are aware, we had seen the numbers.

MR. KATZ: I don't know specifically, but it is very possible, you don't just redact names, you redact any information that would be identifying. And in some cases where numbers are unusual and in effect would be identifying in and of themselves, you would have redacted them too. It is anything that is identifying, not just names. So that is possibly what happened. I couldn't tell you.
CHAIRMAN ZIEMER: They might have redacted whole lines, you mean?

MR. KATZ: So they would have redacted any information that would lead someone to be able to identify an individual, not just a name is what I am saying.

So if you have, for example, only a few data points and so there are only three workers that were ever involved in a certain operation or what have you, you would have redacted all the information you needed to protect the privacy of those individuals.

CHAIRMAN ZIEMER: And of course an M is also considered a number here. So I'm not sure --

DR. MAURO: No, I know exactly where it was --

CHAIRMAN ZIEMER: Well, okay.

DR. MAURO: I was there.

CHAIRMAN ZIEMER: It apparently happened. Our apologies. I wasn't aware that that had happened.
(Simultaneous speaking.)

MR. KATZ: Okay, so that's what --

MEMBER BEACH: And then John had a comment.

MR. ALLEN: Can I make one comment?

CHAIRMAN ZIEMER: Okay. Yes, Dave Allen.

MR. ALLEN: From what Dr. McKeel put in here, the numbers he is pointing to, I just wanted to point out that the column of numbers of that he is pointing to is the permanent column.

CHAIRMAN ZIEMER: The accumulated dose?

MR. ALLEN: Right, this is their essentially lifetime dose for the period of time that Landauer had the dosimetry data. The number to the right of that is the number of the badge reading, the badge number.

CHAIRMAN ZIEMER: The badge, what that represents.

MR. ALLEN: Like 125 for a number
of them, et cetera.

CHAIRMAN ZIEMER: Okay.

MR. ALLEN: The numbers all the way to the left, the column of Ms all the way to the left are the weekly badge readings for that particular week.

CHAIRMAN ZIEMER: Yes.

MR. ALLEN: And the three columns that end with those numbers he is pointing to are calendar quarter, calendar year, and permanent.

CHAIRMAN ZIEMER: Right.

DR. McKEEL: And what I am trying -- this is Dan McKeel again. What I was trying to show is the 300 millirem dose. I understand that is a cumulative dose and I said that in my little report, but that occurred over a month's period of time. So it was a dose that suddenly appeared on the record. That is the only point I was trying to make and I think I showed one report from April 25, '66 and another snippet of a report
from a month later and the 300 millirem was not on the first one but was on the second one. So I think that is the correct interpretation of that, that it newly appeared.

CHAIRMAN ZIEMER: Okay.

MR. ALLEN: That is actually not the correct interpretation but it would be hard for a redacted copy to get the right interpretation. And that is actually a different person. When people who were not there or did not turn in a badge, then they were not on the weekly report.

DR. McKEEL: Well, then that is a great example. I'm glad we have put this on the record because it is one more example of why overly severe redaction can not only impair information flow but it can actually cause -- and I have said it all along, there is a gray area between protecting privacy and censorship. And I think that is a great example. If that is the truth, then it is
misleading to redact those numbers.

    MR. KATZ: Well, it may be hard to interpret, Dan, but it is certainly not any intent of the Agency to censor anything other than to protect privacy.

    DR. McKEEL: Well, the Privacy Act -- Ted, let's not go into that.

    MR. KATZ: Fine. That's fine. But I am just telling you because I know how things work and there is no one censoring anything.

    DR. McKEEL: I do, too.

    CHAIRMAN ZIEMER: Bob, you have a comment?

    DR. ANIGSTEIN: One comment. To clarify those doses right now apparently we are talking about them, the 2,470 was a single one-week incident.

    CHAIRMAN ZIEMER: Yes, well, we have discussed that one over and over again.

    DR. ANIGSTEIN: Okay.

    CHAIRMAN ZIEMER: Don't go through
it again.

DR. ANIGSTEIN: Okay.

CHAIRMAN ZIEMER: Okay.

MEMBER BEACH: I think John had something, John on the phone.

CHAIRMAN ZIEMER: John on the phone had a comment.

MR. DUTKO: Yes, one quick comment, Dr. Ziemer. Can you hear me now?

CHAIRMAN ZIEMER: Yes.

MR. KATZ: Yes.

MR. DUTKO: I would like to inform Dr. Anigstein that there is no law that two castings can't be present in the shooting room at one time. We did that many, many times. A transfer car is a lot shorter than a low-boy. Like you saw the Marion axle loader. The Marion axle weighed 96 tons in over four axles. That, of course, couldn't happen.

But many times, we had two transfer cars back-to-back at the base of the DL and you could unload castings, either/or.
Thank you, sir.

CHAIRMAN ZIEMER: Okay, thanks.

That is helpful. Okay, Bob did you have any additional comments?

DR. McKEEL: I would like to -- this is Dan McKeel. Having heard that answer, what it means is that it underscores what I wrote, that that scenario needs to be modeled.

And it can't be passed off and swept under the rug because it is impossible to occur.

Not only is it possible to occur, but Mr. Dutko has just testified that it did occur frequently.

CHAIRMAN ZIEMER: Okay.

DR. McKEEL: Okay?

DR. ANIGSTEIN: I want to ask Terry. I don't know if it was clear. I didn't say that you couldn't have a second casting in that room. I was going to say that you wouldn't have a second casting on the rail car on the tracks being radiographed at the same time there was another car just outside
the door. Because the only reason that my understanding from you is that you would radiograph the casting on the car on the track would be to save the time. But since you couldn't get one out and the other one in on the same track at the same time --

     MR. DUTKO: Comment, Doctor --

     DR. ANIGSTEIN: -- you would have removed it. You would have unloaded it with a crane and put it elsewhere in the room. I don't disagree with that. I'm just saying that it wouldn't be shot on the railroad track while there was a second rail car just outside the door.

     MR. DUTKO: Dr. Anigstein, we did not shoot everything on the railroad tracks.

     DR. ANIGSTEIN: No, but I was only looking at this limiting scenario. Because once it was off the railroad track, the betatron was no longer pointing towards the ribbon -- in the direction of the ribbon door.

     And I am simply saying that my analysis of
the layout man was --

    MR. DUTKO: But it is not normal casting work, Dr. Anigstein.

    DR. ANIGSTEIN: Pardon?

    MR. DUTKO: A 96-ton casting is not normal.

    DR. ANIGSTEIN: I know. And then I took that as the limiting case.

    MR. DUTKO: It was an exceedingly long casting that would limit another transfer car or low-boy of course behind it. But in all other cases, 99 percent of the time we could put two transfer cars back-to-back close by the shooting cell where they could be unloaded by cranes.

    Many times, sir, many times we have two large turbine hulls in the shooting area. Many times.

    DR. ANIGSTEIN: Sure. I'm not disagreeing with that. I am simply saying you would unload it with a crane. That was my whole point.
CHAIRMAN ZIEMER: Okay, other questions here? Okay, then are we ready to move -- oh, another comment?

DR. ANIGSTEIN: Yes, I am going down the list of Dr. McKeel's --

CHAIRMAN ZIEMER: Oh, okay. Finish up your list.

DR. ANIGSTEIN: So okay, the question is: the point that Dr. McKeel raised about the 80-curie source. Yes, I have seen some people saying that it was there. Several other workers who gave us extensive information on other things said it was not there. It was not there during that period.

So we have it on record, recorded interviews that they said, no, I knew nothing about such a source. If that source had been there, I would have known about it. I don't believe it was ever there.

So we have to make a judgment. And the fact that it would have been difficult for the Commonwealth facility to have obtained
an 80-curie source without an AEC license, and we could not trace where it came from. We even went to the extent of saying, well, maybe they got it from another GSI facility and it was like a transfer in between facilities, wasn't legal but maybe they just did it. There was no other GSI facility that had such a source.

So we just believe on the weight of the evidence that it was highly unlikely.

DR. McKEEL: Well, Dr. Anigstein, this is Dan McKeel.

DR. ANIGSTEIN: Well, let me finish.

DR. McKEEL: Why did you model it in 2008, if you didn't think it was a valid source?

DR. ANIGSTEIN: Excuse me?

MEMBER BEACH: He wanted to know why you modeled it.

DR. ANIGSTEIN: Back in 2008, we didn't know that. We hadn't gotten the AEC
records. We got the 80-curie records --

(Simultaneous speaking.)

DR. McKEEL: That means you should have accepted the worker's testimony.

DR. ANIGSTEIN: The information was always contradictory. Some people said yes. Some people said -- we heard in my interview with the workers back in 2007, I heard there was an 80-curie source, so I put it into the model. I later learned that the 80-curie source came after the covered period. And several workers said it was not there earlier. Some said it was. We just made that judgment.

CHAIRMAN ZIEMER: Well, we have had these discussions before. We know there is conflicting testimony on that source. There is also some conflicting testimony on presence of the iridium source. So we have both on the record.

DR. ANIGSTEIN: Okay, I can go down the list. The radium-226, the small
radium-226 sources, the analysis that was performed, certainly the analysis that SC&A performed is a bounding analysis. It already, whether occasionally or frequently the sources were taken out of the shooting room, the one radiographer said it happened very rarely. As long as NIOSH has now adopted a policy and they will assign the maximum dose for any given period to all workers, it is irrelevant. Because the same person that said they shot outside the shooting room also said they set up a two mR per hour boundary so the workers would not be exposed to -- they were actually exposed to a higher dose rate from that radiographic room in 206 -- in Building 6 if they happened to be right outside the door.

And both Dave Allen and I independently analyzed okay, let's say nobody is watching the store and sometimes the worker is going to cross that boundary. We analyzed. We calculated the doses. They are small. They are very small additional doses. You
know, no worker -- it is highly unlikely the worker will deliberately go and say here is a nice place. I'm going to sit on top of the source and have my lunch. That is ludicrous.

DR. McKEEL: Actually, there is testimony that in fact people walked through there all the time when the source was in there.

DR. ANIGSTEIN: Well, the same person would not have been next to, staying for eight hours next to that source. They might have been walking past it, and we accounted for that. And it is a very small additional dose, and it is far less than the limiting dose to the radiographer.

DR. McKEEL: Well, once again, I have just got to put on the record --

DR. ANIGSTEIN: You may not believe our analysis, but they are on record. They have been reported by NIOSH. They are reported by SC&A.

DR. McKEEL: I don't think the SEC
issue is whether SC&A can calculate that dose. And that is not -- the thrust of my comment was that NIOSH hadn't modeled it correctly.

DR. ANIGSTEIN: Yes, they have.

DR. McKEEL: Oh, okay.

DR. ANIGSTEIN: And the point is it is limited. It is limited by the dose to the radiographer. And then the next item, the iridium-192 source, it would have been, again, as I recall, would have been even more difficult for GSI to have obtained an illegal iridium-192 source. There would have been no point to it because it is only good for a few months, then it has to be sent back to a facility that has a nuclear reactor and they will take the iridium metal and will re-irradiate it to refresh to boost up its activity so it can be used again.

And all of this was going on illegally, hidden from the AEC, you are having a criminal enterprise --

DR. McKEEL: Dr. Anigstein, if I
hadn't h've gotten those 1,016 pages of NRC 2010-0012, you wouldn't have even known about a lot of the sources that were there. You wouldn't have even known about the radium-226 sources.

DR. ANIGSTEIN: As it happened --

DR. McKEEL: I showed you, I sent the Work Group an excerpt from the 1968 renewal application from GSI that said this site was licensed for iridium and cobalt. And the reaction was, oh, well, that was past the covered period. But actually if you think about the words, it didn't say when it was licensed. It just said it is licensed for.

DR. ANIGSTEIN: It is licensed as of the moment.

DR. McKEEL: I am saying that plus I gave you four new worker affidavits.

DR. ANIGSTEIN: Right.

DR. McKEEL: So, again, if you ignore that and disbelieve that and your argument about the half-life and not being
practical, I just point out to you that you 
all easily accept that St. Louis Testing had  
an iridium-192 source.  

    DR. ANIGSTEIN: Why not?  
    DR. McKEEL: You haven't gotten  
their license. You haven't looked at that. 
    So maybe if you tried harder, you  
would get the GSI iridium-192 source license.  
    DR. ANIGSTEIN: Okay.  
    DR. McKEEL: I can't do  
everything.  
    DR. ANIGSTEIN: Dr. McKeel, number  
one, just for the record and I haven't said  
this before, I did go to the NRC and made --  
and requested information on GSI.  
    DR. McKEEL: I understand that,  
but you didn't get the records.  
    DR. ANIGSTEIN: Just a moment.  
Let me finish, please. They told me that they  
have already fielded such a request from you. 
    They gave me your name and said they had  
already searched all their records and they
found nothing.

Consequently, I didn't bother. I said why waste going through the paperwork if they have already told me they already made that search. Now the reason they found nothing is that it had the incorrect name. Your original request to them was under General Steel Castings. They searched that name. They got nothing.

When I asked them about General Steel Castings or General Steel Industries, they said they already searched for it, and I did not pursue it only for that reason.

Now I find out you went back and used the correct name, which I think you deserve credit for, but it is not that we didn't think of it. We were thrown off the trail by your original request under the wrong name.

CHAIRMAN ZIEMER: Well be that as it may, let's proceed here. Any other comments, Bob, on any of the other issues?
DR. ANIGSTEIN: Yes. Well anyway and as far as the iridium-192 going on, we have a continued -- in the records which you finally obtained, there was a continuous sequence of license amendments. The original license, amendment one, amendment two, amendment three. There are no missing numbers. And the first one that mentions the cobalt-80 -- the 80-curie cobalt-60 source and mentions iridium is the amendment that was issued in 1968. The previous, the one number just before it does not mention that and mentions only cobalt-60 not to exceed one curie.

My personal opinion is what they obtained was a camera, which means a big lead shield with mechanism for the sources to be removed -- to stick out and be retracted. And that camera was actually designed both for cobalt-60 and for iridium-192. I forget the name of the company now that made it. It had two channels, and there was one for each
source. So having a camera that could hold both, they apparently decided that they might as well, in case they want to in the future have it, they are licensed for it. But that was only in 1968.

DR. McKEEL: Well I would suggest that that one license that's after the cobalt-60 license, that could have been one license. But for instance, when I was involved with the Dow SEC, they had numerous licenses.

DR. ANIGSTEIN: That's not true.

DR. McKEEL: And so they could have easily had a different license that is not recoverable by DOE, not recoverable by NRC, which many of their records are not. So once again, we have made this point in many other scenarios to the Board that the absence of a particular record does not mean the record never existed.

It doesn't mean it did exist but against that and using that reasoning you also have to deny the testimony of a number of
people, not just the gentleman that Dr. Ziemer interviewed and later retracted and said he meant cobalt instead of iridium, but we have other people who made affidavits about there being a GSI iridium source on different occasions over a long period of time from the 1950s forward. And I am saying that to be claimant favorable, if you really believe that that is what the job is, then the claimant favorable thing to do would be to calculate those doses and show that you can do that.

And, again, I view that as the job of NIOSH. So my statement still stands. I don't think they have done that, and I think they need to do that.

CHAIRMAN ZIEMER: Okay, Bob, any other points?

DR. ANIGSTEIN: I think I will stop.

CHAIRMAN ZIEMER: Okay.

MR. RAMSPOTT: Dr. Ziemer?

CHAIRMAN ZIEMER: Yes.
MR. RAMSPOTT: John Ramspott. If I may, on the one topic Bob mentioned, the radium source.

CHAIRMAN ZIEMER: Yes.

MR. RAMSPOTT: Just to set the record straight or publicly spell it out a little bit, the gentleman that said the radium was seldomly used outside the building was a part-time radiographer who worked primarily on weekends. And the gentleman who everybody acknowledged he actually was that gentleman's supervisor, ‘identifying information redacted’, told us on record at the last Work Group meeting, I believe, that they used radium any time they needed to. They used any of the sources, the small sources, anywhere in the plant, they could do it.

He is also the gentleman who said yes, I set up a perimeter. Then the guy who was teaching me the ropes, we both left. We went and did our other jobs. So setting up a perimeter is only as good as if you are there.
watching it.

And then the other item that he confirmed was the radium source was actually stolen or taken out of 10 Building. He actually had to go report it to upper management and that is when the big search started for the missing radium plumb-bob. It was radium that was used in the plumb-bob.

So to say the sources are pretty much used in the 6 Building radiograph room, that is far-fetched and totally wrong.

CHAIRMAN ZIEMER: Okay, thanks John.

MR. RAMSPOTT: Thank you.

CHAIRMAN ZIEMER: Okay, I would like to move to the matrix, if you would pull that out.

There are ten items in the matrix, one of which we had previously closed. We have a summary that SC&A added on page five where they talked about the importance of the issues and highlighted Issue 1 and 6. They
also indicated that they recommended closing Issues 4 and 5, although in your narration you also made a similar recommendation for 2 and 3. So those are in there. And 2, 3, 7 through 9 are identified as being of medium, what's the term, importance, whatever that means. It is kind of an arbitrary term.

I think we will just go through them in order, even though you have 1 and 6 as highest importance. I think that is easier just to go through them in order and see what questions we have and what issues are still opened up.

Issue 1 had to do with monitoring data or more particularly what was identified as lack of monitoring data for the early years, which would be '53 to '63, maybe late '62. The cutoff may not be quite so clear. But in that time range. And during that period, you have the betatrons in use and you have the radium radiographic sources being used.
DR. McKEEL: And you have the iridium.

CHAIRMAN ZIEMER: And the petitioner also indicates they believe that iridium was used at least in part of that period.

Now as I understand SC&A -- I am going toward the end of the matrix here, SC&A say that they believe it is possible to reconstruct doses during the early years using the bounding calculations. In this case, they would use the bounding calculations for radium for all the workers and then you would use, I guess, the betatron values for the betatron workers.

MR. ALLEN: It was actually just every scenario. We picked the highest essentially is what is going to be.

CHAIRMAN ZIEMER: Every scenario of the --

MR. ALLEN: If the radiography was going to give you more than betatron or layout...
worker --

CHAIRMAN ZIEMER: Right. In other words, if the person for a particular organ --

MR. ALLEN: It would be for a particular case.

CHAIRMAN ZIEMER: -- or for a particular case, if they got more from the dose assigned by the radium model, you would assign that even if they were a betatron worker.

MR. ALLEN: Yes, because I don't think it was ever --

CHAIRMAN ZIEMER: It wouldn't be distinguishing between them.

MR. ALLEN: I don't think you can -- it would be pretty tough in probably any time frame to distinguish a betatron operator from source radiographer. I mean they did some of that interchangeably. Some concentrated on betatron, but they did get a little bit of source and most you just flat wouldn't know.
CHAIRMAN ZIEMER: Okay.

DR. MAURO: A little qualifier here, and Bob certainly --

CHAIRMAN ZIEMER: Well there also is, part of your recommendation is that the '53 through '56 period you say it is not clear that bounding exposures can be assigned during that time period. And I certainly want to ask how do you see the first three years of that as being different from the next five or six?

DR. ANIGSTEIN: Okay, the main reason being that we have next to no information during the first four years. However, starting with '56 we have the one gentleman whom we interviewed, who gave a very good account. He did the radium radiography. He gave a very clear description of how it was done. And he turned over his accumulated exposure records.

We started by looking at it and carefully he recalled coming, he said he had come to work at GSI. He was laid off. He
went into the Army. He came back in '56 and went back to work for GSI. All right, the earlier years he had not done any radiography. Later he did.

But his record starts with -- it was produced in 1962 when the Nuclear Consulting Company came onboard and they applied for the AEC license. So I guess a part of the process they produced this record and they looked at -- they just said records. So they must have had earlier records which they examined and they had 18 quarters. So if you back calculate, this was done early in '62 so it was not a full quarter again. So 18 quarters would be four and a half years. So this would put us into the middle of 1957. So therefore it was most likely that this person started, he had other duties at GSI, started doing radiography in 1957. So that just seems like a good break point.

And by using his exposure record and taking into account the fact that he
worked most weekends one or two days. He said he worked as much as he could. He didn't say he worked every single Saturday and Sunday all year, but he worked most weekends and often more than one shift during the weekend.

So if you can take his record and then prorate it to a full-time worker, you come with something about, my memory of the record, something up to 20 rem a year could have been. So that is one piece of evidence.

The second piece of evidence is the statement made during a site visit made to the AEC inspector that they have maintained records ever since they had this film badge program going back. We know -- we have good evidence it was there in 1953 because we have a photograph taken in 1953 of a betatron operator, and it very clearly appears that he is wearing a film badge on his belt.

And they said that during that period the then applicable -- they were very careful to qualify that each year they kept
track of what the AEC rules were, even though it didn't apply to them and they made sure that they stayed within the limits for that year. So at one point it was 15 rem and then later on it was essentially 12 rem because it could be 3 rem a quarter. So they said they always stayed within that. And they said they were never exceeded, which led to the possibility that they might have reached somewhere near that limit and on average for 25 percent. So I take that as a second piece of evidence saying during these years it was probably 12 rem would be a good upper limit. And that is within the range of the extrapolated readings from this one person who worked on the weekends. So that was the second piece of evidence.

And the third piece of evidence is the model which I showed earlier my diagram of that room where I modeled here is the man -- well the source is inside a deep well inside a lead shield so -- a little external radiation.
He lifts it out, holds it four feet away from his body, brings it in, puts it down next to him, puts it back. In-between shots he is in that concrete room but without any steel shield and that comes out to about 12 rem a year.

So when you get that much coincidence, you say you know, that looks like a pretty robust model.

And prior to the record to the verbal testimony of this gentleman and prior to this record, we really don't have any information. We still say, yes, they probably didn't exceed the limits, but that is only one leg of a three-legged stool and now we have all three legs.

And you can say, well, can you trust their testimony. They would not have likely lied to the AEC inspector when he could simply say is that what you are telling me? Let me see those records. So it seems unlikely that they would have. They
volunteered that information. They weren't required to give it because the radium use was not under AEC control.

All in all it seemed like a very believable story that from mid-'57 to somewhere, you know, we can talk about the exact number but something on the order of 12 rem from mid-'57 to mid-'62, it would be a five-year period, would probably be bounding. Starting with May '62, you have the cobalt-60 sources, which were much more tightly controlled that were using these lead shielded cameras, the exposures were much lower. And as a matter of fact, this gentlemen's film badge records for as soon as the cobalt-60 sources dropped dramatically from a rem a year to a millirem a year.

And then if we just say in rough numbers let's consider, even though they started using the cobalt in '62, let's assign the annual dose for all of '62 the same as for the previous years. And then in '63 already
you have the betatron. True, it is toward the end of the year but if we just say this time, we don't know exactly when, let's assign it for the full year. And we have again, by this model that I showed you a little earlier, 9.2 rem -- 9.2 R per year.

So all of those periods are covered and with very claimant-favorable exposure estimates. And so that would seem to be a good break point.

CHAIRMAN ZIEMER: I will add one comment. I went back and looked at Dr. Konneker's letter which is part of the -- I think January '63 was the date on it. It was part of the application for the AEC license.

DR. ANIGSTEIN: Well he followed it up with a survey.

CHAIRMAN ZIEMER: Yes, but --

DR. ANIGSTEIN: But the license -- they got the sources in May, I believe in May of '62.

CHAIRMAN ZIEMER: But there is a
statement in his letter that says and he is
talking about the training courses and the
film badges. He says the training course has
been used successfully for 15 years and the
published dose limits were followed. The
published dose limits --

DR. ANIGSTEIN: Yes, that is what
I said.

CHAIRMAN ZIEMER: -- these are
NCRP or --

DR. ANIGSTEIN: They meant AEC, I
believe.

CHAIRMAN ZIEMER: Well it could
have been AEC also.

DR. ANIGSTEIN: In another place
they --

CHAIRMAN ZIEMER: If you go back
15 years, yes it could be either one. It says
the published dose limits were followed. And
it also said no one has exceeded these limits.

Now if he goes back 15 years from
1963 --
DR. ANIGSTEIN: I see.

CHAIRMAN ZIEMER: -- you are actually back to '48 --

DR. ANIGSTEIN: Right.

CHAIRMAN ZIEMER: -- which is prior to this date.

But all I am saying is that Konneker suggests that whatever that program was was being followed earlier.

DR. ANIGSTEIN: Oh, okay.

CHAIRMAN ZIEMER: That is all I am saying.

But there is not any -- you have some sort of independent evidence. Two things. You have that person's film badge records --

DR. ANIGSTEIN: Yes.

CHAIRMAN ZIEMER: -- and we do have the photograph of '53 showing or '56 --

DR. ANIGSTEIN: 1953.

CHAIRMAN ZIEMER: Yes, '53.

DR. ANIGSTEIN: And also I have,
you are going by Konneker's letter which I must have -- I probably -- I'm sure I saw it but I was going by a part of the AEC application where they had made this statement to the AEC, where the person in charge of the program, a GSI official, made that statement to AEC that they've always followed -- that they followed the AEC rules. They followed the AEC limits.

CHAIRMAN ZIEMER: Right. This letter was in connection with a survey that Konneker did.

DR. ANIGSTEIN: Yes. It is not contradictory.

CHAIRMAN ZIEMER: Right.

DR. ANIGSTEIN: As a matter of fact, I think it reinforces it.

DR. McKEEL: Dr. Ziemer, this is Dan McKeel.

CHAIRMAN ZIEMER: Yes?

DR. McKEEL: Let's see, my comment would be as follows. I really find it
astounding that we are basing an argument that
you can bound doses based on letters and a
photograph. I'm sorry, I just have to put
this on the record.

The Board has given SECs to many
sites that have far more hard film badge data
with neutrons and everything. This is really
ridiculous.

I'm sorry. I understand words and
what they are meaning, and I hate to use a
term like that, and I am using this in terms
of scientific proof and good science. This is
terrible.

You are saying that one man's film
badge records. You can't even substantiate
the program. You don't have any other
reports. It happens to be this one fellow
volunteered this material to us and we gave it
to you. That's fine.

But to base an entire seven years
on that and then to say that to base it also
on Dr. Konneker's letter, if Dr. Konneker was

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accurate, then where is all that data? You know, did it just go away? Did it vanish in thin air? There is no evidence of that film badge data. And to say that a letter that a self-serving company is providing with their license application is absolutely ridiculous.

Now I know, as a matter of fact, from interacting with the Hematite site in the early days, back in the early '50s and so forth, that they were required from day one to hold on to their film badge records. Yes, the AEC may have gotten a copy, but that site had to hold on to their own film badge records. And what is totally missing, what is totally absent is any evidence that that data actually existed at GSI.

So when Dr. Konneker says they have been having a program like that for 15 years, I'm sorry. We had an opportunity to interview him. We had a deal set up. Dr. Anigstein was going to call him; Dave Allen was going to interview him; and I was going to
listen in. That interview was aborted. Dr. Anigstein had a talk with Dr. Konneker, but not Dave Allen, and I wasn't even allowed to participate other than to listen. And I didn't even get that opportunity.

But if I had talked to him, I would have asked him questions like that. You know? I mean, I don't think that stands up at all.

And I will just point out another thing. We have direct testimony from 'identifying information redacted' is one and other workers who absolutely contradict that idea that there were annual AEC training courses. There was not. There was a lecture that Dr. Konneker gave at Washington University that 'identifying information redacted' said he attended with three other supervisors. The other three supervisors flunked the written test, and he passed.

But the point is that that is the only evidence we have on the record of any
worker ever taking a written test.

Now yes, does the license application say that that was done all the time? Yes, it does. Is there any proof that it ever happened? And there were men who lived back in that era. No, there is not. "identifying information redacted" was the only one. He said there were three people there.

So I think that to accept that kind of data, I hope this Work Group won't do it, and I am going to argue until the last vote is cast that the full Board does not accept that kind of evidence.

I think the fact is you have no hard evidence from 1953 up through 1962 that would stand up in court. And an n of one to base seven years of denying an SEC on is just not acceptable scientific reasoning, and I hope you won't do it.

I guess that's all I want to say.

CHAIRMAN ZIEMER: Okay.

MR. RAMSPOTT: Dr. Ziemer?
CHAIRMAN ZIEMER: Yes.

MR. RAMSPOTT: I would like to add something to that, if I could.

The worker, again I don't want to beat a dead horse, but you have got one worker's badge records. He is a part-time worker, part-time radiographer. And what do you do when he is part-time? They do look at these badges weekly. If he is not there and then all of a sudden he goes there on Saturday, his weekly badge report is going to look pretty good, even if he got a dose, a heavy dose because it would be divided by seven days instead of one. I mean, that is almost fictitious.

You know, and now I am actually looking at a magazine here in front of me, and I know I have provided it to SC&A, NIOSH, I think yourself. I can email it to you in about a minute. It is dated 1964. And the one source that you are referencing as a radiographer, it states in here these
Commonwealthers have just completed the first isotope training course. This is 1964 March. Here is Mr. Powers. Here is Mr. Leroy Dell. Here is all these guys in here. A whole crew. 1964. This guy that wrote a letter and said they went back to 1948 is on drugs. He's way off. I'm going to email this to you here in about a second. I will send it to Ted. It is 1964.

CHAIRMAN ZIEMER: I think we have seen that actually. The only point I was making, I think Bob was making, was not that we would base an SEC or not an SEC on these pieces of data. The question is whether or not there was any kind of monitoring going on during those early years.

MR. RAMSPOTT: It said the Commonwealthers pictured here were the first to successfully -- the first to successfully complete a 32-hour course in radiation health physics. This is 1964, and this is the first class. And it names all these guys we are
talking about. It names the guy with the massive dose that starts with a P. James Powers is in here. I mean, these guys weren't trained, not until `64. This is a magazine. I heard this, I can't even believe it. This is ludicrous.

See what GSI does? They say there was a building 1,000 feet away and they forget the one that is 40 feet away. They would do anything to get a license. I'm more upset because no one came out and looked. They wouldn't have put that new betatron where it was if somebody had come out there and looked. There is a reason the United States government and the Army put one out in a field.

CHAIRMAN ZIEMER: Okay, we hear you, John.

MR. RAMSPOTT: All right. Thank you.

CHAIRMAN ZIEMER: Any comment, Bob?

DR. ANIGSTEIN: Yes. First of
all, there was a letter or a report from Dr. Konneker that he had both instructed and tested, and there were eight workers who qualified on the very first AEC license -- or the second one. The first one didn't identify who the workers were.

And the supervisor was not one of them. He came later. And he said he tested them. There was nothing about he gave a course at St. Louis University -- at Washington University. I believe that gentleman in his memory is mistaken. The courses would have been given at -- he came to GSI. This is where he was hired as a consultant, and this is what he did. And he tested them, and he said there were eight that qualified.

The one going back 15 years they said in the various AEC applications that they had informal training; meaning you can take that whatever, on-the-job training, some discussions. They did not say they had a
formal program with testing.

Konneker put in the first formal program with testing. So if that magazine was '64, perhaps they were referring to something that happened slightly earlier. I'm sure I can pick out the dates. I haven't got them in front of me at my fingertips right now. I don't want to hold up the meeting for that. But there is nothing there that is contradictory. They had first informal training. He went over the records and said this was not, or he was told that there was nothing earlier. And then as far as the interview with Dr. Konneker, he basically said each and every question I really don't remember. He had no, I asked him do you have records, no. He didn't even remember where he got his film badges.

You get somebody 50 years later, a gentleman 90 years old sounded very, very feeble. He could barely get his words out. I did not think it was -- as a matter of fact,
Dr. Ziemer instructed me to contact him first to see if he had anything useful to say and then maybe we would set up a formal interview with NIOSH and Dr. McKeel participating. And there just didn't seem to be any point in bothering him. Nothing more he could tell us. He said at the end, I'm sorry I couldn't really help you.

CHAIRMAN ZIEMER: We can't beat that horse to death. You have the information that is in the document. You have heard the discussion. You have heard the points from the petitioners. You have heard the discussion here.

Let me ask the Work Group Members, what would you like to do on the Issue 1? Currently it is open. SC&A's recommendation is to accept the bounding for the second half of that period but not the first half I think is basically what I would interpret your recommendation to be.

DR. ANIGSTEIN: Yes, following '57
MEMBER BEACH: Well from my point of view, Paul, I don't agree with the recommendation that the second half, '57 to '62 is boundable. I think the evidence is too flimsy from my personal opinion, and I think that we should recommend that the SEC be passed for '53 through '62 on that issue for number 1.

CHAIRMAN ZIEMER: Through '62?

MEMBER BEACH: Yes. That is my personal opinion.

CHAIRMAN ZIEMER: Okay. And Wanda, what are your thoughts on that?

MEMBER MUNN: I have a tendency to believe we have adequate information to be able to bound, although we do not have the kind of records we would like to have for the early years. That is frequently the case.

We do, however, I believe have enough information about sources for those early years to be able to make a logical
bounding estimate.

I would like to hear what NIOSH feels with response to the SC&A recommendation. We haven't had an opportunity to really probe that.

MR. ALLEN: As far as my opinion on this, I actually think Bob laid it out fairly decent as to what the information is, and we have put our best estimate forward for those early years. And I am not going to pretend that it's iron clad 100 percent accurate, and I am also not going to pretend to know what is sufficiently accurate. That is unfortunately your job, Wanda.

MEMBER MUNN: Yes, I recognize that. But my job relies on the information that we have in front of us with respect to source terms. And it seems to me that we have done a -- does NIOSH not feel comfortable with the source terms that we have. We are fairly sure that we have covered those bases well. Correct?
MR. ALLEN: I believe we have got the source terms. I also, I still believe in our estimate as a reasonable estimate. Bob's opinion seems to be that we have information about practices, et cetera, back to '57-ish. My opinion was those practices didn't come out of thin air in '57. You know, they are based on what was going on prior to that. They didn't reinvent the wheel in '57. There is nothing that happened in '57 that we can find that really changed anything. So, yes, I am back extrapolating those practices to '53. That is where my opinion is.

And like I said, I know that is not bullet-proof. It is not 100 percent. Bob wanted something more significant.

DR. ANIGSTEIN: The only point I would make about that is the second-hand account of the missing radium source, which is there was some question to the validity because it was always, I heard this from someone. Everybody who said that gave an
account that they heard it from someone else.

But the best account was again from the same person whose badge records we have who said it happened when he was away in the Army and when he came back there was a lock on the door.

So, you might look at that as a watershed moment that they improved their security and not so much that the radiography practices were different but that perhaps the controls were a little more lax.

There is question in my mind whether that incident actually happened at GSI. We know it happened here earlier at Eddystone. Eddystone was the same company and it is not inconceivable that the word simply went to the Granite City facility saying you better watch your radium sources because here we had a case and the word got around. And then second, third-hand next generation of workers heard about it and thought that it happened there. I'm just saying it is a
possibility.

MEMBER MUNN: Yes, I doubt that we have the information that can assure us of that one way or the other, although I do understand how stories of that type take a life of their own and spread from one site to the other, but I would not go so far as to say that is a probability here.

Even though we assume that that may indeed have occurred, I --

DR. ANIGSTEIN: In which case, there would be a reason for that being an SEC period because the controls were more lax than later.

CHAIRMAN ZIEMER: In either case, even if you had no information about either the lock or the one person whose records you have or the Konneker letter about the training and so on, the bounding is not dependent on any of those.

MEMBER MUNN: No, it isn't.

CHAIRMAN ZIEMER: My question to
SC&A and to NIOSH, I know NIOSH's answer, I guess you were only thinking of that in terms of whether or not the controls were inherently tighter and you would feel a little more comfortable about bounding under conditions where they were perhaps more controlled.

The bounding methodology would be no different in the first three years in the next six years if you went with bounding. Isn't that correct?

MR. ALLEN: That's correct.

CHAIRMAN ZIEMER: You are not dependent at all on any of those records that Bob has got --

DR. ANIGSTEIN: Exactly.

CHAIRMAN ZIEMER: -- or any of those letters, anybody's training program, any locks or lack thereof. Your bounding methodology is the assumptions about -- well assumptions, the idea that the radium when it was used outside the room was roped off. That is sort of inherent in the control issue.
MEMBER BEACH: That's an assumption also.

CHAIRMAN ZIEMER: Yes, it is. It is.

MEMBER BEACH: So what I heard though was the back-extrapolation that you would take data from '62 and back-extrapolate to the 1953 time period or that 11-year period.

MR. ALLEN: No, it is the portable sources, I'm trying to recall, I don't think it was really -- not sure I'm going to be able to remember this --

MEMBER BEACH: I just wanted to make sure I heard what I thought I did.

MR. ALLEN: It wasn't based on --

The data that we used was the scenarios the workers gave us as far as practices, et cetera, roping it off, that people walked through the barriers.

MEMBER BEACH: Right.

MR. ALLEN: The number data, the
values that we used that came after that was I think the only one we really used was the NRC document thing and it was 500-millicurie sources, which I don't think anybody has actually disagreed with that or anything.

And Bob you can correct me if my memory is wrong but from that and the fishing pole techniques, etcetera, it was all the worker information that we got on their practices and what we based our exposure estimate on.

Like I said, I don't know of anything that really changed in '57. We didn't use really film badge data or anything, if that is what you were saying from pre-'62 or anything. We just used the practices and the source terms.

MEMBER BEACH: I just heard back-extrapolate. So I wanted to make sure I understood what you were saying earlier.

MR. ALLEN: I think what I meant was back extrapolate the work practices.
MEMBER BEACH: Well that's fine.
I got that.

CHAIRMAN ZIEMER: John?

DR. MAURO: There is one thing I did want to say. I like the place that SC&A is in and NIOSH is in. I think that we have exhausted the fact-finding. What I mean by that is to try to bring to the table the history of this, including Dr. McKeel and all of the GSI folks what we did is collect facts and do calculations, explore the probe and try to place into a big basket everything we know. And I think you have it.

I don't think there is much more that your contractor or that NIOSH can tell you in order to collect more information that will help you make your judgments. Unfortunately, I think that, and I agree with everything I am hearing around the table, certainly there is some softness before 1962. And the way we see it, it is really soft in my opinion from '53 to '57 or '56; not so soft
from '57 to '62 and things get pretty good at '62.

And I mentioned this at one of our earlier meetings and I still feel that way. The difficult part is what you have in front you right now. This is the facts. This is what we have got. Now it becomes a judgment and it is almost a personal judgment. I don't know if there is anything more that we can do to gather any more information, do any more calculations, do any more surveys. Maybe but I have got to say I don't see it.

Now it is really a tough call. And in my opinion, Bob and I struggled with this, you know, can you go all the way back to '53 given the information? I walk away saying no. And the reason I say no was 'identifying information redacted''s testimony about his concern about lack of controls, the lost source that might or might not have occurred. And that is why I had this elbow in 1956 and '57 because things seemed to be soft,
very soft at that time.

But I can see someone saying, Wanda, yes, no we can go back, you know, for the reasons we all talked about. And I could also see someone saying from '57 to '62 that is not good enough for me.

So I could see. I'm trying to look at it through your eyes but I don't think there is very much more we can do. Sort of the card is now, as far as I am concerned, in your hands. There might be a couple of things you may want us to follow up on but I think we are almost there in terms of fact-finding.

MEMBER MUNN: To answer your question specifically, given the information that we have, given the understanding we have of the sources, and we are fairly certain of those, and given the understanding of the practices that were intact in '57 and afterwards, the bounding process is a perfectly legitimate one and certainly spreads enough umbrella to be sufficiently accurate,
in my view.

CHAIRMAN ZIEMER: For '53 to '62?

MEMBER MUNN: Yes.

CHAIRMAN ZIEMER: Because right now we are talking about --

MEMBER BEACH: Well SC&A has said they don't think '53 to '56 is doable --

CHAIRMAN ZIEMER: Right.

MEMBER BEACH: -- but '57 to '62 is.

DR. ANIGSTEIN: Can we make a change? Can we amend?

DR. MAURO: Well we can do whatever you want.

DR. ANIGSTEIN: I would say that it is a little less firm, there is less evidence but I agree with Dave Allen that there is no reason to believe there was a change of practices. And it is basically this is something we wouldn't argue, neither John or I would argue very hard with the Board. I mean, it is not our place to argue but even
so, it is not impossible. It is not necessarily inappropriate to assign doses from the '53 to '56 time period, I agree, based on the same information. The information is a little more firm in the later period but there is no reason to really believe that it should have been different in the earlier period.

And even if say one person one time did take that radium source, I don't think that over a couple of days he would have gotten in excess of say 12 rem. And that would have been his only exposure because he certainly was not a radiographer, regularly exposed. So that was a single incident.

CHAIRMAN ZIEMER: Well actually if you have an incident where a worker with a claim says I took that source --

DR. MAURO: We could deal with it.

(Simultaneous speaking.)

MR. ALLEN: We actually did it at GSI but I was trying to leave it open for --

CHAIRMAN ZIEMER: The bounding is
not necessarily intended to cover incidents that either are known or can be identified by a worker.

DR. MAURO: Yes, I understand what you are saying but I saw that as a breakdown in controls.

CHAIRMAN ZIEMER: It is. And the wandering through the workspace is also. And the question was if that is sort of a regular practice and not just a one-time thing and some worker says you know I remember once walking through that, and so add that to my dose. But in a sense, we are adding it to everybody's dose. We are assuming all the workers wander through the radium sources.

MR. ALLEN: It is assumed that the boundaries aren't respected.

CHAIRMAN ZIEMER: This bounding that is being proposed is based on loose work practices.

DR. MAURO: Yes, that's true.

CHAIRMAN ZIEMER: And that is one
of the reasons that I personally am supportive of the bounding. I think the full Board has to weigh in on this.

You know, I am like you, John. I think reasonable people can disagree on this because we are working in an area where there is not a whole lot of confirmatory data. But unlike some other facilities, we do have good source term data. We know that there are the radium sources and we know there was the betatron. And by the way, if there was an iridium source actually being used, that would be easy to bound that in because it is going to behave. I mean, you would assume the same loose work practices and you would, my guess is if you did that, you wouldn't -- if you are working with the radium, you are not working with it, and vice-versa. So I am not even sure. It would be an interesting thing to look at. But in any event, I think you could bound it also that way.

Now we don't necessarily have to
close this right now but we sort of have to know where we are on each of these.

    I mean, I think -- I'm not sure what closing means on the matrix. Does it mean we all agree?

    MR. ALLEN: Well I kind of mentioned that the last time a couple weeks ago. I think there are some where we have reached, as John is saying, all the information we have got and all the analysis we are going to be able to do are out there. And reasonable people can disagree. Whether you call that closed or not, I think the fact-finding might be closed.

    CHAIRMAN ZIEMER: Well it sounds like SC&A is cautiously agreeing that you can bound or are you?

    MR. ALLEN: Reasonable people disagree.

    DR. ANIGSTEIN: I think the wording here is not simply to put '53 to '62.

    It does not -- we would not disagree with the
bounding approach even for that period.

                                           CHAIRMAN ZIEMER: Well okay, let
                                           me ask the Board Members. Do you wish to
                                           close this item or pursue it any further? I
                                           mean we can close it and not necessarily agree
                                           on the final recommendation on this.

                                           MEMBER MUNN: I don't know what
                                           else one could do.

                                           MEMBER BEACH: Well if there is no
                                           other work to be done, I don't think we need
                                           to leave it open.

                                           DR. ANIGSTEIN: Right.

                                           CHAIRMAN ZIEMER: Then we'll agree
                                           to close it.

                                           The next one, item two, incomplete
                                           monitoring of workers. Of course some of
                                           these are very related one to the other. I
                                           mean, we have discussed the fact that we have
                                           some film badge data that is useful for
                                           certain things but we are largely relying on
                                           the modeling for bounding. So the title line
                                           here SC&A says we believe that using
reasonable bounding claimant-favorable assumptions and the latest calculational tools, that it is possible to reconstruct doses over the period January '64 to '66. And this needs to be addressed by NIOSH in revision of Appendix BB.

Again, let me ask the Work Group Members what you believe.

MEMBER BEACH: I personally believe these should stay open until we see that that has been done. That is my personal thought.

MR. ALLEN: Can I make a silly suggestion on that?

CHAIRMAN ZIEMER: Yes.

MR. ALLEN: Would it be appropriate to transfer that to the Appendix Matrix or is that --

MEMBER BEACH: Oh, to the other --

MR. ALLEN: Yes.

DR. NETON: Dave makes a good point that if it is not considered an SEC
issue, it becomes a Site Profile issue and then this is a matrix for the SEC evaluation. And the Working Group feels that the issue has been addressed as far as SEC is concerned.

DR. ANIGSTEIN: Yes, that was already done with issue 10.

CHAIRMAN ZIEMER: Right.

DR. ANIGSTEIN: Which will be transferred. It wasn't resolved. It was addressed.

MEMBER MUNN: Recommend it be transferred.

MEMBER BEACH: That's fine.

CHAIRMAN ZIEMER: Okay, we will agree we are going to transfer this to Appendix BB.

Now in essence, that takes it off the SEC table at the moment. Now that doesn't mean that later it couldn't -- that doesn't preclude an SEC in the later years, depending on how this comes out. But for the time being it removes that later year.
Lack of documentation, high-importance one. It was of high importance.

MEMBER MUNN: Another transfer issue.

CHAIRMAN ZIEMER: This is similar. This has to do with the bounding in the post-radium era. SC&A agrees with NIOSH that bounding can be done and recommend moving this to Appendix BB and closing.

MEMBER MUNN: Agree.

MEMBER BEACH: I agree.

CHAIRMAN ZIEMER: Okay. Close this or move this to Appendix BB.

Issue 4 is the film badge dosimetry dependence on photon energies and exposure geometry. This had to do in part with the AP exposure press back and so on. There was a commitment from NIOSH that they would revise their assumptions and repeat the analysis but I think we had come to an agreement on this. Did we not?

DR. MAURO: You said this might be
in abeyance until I'm done?

    DR. ANIGSTEIN: We have the recommendation, my recommendation was that it be closed.

    DR. MAURO: That it be closed. Oh, okay.

    DR. ANIGSTEIN: Right.

    DR. MAURO: All right. I told you we are delayed until the Site Profile is revised. I was thinking in Procedures Subcommittee space.

    DR. ANIGSTEIN: No, the conclusion sentence is, "Whichever set of assumptions is used, it is clear that the betatron operator would not receive the bounding exposure and, therefore, it can be closed."

    DR. MAURO: Oh, okay. Sorry.

    DR. ANIGSTEIN: The layout workers --

    CHAIRMAN ZIEMER: The layout workers would have the higher values.

    DR. MAURO: It preempts this. I'm
sorry.

CHAIRMAN ZIEMER: Close?

MEMBER MUNN: Close.

MEMBER BEACH: Close.

CHAIRMAN ZIEMER: Close.

Issue 5, lack of validation of models of radiation exposure of betatron operators. This had to do with the use of MCNPX and some of the things we went through there. And then the modeling and use of the normalization with the film badges, versus just the modeling in part.

Bob says the discrepancy has now been resolved but numerically we are not seeing that quite yet because there is a couple things still out there. One of them -- well, I guess we are going to get some confirmation on the steel door issue. But the other one --

DR. MAURO: The control badge --

are you still --

MR. ALLEN: Well I might be wrong.
I was taking this one to be the kind of calibration for the validation they did in the beginning of that White Paper. That is based on the 1971 survey and the 80-curie cobalt source.

CHAIRMAN ZIEMER: Right.

MR. ALLEN: The lead shielding, et cetera, the best we can tell were in place at that point. So I think what you are talking about is the shot scenarios put together for the betatron itself, which come under the other ones that we already discussed, I think.

CHAIRMAN ZIEMER: Oh, yes. Okay, yes. This was just the calibration. I think we have agreement on this one. Don't we?

DR. ANIGSTEIN: I'm sorry, on which?

CHAIRMAN ZIEMER: This is number five.

DR. ANIGSTEIN: Yes, we think that we resolved -- there was a big discrepancy between the film badges and the model. And we
resolved it. We understand now why that was the case. So we don't think there is any more issue.

DR. MAURO: Well help me out a little bit. There are a couple of matters here and I might just be disoriented.

CHAIRMAN ZIEMER: This doesn't have to do with the actual assigning of doses to people. This has to do with, I think, with the use of the 80-curie source, calibration.

DR. ANIGSTEIN: No.

CHAIRMAN ZIEMER: No?

DR. ANIGSTEIN: I mean, let me give you a quick overview of this. Remember this goes back to 2008 in time for starters. October 2009 the matrix was done. So we have come a long way since then with our understanding.

At that time, there seemed to be discrepancies. Now we understand reasons for the discrepancy. We don't expect that the limit that the film badges would actually
represent the limiting doses that we calculate in the model because the model predicts the worst doses in the worst locations in the worst time. So the fact that there was a difference we now have a degree of comfort and we understand why there is a difference and why the model has already been modified.

One of the issues is that the main source of exposure actually was that residual radiation from the betatron and we have now pretty much have a better understanding of what it is, what it isn't. And so we just don't think there's an issue.

CHAIRMAN ZIEMER: Okay, close?

Close.

Issue 6, underestimate of external exposure of unmonitored workers.

MEMBER MUNN: Transfer to BB.

CHAIRMAN ZIEMER: Well, this is the actual bounding part. Right?

DR. ANIGSTEIN: Yes.

CHAIRMAN ZIEMER: And it is the
issue bounding in later years. And both SC&A and NIOSH are agreeing that they can bound in later years. We do still have some differences. And so I think we want to see what those look like.

I mean, we can transfer this to --

MR. ALLEN: Well that is why I suggested transferring because then it wouldn't be closed but it would be in the TBD.

CHAIRMAN ZIEMER: They would still have to show that they -- and if you didn't, this would reopen it for an SEC in the later years.

DR. ANIGSTEIN: Yes.

DR. McKEEL: Dr. Ziemer, this is Dan McKeel.

CHAIRMAN ZIEMER: Yes?

DR. McKEEL: I didn't hear you on Issue 5. Did you close that or what was the disposition?

CHAIRMAN ZIEMER: Issue 5, we closed that.
DR. McKEEL: Okay, thank you.

CHAIRMAN ZIEMER: Issue 6 would transfer, we all agreed to transfer to Appendix BB.

MEMBER MUNN: But Bob has something to say.

CHAIRMAN ZIEMER: Yes, Bob?

DR. ANIGSTEIN: We have a burning question.

CHAIRMAN ZIEMER: Yes.

DR. ANIGSTEIN: It is 2:45. Do you think we are going to adjourn at 3:00?

CHAIRMAN ZIEMER: Yes.

DR. ANIGSTEIN: Okay.

CHAIRMAN ZIEMER: Issue 7, dose reconstruction is not based on best available science.

MEMBER BEACH: In progress.

MEMBER MUNN: Or Appendix BB.

CHAIRMAN ZIEMER: Let's see. Well this was one where there was an actual error in a table or something. You were using the
wrong value for uranium surface dose rates or something. So it was scientifically an error. And they have agreed to correct it and the correction will be in the new -- it is strictly an error, an actual error.

MR. ALLEN: Math error.

CHAIRMAN ZIEMER: Isn't that right?

DR. NETON: Well, it all had to do with a new MCNPX.

CHAIRMAN ZIEMER: But now it has gone beyond that?

DR. NETON: Kind of morphed into this -- which version of MCNP to use.

CHAIRMAN ZIEMER: Okay, but originally it was just an error that you were going to correct.

DR. ANIGSTEIN: Now we found new --

DR. NETON: But it is still the similar issue which is using the best available model in time.
DR. ANIGSTEIN: I noticed that Dave's latest calculation was using version 27E.

MEMBER BEACH: Which had some errors, too, didn't it?

DR. ANIGSTEIN: Not really. The latest one is 27. Oh, this is.

No, there is no problem.

CHAIRMAN ZIEMER: Okay, we are going to transfer this one, also now, I believe, to Appendix BB.

MEMBER MUNN: I guess I should raise a process question here. We notice we have indicated that it is in progress, which is what we have done in the past when we transfer things from one to the other. In other venues, that is what we have done in the past. What are we doing to do here?

CHAIRMAN ZIEMER: It is in progress.

DR. NETON: It will be closed in the SEC matrix. So it would transfer as in
progress in BB.

   CHAIRMAN ZIEMER: Right.

   MEMBER MUNN: That is what we have done in previous cases.

   DR. NETON: That makes sense.

   MEMBER MUNN: So we keep it alive until it is done completely.

   CHAIRMAN ZIEMER: Issue 8 had to do with the model again, incomplete model use for exposure assessment. A lot of these are interrelated, I guess.

   The latest one getting down to the assumptions and how that affected neutron dose. And I think both of you again have agreed that you can model this and you are kind of fine-tuning that model. Right?

   MR. ALLEN: Yes.

   CHAIRMAN ZIEMER: So this one should also transfer.

   MEMBER MUNN: Transfer to the Appendix.

   CHAIRMAN ZIEMER: I believe the
underestimate of the beta dose is going to be the same.

MEMBER MUNN: Yes.

CHAIRMAN ZIEMER: Transfer.

MEMBER BEACH: On this one you questioned the use of 26E but you just said they used version 27E.

DR. ANIGSTEIN: No, only for the latest. Not for the betas.

MEMBER BEACH: Okay. With the others, okay.

DR. ANIGSTEIN: We haven't mentioned the beta. It is just a matter of rerunning it.

CHAIRMAN ZIEMER: And number 10 we have already done.

DR. ANIGSTEIN: Right.

CHAIRMAN ZIEMER: Now, I want to go back and on Issue 1, I think we are at a point where we can probably go forward to the Board on the early years. The Work Group, I mean, we have a 2-1 split but that's alright.
What we would do would be to tell the Board that -- all of this other modeling is later year stuff. The rest of these items that we transferred. But the early year section is what it is. I don't think -- we have agreed there is nothing more we can really do on that and we can present that to the Board.

And I will work on a summary and I will ask the Board -- you all know I try not to bias these things. I try to be fair to these minority reports.

MEMBER BEACH: I will get my say is what you are saying.

CHAIRMAN ZIEMER: My report is a minority report. The other two are women, see.

(Laughter.)

CHAIRMAN ZIEMER: In any event, I will try to summarize where we are on this at the full Board meeting. And then we will --

MR. KATZ: And then you will make a recommendation.
CHAIRMAN ZIEMER: -- make a recommendation.

Dan, are you still there?

DR. McKEEL: Yes, sir.

CHAIRMAN ZIEMER: I will want you to be prepared also to make a case for the early years, focus on that for the SEC. Okay?

DR. McKEEL: Of course.

CHAIRMAN ZIEMER: I'm not trying to talk you into it, Dan. We are going to I think focus on the early years. They have a process question.

DR. NETON: Yes, I just saw the Working Group transfer all of the SEC issues over to the Appendix BB Site Profile Issues.

CHAIRMAN ZIEMER: All except one.

DR. NETON: So I am a little bit confused, except for number one.

And since they have been transferred, I am wondering why -- does the SEC Work Group continue to remain open to
study them? Then I question why you transferred them over the Appendix BB Work Group because --

DR. ANIGSTEIN: It is the same Work Group.

DR. NETON: Well there is a fundamental difference here, though. If it is a Work Group that is reviewing Site Profile issues, that sort of implies that the determination has been made that these are not SEC issues.

MEMBER BEACH: That is still in question also.

DR. NETON: Well I don't know why it is. I mean, if we all agree that they are Site Profile issues and they are tractable problems, to use SC&A's language, why would we leave these open? Otherwise you are going to go to the Board and say we made a recommendation for this first early period or we are going to make a recommendation and then these just stay open forever. We will just
have to go back and rehash them as SEC issues all over again.

At some point, the SEC Work Group has to come to determination whether these are tractable issues and are not SEC issues. To leave them open indefinitely, it is going to be very painful.

You can do what you want I suppose but in other Work Group situations, it is normally you sort of triage them. Are these SEC issues or Site Profile issues and then you decide to make a recommendation on the SEC unless you feel it is expeditious just now to move this first one forward and continue to study these, in which case I think they need to come back from the Work Group and stay on the SEC Matrix as open.

CHAIRMAN ZIEMER: Well we could do that with them. I think that the transferring that we did was based on an agreement that they were tractable.

DR. NETON: Right, which implies
that they are Site Profile issues.

    CHAIRMAN ZIEMER: Right.

    DR. MAURO: In our position, SC&A's position, all betatron issues are tractable and it is just a matter of bringing out details. Everything else with regard to the radium, iridium, cobalt, we feel that the only place where there is some subjective judgment is that there is only '53 to '62, a big time period.

    SC&A's position is we believe that they could be bounded and are tractable from '57 or '56-'57 to '62. We feel that they may not be tractable for various reasons. And this is all we can give you from '53 to '57.

    So the way we see it is the only real SEC issues are can you reconstruct the doses with sufficient accuracy from '53 to '57. That is SC&A's position.

    Now, but that may not very well be our position.

    MEMBER BEACH: Well that may not
be the thought of the Board either.

   DR. MAURO: That is not your position. Exactly. Right.

   MEMBER BEACH: But unless you bring it to the Board and explain that -- we can fill it all in. And I'm not so sure I totally agree with that either.

   MR. ALLEN: I guess my question was you keep talking the early years. Are you not going to make a recommendation on the later years, then for this Board meeting?

   MEMBER BEACH: At some point you have to make a recommendation. The Board has to --

   DR. NETON: But we have transferred them all to Site Profile issues. That is why I am confused.

   MR. ALLEN: That's what I thought your question was.

   DR. MAURO: And you are right.

   MR. ALLEN: It seemed like there was almost some agreement.
CHAIRMAN ZIEMER: Well haven't we done that on other SECs where we have left open the study?

MR. KATZ: Well if you make the judgment that they are tractable and they are TBD issues, you have made the judgment with respect to the petition as to where they stand and you can make that recommendation to the full Board.

CHAIRMAN ZIEMER: For the whole thing.

MR. KATZ: Yes, for the whole thing. That doesn't mean that you don't follow up on the TBD issues as a Work Group. And the Board of course will do what it will do going forward on all of this. But you might as well, if you have made the decision, you all did just go through this process of saying this is a tractable TBD issue. This is a tractable TBD.

But in effect you made a decision as a Work Group, you might as well recommend
on the whole kit and caboodle to the Board and then of course the Work Group can follow through with TBD and the Board of course can say go dig more on this or that if they want to. But you might as well put the full plate in front of them.

MEMBER BEACH: I agree with that.

DR. McKEEL: Dr. Ziemer, may I make a final comment?

CHAIRMAN ZIEMER: Yes, you sure can.

DR. McKEEL: Okay, well the final comment of the co-petitioner is that I could not be more disappointed by this decision nor could I disagree more with the shunting of many of these issues over as Appendix BB issues, which I do not believe they are exclusively.

The second thing I have got a comment on that I am extremely disappointed about is during the four-year course of the deliberations of this Work Group we have lost
two members. Mark Griffon, as I understand it, resigned on his own volition. And Dr. Poston has missed the last four meetings and isn't even mentioned during roll call as trying to attend the meetings.

So essentially what I feel is that I have spent a large major fraction of my life providing information and interacting with this Work Group and trying to be an honest broker between the Work Group and the workers and site experts. And I really feel that the two members who voted against an early SEC have let us down.

I also want to say that I think it needs to be said for the record that SC&A was not definite about their recommendations. They made a sort of piece of advice to the Work Group that well, the 1953 to '57 data was soft. And you know, but they would not disagree with bounding the doses for that period. Well that is essentially just avoiding a recommendation altogether and I
don't think that is their job.

I also want to say that despite all of the protests to the contrary, I believe that when this complete record is looked over, and I certainly hope it will be, that many people will find that SC&A did much of the work that NIOSH was supposed to be responsible for and that NIOSH was allowed an inordinate amount of time to rework their models over, and over, and over and in particular this last period of time of 18 months with the Path Forward.

And now essentially all of the SEC issues magically have now been declared Appendix BB issues. So not only will I address the Board about the way I feel about it, but I am going to be vigorous in my defense. This was a very bad decision on the part of the Work Group. I respect your right. That is your right to do exactly as you see but I think it is a cloudy decision. And frankly, I welcome taking it to the full Board
and making my case to them.

CHAIRMAN ZIEMER: And that's fine, Dan. And I certainly will expect you to make a vigorous defense and I will do the same for the Work Group. And that's fine. We will each try to make our case.

But we will let the larger Board look at the issues and then hopefully they will come to a conclusion or they may ask us to do additional work. We will throw it in their lap at that point.

But thank you again for your input and John and Mr. Dutko and others. We are going to adjourn at this time and then plan to see you at the full Board meeting. Thank you.

(Whereupon, the above-entitled matter went off the record at 3:00 p.m.)