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UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON THE MEDICAL USES OF ISOTOPES

(ACMUI)

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OPEN SESSION

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TUESDAY

SEPTEMBER 10, 2013

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ROCKVILLE, MARYLAND

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The meeting was convened in Room T2-B3 of Two White Flint North, 11545 Rockville Pike, Rockville, Maryland, at 10:30 a.m., Bruce Thomadsen, Ph.D., ACMUI Chairman, presiding.

MEMBERS PRESENT:

BRUCE THOMADSEN, Ph.D., Chairman

MILTON GUIBERTEAU, M.D., Vice Chairman

SUSAN M. LANGHORST, Ph.D., Radiation Safety Officer

STEVEN R. MATTMULLER, Nuclear Pharmacist

CHRISTOPHER PALESTRO, M.D., Nuclear Medicine Physician

MEMBERS Cont'd:

JOHN H. SUH, M.D., Radiation Oncologist

ORHAN H. SULEIMAN, Ph.D., FDA Representative

WILLIAM A. VAN DECKER, M.D., Nuclear Cardiologist

LAURA M. WEIL, Patients' Rights Advocate

JAMES S. WELSH, M.D., Radiation Oncologist

PAT B. ZANZONICO, Ph.D., Nuclear Medicine Physicist

NRC STAFF PRESENT:

BRIAN McDERMOTT, Director, Division of Materials Safety and State Agreements

PAMELA HENDERSON, Deputy Director, Division of Materials Safety and State Agreements

CHRIS EINBERG, Chief, Radioactive Materials Safety Branch, Designated Federal Officer

MICHAEL FULLER, Medical Radiation Safety Team Leader, Alternate Designated Federal Officer

SOPHIE HOLIDAY, ACMUI Coordinator

ASHLEY COCKERHAM, Alternate Designated Federal Officer

SUSAN CHIDAKEL, OGC/GCLR/RMR

DONALD COOL, Ph.D., FSME/DILR

SAID DAIBES, Ph.D., FSME/DMSSA/RMSB

SARA FORSTER, R-III/DNMS/MLB

CASSANDRA FRAZIER, R-III/DNMS/MLB

LATISCHA HANSON, R-IV/DNMS/NMSB-A

MICHELLE HAMMOND, R-IV/DNMS/NMSB-B

VINCE HOLAHAN, FSME/DMSSA

DONNA-BETH HOWE, Ph.D., FSME/DMSSA/RMSB

ANGELA McINTOSH, FSME/DMSSA/RMSB

GRETCHEN RIVERA-CAPELLA, FSME/DMSSA/RMSB

RONALD ZELAC, Ph.D., FSME/DMSSA/RMSB

MEMBERS OF THE PUBLIC PRESENT:

SUE BUNNING, Society of Nuclear Medicine and Molecular Imaging

ROBERT DANSEREAU, New York State Department of Health

WILLIAM DAVISON, University of Pennsylvania

LYNNE FAIROBENT, American Association for Physicists in Medicine

DEBBIE GILLEY, American Association for Physicists in Medicine

ANDREW McKINLEY, American Society of Nuclear Cardiology

MICHAEL PETERS, American College of Radiology

JOE RODGERS, Theragenics

MEGAN SHOBER, Wisconsin Radiation Protection

Section

MIKE STEPHENS, Florida Bureau of Radiation Control

CINDY TOMLINSON, American Society for Radiation Oncology

GARY E. WILLIAMS, Veterans Health Administration

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

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

(10:30 a.m.)

CHAIR THOMADSEN: Welcome to the second day of the ACMUI meeting for the fall and starting with Ms. Holiday discussing the ACMUI reporting structure.

15. ACMUI REPORTING STRUCTURE

MS. HOLIDAY: Good morning, everyone. I will be the first speaker for the open session for today's meeting, our final day of the meeting. And the first talk will be about the annual presentation for the ACMUI reporting structure. Today I will speak about our current reporting structure; give what we consider to be the annual review, which essentially is this presentation; go over our meetings; and allow for discussion.

So, as was presented during Ashley's presentation yesterday on what is ACMUI, this is our current reporting structure. ACMUI directly reports to the Director of the Division of Materials Safety and State Agreements, as does the medical team or the Radioactive Materials Safety Branch. And then, of course, our division follows under the purview of the Office of Federal and State Materials and Environmental Management programs, FSME. And then

we, of course, follow the EDO. And then the Commission is the higher governing body of the NRC.

So our current reporting structure, we had a teleconference in January of 2011 to make a recommendation as to whether the ACMUI wanted to continue to report to the Director of MSSA or to the Commission or to ACRS. This stemmed from the SRM that we got from the Commission to bring forth the discussion about the pros and cons of having the ACMUI restructured to, instead of reporting to the Director of MSSA, report to the Commission. So Ashley Cockerham drafted that paper. And it was during the teleconference that we brought forth these pros and cons and the ACMUI made the recommendation to maintain their current reporting structure, again, which is to report to the Director of MSSA.

Then we had a subsequent teleconference the following week. This was so that the ACMUI had enough time to review Ashley's paper. And from that teleconference, the ACMUI made a recommendation to have this annual review of the reporting structure. And I gave that presentation at last fall's meeting. So here again we're having our second annual review of the reporting structure.

Currently ACMUI meets here at

headquarters twice a year: once in the spring, which is usually in April or May; and then once in the fall, which is usually September or October. Approximately there are two to three teleconferences a year but only as needed or as directed.

A few members have voiced their opinions or their concerns that they would like to have more than two meetings face to face at headquarters a year. These are one of the items that we would like to bring forth for discussion and also to pose to the Committee as to whether or not you would like to continue to review this, the reporting structure, on an annual basis.

So now I would like to open that up for discussion.

CHAIR THOMADSEN: Thank you very much. Are you going to be coming back to any other presentations?

MS. HOLIDAY: Presentations?

CHAIR THOMADSEN: No?

MS. HOLIDAY: Just for the administrative closing.

CHAIR THOMADSEN: Okay. Fine. So the first question I think we should answer is whether we should be meeting more than the twice a year. Is

there discussion? People who feel that we should be increasing the number of meetings we have per year? Dr. Zanzonico?

MEMBER ZANZONICO: Pat Zanzonico. I don't see a need for a standing appointment, so to speak, for more than two meetings per year. There may be instances where there were some pressing matters that might require an additional meeting, but my impression is that two face-to-face meetings per year plus teleconferences as needed seem to address all of the matters brought before the ACMUI. So I would recommend maintaining the current frequency of meetings and teleconferences.

CHAIR THOMADSEN: Thank you. Dr. Zanzonico.

Other opinions? Dr. Langhorst?

MEMBER LANGHORST: I think maybe in light of the revision of Part 35, that additional ACMUI face-to-face meetings may be very helpful in going through that process of updating regulation and providing another public forum for discussion with the ACMUI in attendance. So I would make that point.

CHAIR THOMADSEN: Would you be just talking about additional meetings during a certain period of time or making a standing third meeting? I

think --

MEMBER LANGHORST: My point was

CHAIR THOMADSEN: -- what you're talking about right now is the standard.

MEMBER LANGHORST: Yes, a standing third meeting. I don't know for sure, but in the next year or two, I think we probably could use a third meeting.

CHAIR THOMADSEN: Thank you, Dr. Langhorst.

Other opinions? Dr. Welsh?

MEMBER WELSH: I might agree with what Dr. Langhorst just said. And perhaps the structuring is such that we have our standing two meetings and a third meeting that is on the books but perhaps optional or as needed.

I can say, for example, during those years where we were in the midst of the heat of all of the discussion regarding the medical events in permanent implant brachytherapy, there were many, many discussions, teleconferences, telephone calls, stakeholder meetings that certainly were longer than the traditional meeting we have here. So perhaps that could have been implemented during that slot.

So I am not opposed to having three

meetings a year. I just don't think that we would routinely use the three meetings per year.

CHAIR THOMADSEN: Ashley -- I'm sorry. Ms. Cockerham, can I ask, is it possible to set up ad hoc meetings of the ACMUI other than the --

MR. EINBERG: Should be directed to Sophie.

CHAIR THOMADSEN: Oh, yes. You're right there. I have to apologize. I was looking over there. So you weren't there. Ms. Holiday, is it possible to set up the additional meetings as needed of the ACMUI?

MS. HOLIDAY: Correct. There's always an opinion to set up as-needed meetings, such as we do for the teleconferences. The only distinction would be to say that it's meetings here at headquarters versus a teleconference.

CHAIR THOMADSEN: Mr. Einberg?

MR. EINBERG: Yes. Chris Einberg. The practical implications of that, though, are that we need to budget to bring all of the staff or the ACMUI members here. And so that is a large expense that we would have to budget for. So we would want to have some level of certainty that we would be utilizing that third meeting.

The other option is to have standing funding for a subcommittee to come in once a year to work on various items that may be of interest to the Committee and then report out to the full Committee during the two standing meetings.

And Ms. Cockerham has something she would like to add.

MS. COCKERHAM: In addition to the travel budget being, reserving this room, in particular, can be problematic. There are other advisory committees that use this room. And so the space that we have to choose from to accommodate a large committee and the public, that could be an issue on our end.

MS. HOLIDAY: Correct. We would have to work that schedule out with the other advisory committee.

CHAIR THOMADSEN: One more question is, how easy is it to do something on the order of GoToMeeting, a web-based meeting?

MS. HOLIDAY: It is very easy to do things on GoToMeeting or GoToWebinar.

CHAIR THOMADSEN: Now, I could ask, Dr. Welsh, do you think that a meeting on the web would be a useful substitute for a physical face-to-face

meeting?

MEMBER WELSH: Thinking back to the numerous subcommittee meetings for the medical event, the prostate implant medical event, discussions, I don't know. I suppose that the answer is yes.

MS. HOLIDAY: Dr. Thomadsen, this is Sophie. To follow that up, I will point out the full Committee was not in attendance for the June 18th teleconference, but we did utilize the function for GoToMeeting during that teleconference. So I guess I would ask those members who did participate if that was an agreeable option that we used or how useful that was for everyone.

CHAIR THOMADSEN: Anybody who was on that conference wish to give an opinion? Mr. Mattmuller?

MEMBER MATTMULLER: Steve Mattmuller. It's a substitute, but it's not nearly in my opinion as effective as everyone physically being here today. There are still some technological issues as far as everyone being able to participate or getting their comments in properly or in a timely manner in order for those comments to be recognized.

In a number of not just NRC GoToMeetings, other GoToMeetings I have attended, there have been some issues where if you're -- I realize there is a

difference in cost, but the other huge advantage when we all get together is that oftentimes the meeting continues across the street and there are some very productive discussions afterwards. And it also helps build rapport amongst the Committee members, too, because a lot of us are, especially when you first come into the Committee, it helps build your comfort level with your own fellow Committee members.

CHAIR THOMADSEN: When you did the GoToMeeting, were comments typed in or spoken? You are indicating with your fingers typing.

MEMBER MATTMULLER: Again, typing.

CHAIR THOMADSEN: Was there not verbal discussion?

MS. HOLIDAY: There was verbal discussion because it was a teleconference call.

CHAIR THOMADSEN: All the GoToMeetings I have been on have all, I mean, you had the ability to type in comments, but most of the discussion was all verbal like a meeting.

MEMBER MATTMULLER: True, but then you have to, there has been some frustration in getting the attention of the moderator to say "Steve Mattmuller," for example, "from Kettering would like to make a comment."

CHAIR THOMADSEN: Dr. Guiberteau?

VICE CHAIR GUIBERTEAU: I agree with Steve in that some meetings are better face-to-face, but there are many meetings that don't need to be. And virtually every organization that I belong to has WebExs or GoToMeetings. And there is a function on there where you can raise your hand to the chair of the committee and they can see who wants to speak so you don't really have to interrupt on the phone.

I think they can be very useful, but it also, if possible, might be good to see if we could budget an option if we really needed a face-to-face meeting. And for a one-day meeting, to come to Washington and have the meeting and go home is really a two-day away from our regular duties. And so, I mean, I think a mix of those would be an excellent, you know, set of options.

It took me a while to get used to the Go To Meetings myself because I like face-to-face meetings, but once you get used to it and for certain topics, it works extremely efficiently and very well.

CHAIR THOMADSEN: Thank you, Dr. Guiberteau.

Other comments? Dr. Palestro?

MEMBER PALESTRO: Yes. Chris Palestro.

I have to agree with Dr. Guiberteau that it's not 100 percent perfect. It's not ideal face-to-face, I think certainly a first choice, but given the limits of time constraints that organizations and individuals have, it works well.

CHAIR THOMADSEN: Thank you, Dr. Palestro.

Dr. Zanzonico?

MEMBER ZANZONICO: Well, I tend to favor, if needed, more frequent either teleconferences or GoToMeetings, mainly because sometimes when you deal with these technical issues that require the need for background material, researching literature, you really can't do that in real time, so to speak, at a face-to-face meeting such as this; whereas, if issues arise in the GoToMeeting, you can say, "Okay. We've come this far. Perhaps in a week from now, we can schedule a half-day GoToMeeting." And in the intervening time, issues that arose in that initial meeting can be addressed in terms of research in the literature, so forth and so on. So I think there's some advantage for certain issues to sort of being at your home base and having access to all your research facilities and so forth and so on that you don't have in a face-to-face meeting away from home without you

know, there are advantages for these are well.

CHAIR THOMADSEN: Thank you, Dr. Zanzonico.

It seems to me that in the absence of some particular items, such as possibly the rollout of Part 35 in addressing that, that we have been doing fairly well at covering the topics that we have to cover in two meetings a year. I would think that we probably don't need to increase the number of face-to-face meetings if we could have web meetings in between as needed.

The question that Dr. Langhorst brought up about having a face-to-face meeting dealing with the rolling out of Part 35 I think is a good point. And we may need to do that depending on the timing of when that actually comes up and what the problems are going to be. How far ahead, Mr. Einberg, would we need to know to do that budgeting?

MR. EINBERG: Yes. At least a year in advance. So now is the time to start planning for that and figuring that the Part 35 rulemaking, at the earliest, would go final in 2014 or beginning in 2015. And now is the time if we wanted to schedule an additional meeting in the 2015 time frame.

CHAIR THOMADSEN: Okay. Perhaps the

thing to do is to do exactly that, try and budget for a meeting in 2015, additional face-to-face meeting, but unless I am hearing any motions for increasing the number of meetings from 2 to 3 as a routine, I am not hearing that there is a lot of support for doing that.

Dr. Suleiman?

MEMBER SULEIMAN: I think also, not ignoring the current budgetary situation in the federal government, I think it would be prudent for us to I mean, webinars are successful. And I understand there are some projects that are not being implemented or put on hold because there is not enough funding.

CHAIR THOMADSEN: Right.

MEMBER SULEIMAN: So I think, you know, even though it is outside our direct purview, I think we ought to be sensitive to that as well.

CHAIR THOMADSEN: I am confident that the federal government will solve the budgetary problem before 2015.

(Laughter.)

CHAIR THOMADSEN: Are there any

MEMBER MATTMULLER: Yes.

CHAIR THOMADSEN: Mr. Mattmuller?

MEMBER MATTMULLER: I'm sorry. This is different. I would like to raise a different issue

CHAIR THOMADSEN: Yes.

MEMBER MATTMULLER: -- than the rest of the Committee.

CHAIR THOMADSEN: Good because we are going to --

MEMBER MATTMULLER: Okay.

CHAIR THOMADSEN: Go ahead.

MEMBER MATTMULLER: And this touches on what Sophie discussed yesterday in regards to membership on the Committee. And typically our terms are for two terms. But I am thinking of if, for example, Pat were ready to cycle off, as Dr. Van Decker is. Because of his great work leading the subcommittee in Part 35 and Part 35 efforts are still going forward, it seems like, rather than creating this void on the Committee, that it would be worthwhile for individuals in that situation to continue on ACMUI.

So I guess I'd like to propose in certain circumstances that the term -- it not be a definite two-term limit for some Committee members because of their expertise and what issue at the moment is going on.

I had another conversation this morning with Dr. Welsh in regards to how beneficial it would have been for him, for Dr. Nag, to continue on during the brachytherapy issues. So I think that, unfortunately, at times the effectiveness of the Committee takes a hit depending on what time certain members cycle off.

CHAIR THOMADSEN: Thank you, Mr. Mattmuller.

To the NRC, Mr. Einberg, can you address the possibilities?

MR. EINBERG: Yes. It's within the charter that the ACMUI members can only serve up to two terms. To have someone serve a third term, it needs to have a special exception from the Commission and special Commission approval.

As you know, Dr. Malmud served three terms. And that received Commission approval. So the precedent is there. And it can be done. But there have to be extenuating circumstances.

Having said that, Dr. Nag also -- for instance, take Dr. Nag as a case here. Dr. Nag serves as a medical consultant to the staff. And so Committee members who rolled off of the Committee can still provide advice to the staff on an as-needed

basis and serve as medical consultants to us. So that option is still available as well.

CHAIR THOMADSEN: Dr. Welsh?

MEMBER WELSH: If I might offer a counterpoint to that comment, however, there was an interval where I was the sole radiation oncologist for what seemed an eternity. We were fortunate to have Dr. Suh join us. And it was at a very stressful time where there was an intense debate about the permanent implant brachytherapy medical event definitions. Just I know that that was a very, very busy year for me personally.

And although Dr. Nag was available to you, he was not allowed to participate in the subcommittee discussions. And there was an awful lot of conflict, difficulty, and confusion that could have perhaps been alleviated if, rather than a full third term, the individual were allowed to sit until that new representative has been appointed. It's just an idea I throw out as an alternative to a full third term for these extenuating circumstances.

CHAIR THOMADSEN: Mr. Einberg?

MR. EINBERG: Yes. Thank you for that. We will take that under consideration or look at the possibilities of that. I'm not sure if that is even

a possibility, to be honest. So we'll look at what the personnel rules and regulations are in that regard. I understand what your concerns are.

CHAIR THOMADSEN: What you are talking about, rather than a continued appointment on the Committee, is there a possibility in HR or something to look at in the HR regulations of a special appointment to the Committee without the normal three-year commitment?

MEMBER LANGHORST: Four-year.

CHAIR THOMADSEN: Four-year. Sorry. Yes. Right. Thank you for the correction.

MR. EINBERG: That's possible. The other thing that comes to mind is, you know, we are looking at the charter right now or the bylaws. This might be something that we consider, you know, addressing in the bylaws. And so the subcommittee that was formed may want to make a recommendation in this regard to the bylaws.

CHAIR THOMADSEN: So the subcommittee has this idea. Good, good. And thank you for that.

We should probably now address the question of the reporting structure, which we discussed on several occasions before. Is there a thought by the Committee that this is a time when we

should try to restructure our reporting organization in the NRC? Would anybody like to have any discussion of that? Pat Zanzonico?

MEMBER ZANZONICO: Pat Zanzonico. Well, based on Dr. Langhorst's presentation in closed session, it would seem there would be some benefit in since elevating the visibility of the ACMUI and the entire medical operation to the Commission, to reporting to the Commission.

I recollect when we discussed this issue some time ago, there were some compelling reasons for not doing so. Sophie, if you recollect those offhand, could you review those or someone from NRC staff review the pros and cons of that?

MR. EINBERG: Could we defer that to Ashley? Are you willing to speak to that? And it's kind of extemporaneous, but Ashley is the one who wrote the SECY paper at the time.

MS. COCKERHAM: I can't think off the top of my head exactly what the reasons were, but it was very clearly outlined in the SECY paper, 2011.

CHAIR THOMADSEN: Could we ask, could you recirculate that paper to the Committee?

MS. HOLIDAY: Sure.

CHAIR THOMADSEN: And possibly the

Committee that is looking at the charter at the moment might take a closer look at that and bring that as well as the recommendations on the charter to this Committee, a discussion of the reporting structure since it seems like those might go hand in hand.

Any other -- yes, Dr. Welsh?

MEMBER WELSH: While I fully agree that it would be prudent for the Commission to have clearer, maybe more frequent medical input, doing it through the ACMUI, reporting directly to the Commission, in my opinion is perhaps not warranted at this time. The reason I say that in response to Dr. Thomadsen's question is that in the past, perhaps before I was on the Committee, there were some questions about whether or not the communication was freely flowing from the ACMUI to the Commission.

I think the flow depends very much on the staff individuals in place at the time. And I am pleased with the flow at the moment and, therefore, see no reason to change to the more onerous system of ACMUI reporting directly to the Commission because the staff is effectively communicating our perspectives.

CHAIR THOMADSEN: Thank you, Dr. Welsh.

Mr. Einberg?

MR. EINBERG: One of the cons that I recall from the SECY paper was that if you report directly to the Commission, then your recommendations will be on the Committee. However, the staff will have to respond to your recommendations. But we will not be able to rely upon the ACMUI for advice anymore because you're reporting to the Commission. As such, then we would have to have a separate infrastructure developed for the staff to get advice. And so that was one of the cons, as I recall, from the paper. So it would become much more onerous and burdensome to the staff. And much more resources would need to be devoted to this.

CHAIR THOMADSEN: Thank you, Mr. Einberg.

Mr. Mattmuller, did you have --

MEMBER MATTMULLER: I did. Just I'm sorry. If I could make a request to be added to the subcommittee on the charter?

CHAIR THOMADSEN: Certainly.

MEMBER MATTMULLER: Thank you.

CHAIR THOMADSEN: Do you have that or --

MS. HOLIDAY: I'll have that.

MEMBER MATTMULLER: She has my number.

CHAIR THOMADSEN: Dr. Langhorst?

MEMBER LANGHORST: I guess I would also like to ask a question of who advises the Commission. And maybe there should be additional advisory resource directly for the Commission and not remove that advisory resource from the medical team. I raise it as a possibility, but I am not clear what kind of routine advice the Commission gets directly on medical uses of radionuclides.

CHAIR THOMADSEN: Mr. Einberg, did you have a comment?

MR. EINBERG: Yes. The way the Commission is formed, each Commissioner has technical assistants, whether it be a reactors technical assistant or a materials technical assistant. And those technical assistants provide the advice to that individual Commissioner. And so the medical area, that would fall under the materials in the technical assistants.

Those technical assistants reach out to the staff to get information or make requests for information to advise their Commissioner.

MEMBER LANGHORST: This is Sue Langhorst. But not routinely to a medical professional, to NRC staff and --

MR. EINBERG: To NRC staff, recognizing

that we don't have the complement of medical expertise that the ACMUI has, correct. However, if we do not have the answer, we reach out to the ACMUI for those questions.

CHAIR THOMADSEN: Thank you, Mr. Einberg.

Dr. Zanzonico?

MEMBER ZANZONICO: Pat Zanzonico. I just have a follow-up question. So is the solicitation always from the Commission's technical assistant to the medical staff or does it go the other way? In other words, is there the option if the NRC medical staff has a pressing issue that they want to bring to the attention of the Commission that they can do that sort of proactively or is it always a matter of we're waiting for some solicitation from the top?

MR. EINBERG: Chris Einberg once again. Those mechanisms for communicating with the Commission, the most formal way is with a SECY paper. If we have an issue that we want the Commission to be aware of or to provide some policy guidance to us, we develop a SECY paper, a Commission paper. And we outline the arguments within that paper in what the issues are and ask for their guidance. And then they vote on that SECY paper.

For instance, a good example was the

medical event reporting for permanent implant brachytherapy. There had been numerous Commission papers we had informed the Commission on. They provided their guidance in how the staff should proceed. And so that is one vehicle, and that is the most formal vehicle. There are also less formal ways, but it's still relatively formal.

We have Commissioner assistants' notes that we could send up fairly quickly, and that gets up to their materials TAs, to their technical assistants. And they share that with their respective Commissioners to inform them. And then there are also technical assistants or Commissioner assistant briefs if there is something that we need to brief the commissioners on, we could use those. And we have used that.

And then, lastly, if there's something that the Commissioners or we feel that you know, we could have one-on-one briefs also. The office director has a monthly brief with all the Commissioners. And so we raise issues to our office director, and he can raise issues to the Commissioners as well. So those are some of the vehicles.

CHAIR THOMADSEN: Okay. Thank you.

Thank you very much.

I think this will be the last comment on this.

MEMBER LANGHORST: Thank you.

CHAIR THOMADSEN: Dr. Langhorst?

MEMBER LANGHORST: How does the medical community plug in, then, to the Commission? And if there were an advisory committee, I mean, I would think that would be made up of medical community professionals. And that could be another route to bring these types of issues more routinely to the Commission and to support the Commission in their medical use policy and medical use regulatory responsibilities.

MR. EINBERG: Well, first, the ACMUI here does represent the medical community --

MEMBER LANGHORST: Right.

MR. EINBERG: -- to a large extent. And we would be relying on your advice, your input from the medical community. And so if the ACMUI has anything that they would like to raise before the Commission, we are always available as a venue or avenue to, you know, have discussions or inform the Commission. So the staff is here to provide that avenue to inform the Commission. So we're here to

help out with that. But you learnedly represent the medical community.

You know, how else can the medical community have input into the Commission? When we go out with public rules for comment, the medical community provides their input on those rules. And that's the formal process for getting input into the rulemaking process and into the process.

And so, for instance, a Part 35 rule that is in front of the Commission right now, you know, we have held public workshops on that as well. We solicited it and put it to the medical community. When that goes out I guess we are going to have the Commission briefing in October here. And the medical community has been asked to weigh in on that. So those are some of the various ways.

MEMBER LANGHORST: Thank you.

CHAIR THOMADSEN: Well, we have now an additional charge for the charter subcommittee. And this discussion will be resumed when we hear back from that subcommittee.

Thank you very much, Ms. Holiday.

MS. HOLIDAY: Thank you.

CHAIR THOMADSEN: Now we'll hear about the ViewRay system licensing guidance, C. Frazier and

M. Shober.

MS. SHOBER: Good morning. My name is Megan Shober. And I am an advanced nuclear engineer with the State of Wisconsin Department of Health Services. I am a co-chair of the working group that developed the licensing guidance for the ViewRay system for radiation therapy. On this group, I am representing the Organization of Agreement States. Sandy Frazier is my NRC co-chair in this effort. And we thank you for the opportunity to share a little bit about ViewRay licensing guidance with you this morning.

In my talk today, I first want to give you an overview of the ViewRay device. And then we'll describe the tasks of the working group. Then we'll discuss the decision to license the ViewRay under 10 CFR 35.1000. And, finally, I want to highlight a few features of the guidance.

There are two novel irradiation therapy devices: the ViewRay System for Radiation Therapy and the MASEP Infini device. They both received 510(k) premarket notification clearance from the U.S. Food and Drug Administration. And the devices have components and operating characteristics that are a little bit different from the devices that are

currently regulated under 10 CFR 35.600.

Our working group was convened last year, in October. By that time, the State of Ohio had issued a sealed source and device registry certificate for the ViewRay system. And the State of California was reviewing a sealed source and device application for the MASEP device.

The working group was tasked with evaluating whether the devices could be appropriately regulated under 10 CFR 35.600 or whether they should be licensed under 10 CFR 35.1000. Then if the working group decided to regulate them under 10 CFR 35.1000, the working group was responsible for writing the licensing guidance.

The balance of my talk is only going to talk about the ViewRay device, as the State of California has had lengthy delays in getting the MASEP device to the United States to complete their SS&D application. There are three NRC staff and then three state representatives from the State of Ohio, State of California, and State of Wisconsin.

This is a picture of the ViewRay device. It features real-time imaging guidance using an on-board MRI system. There is a rotating gantry that has three cobalt-60 radiation sources and has each

with a multiple-leaf column meter.

This picture is really pretty. And, just to give you a little sense of how this device is built. You can see the green there represents the rotating gantry. And then the orange boxes are the position where those source heads actually are.

The source heads are designed to point toward an isocenter right at the middle of the circle. And this device features anintegrated treatment plan delivery software. So it looks substantially different from what we are accustomed to seeing for just kind of a teletherapy device with a single source on an ARM.

The working group began by discussing these two questions on the slide. Can the ViewRay system meet all of the requirements of a single section of in 10 CFR 35.600; in this case, the teletherapy section? And are there safety issues with the ViewRay device that are not adequately addressed by the current regulations?

As you know, 10 CFR 35.1000 allows NRC and Agreement States to adapt to emerging medical technologies without waiting for rulemaking. As the working group examined these questions, we concluded that the ViewRay device can meet most but not all of

the teletherapy regulations in 10 CFR 35.1000 and that there are many safety issues associated with this device which are not addressed in the regulations at all.

The working group felt that the licensure under 35.1000 was warranted for the following reasons. First, there are spot-checks and full calibration requirements that are in the regulations for functions that a ViewRay device does not include. Second, the licensee needs to perform source coincidence testing due to the multiple sources. And that feature is not a part of the current teletherapy regulations.

There are issues that are raised by the reliance of this device on real-time MR imaging. And MR imaging obviously doesn't exist anywhere else in our teletherapy regulations.

This device also includes a number of daily and weekly testing that are required by the ViewRay owners' manual. And there are no daily or weekly testing requirements in the teletherapy regulations.

So, for these reasons, the working group decided, we unanimously supported the decision to license this device under 10 CFR 35.1000. And this

decision was endorsed by NRC management.

ViewRay was notified of this prior to the issuance of the license. The guidance was published in the NRC medical uses toolkit on July 24th. There was a letter that was distributed to the Agreement States dated July 26th and an announcement over the medical server that went out on July 31st. So the guidance is out there.

I want to say just a little bit more about our decision to license this device under 10 CFR 35.1000. There was significant discussion on the working group and within NRC about the spot-check and the full calibration requirements.

I am going to list two examples here of requirements which we felt the ViewRay device could not meet. The first example is a full calibration requirement. This is the one that requires coincidence testing of the radiation field with a field that is indicated by the light beam localizing device. And in standard teletherapy units, this was very simple, very basically a light. And the ViewRay system does use an integrated laser system for that coincidence testing. So that's a little bit different.

And the second example there is a spot

check requirement that involves monthly testing of electrical or mechanical stops to make sure that the primary beam of radiation can't go beyond a certain angle. And so this was critical, for example, to make sure the device wasn't pointing the primary radiation beam at an area that had reduced shielding, for example, at the ceiling.

This feature isn't part of the ViewRay device. As you saw before, the sources are on a rotating gantry. Those sources do have a limited range of motion, but that limited range is due to the presence of multiple sources, not to anything that is in here about how the shielding was designed.

There are a few safety issues that are not addressed in the current regulations. These include multiple treatment heads and, as I mentioned before, the need for the coincidence testing with the sources; the real-time MR imaging during treatment. There is also a need to ensure that the isocenter for the MR image is the same as that radiation isocenter. This device does have three multi-leaf collimators, one on each head, which allows for gated treatment delivery. So the shutters open and close on this device as the target organ moves into and out of the field of view.

And then, in addition to the monthly and the annual QA tests that are required by regulation, the ViewRay operators' manual requires the daily and the weekly QA tests.

So we took in all of this information. And we based our guidance on three primary references, the existing regulations in 10 CFR 35.600, the sealed source and device registry sheet that was issued by the State of Ohio, and the ViewRay operators' manual.

So we determined which of the regulations applied to the ViewRay device, which ones had to be supplemented with or replaced by other information, primarily the operators' manual. And then the guidance also provides relief from certain regulations. The ViewRay device, because it is brand new, there is no body of knowledge that exists to support it at the moment.

I do also want to point out that the daily QA tests that are required by the ViewRay operators' manual, they're very, very similar to the daily QA tests that are currently in 10 CFR 35.600 for a high-dose rate remote after-loader unit and gamma stereotactic radiosurgery units. There are a lot of the same issues as far as checking interlocks

and checking radiation monitors and things like that. So those are definitely very similar to things that already exist in other areas of 10 CFR 35.600.

I want to touch briefly on the issue of physical presence. I know this was a question for a lot of people as we were getting underway with the guidance. The working group initially had a wide range of opinions about physical presence requirements. We understood that the ViewRay device is meant to be a workhorse. It's meant to treat a lot of patients every day and the patients receive a large number of fractions. We understood that it's impractical to require physical presence in the same way that physical presence is required for high-dose rate remote after-loader units and Gamma Knife units.

We also recognize that the sources are designed so that the radiation only points inward at the counterweights in the gantry. And once a patient is moved out of the device isocenter, the radiation levels do drop off pretty rapidly.

We also knew that the patient is not physically attached to the device in the same way that they are attached to a GammaKnife unit and the source is not inside the patient, as it is with an HDR unit. However, due to the activity of the

sources, they're in the ViewRay device. If something were to go wrong, it would go wrong very quickly. And so the working group came to a consensus agreement that requiring an authorized user or an authorized medical physicist to be in the department, but not at the treatment console, was an appropriate compromise and constituted an acceptable health and safety risk.

To touch on training requirements just a little bit, the working group did decide to -- what you see here is very standard as far as training requirements for all kinds of radiation therapy devices.

You will notice that a requirement for a preceptor attestation is missing. We decided to delay implementation of the preceptor requirement for five years due to the lack of availability of preceptors at this point in time. And our working assumption is that after five years, the preceptor attestations would be required only for those individuals who are not board-certified and that by this time, the Part 35 rulemaking that's making its way through, will eliminate the requirement for preceptor attestations for the board-certified individuals.

Preceptor attestations are also not required for the radiation safety officer, just for the ViewRay device. But obviously if you had a brand new radiation safety officer, they would require that just with the regular process for adding a radiation safety officer.

As far as where we are going from here, one of the advantages of 10 CFR 35.1000 is that the guidance is nimble and it allows the NRC to be responsive to the concerns of the regulated community. We fully expect to revise this guidance as more clinical experience is gained. And just, for example, the Y-90 microsphere guidance has been revised 9 times in 11 years. And so this is clearly a place where we can revise things as we need to revise them.

And if there is a portion of the guidance that doesn't work in practice, just let your regulator know. And we can help you find an alternative way to meet the intent of the provision. This is something that I hope will encourage some dialogue with the places that are kind of leading on the front edge of this because, obviously, we don't want regulations that are impossible for you to meet. So just be in communication with us, and we will come

to a mutually agreeable place.

That is basically what I had for this part of the presentation. And we will be happy to entertain any questions.

CHAIR THOMADSEN: Thank you, Ms. Shober and Ms. Frazier. Does the Committee have questions or comments? Dr. Zanzonico?

MEMBER ZANZONICO: I have a technical question. Pat Zanzonico. When you were talking about coincidence testing, I presume you are talking about the coincidence of the isocenter of the MR and the cobalt-60 scan heads. Is that correct?

MS. SHOBER: There's a few different coincidence testings that are required with this device. So the three sources -- there is a coincidence testing for the three sources. They all have to meet at the same radiation isocenter. Then there is also coincidence testing between the MR isocenter and the radiation isocenter. So there are two different things that are going on there.

MEMBER ZANZONICO: And is that part of the daily or the pretesting?

MR. SHOBER: Daily.

MEMBER ZANZONICO: The other question I have is, when you are talking about an AMP,

presumably that most commonly would be a board-certified radiation oncology physicist.

MR. SHOBER: Not necessarily. There's a lot of authorized medical physicists that are not, they're not necessarily board-certified.

MEMBER ZANZONICO: Okay. Because typically, as far as I know, for example, MRI physicists are often not board-certified.

MR. SHOBER: This that I am speaking of would be a radiation physicist. It wouldn't be someone that just deals with MRI.

MEMBER ZANZONICO: But that's kind of the issue.

MR. SHOBER: They have to meet the training requirements to be an authorized medical physicist according to the regulations. And I don't speak NRC here, in 10 CFR 35.51.

MS. FRAZIER: So there would be the AMP in accordance with the regulations.

MEMBER ZANZONICO: Right. That's the

MS. FRAZIER: Right.

MEMBER ZANZONICO: -- issue I am raising. I mean, there are two advanced, complex technologies here. And you are going to have expertise in one of them, namely the teletherapy, but not necessarily the

same level of expertise in that individual in the MR component subsystem of this system. And I am just wondering if that introduces a potential problem.

MR. SHOBER: I think that we would expect there to be some MR expertise involved with this unit, but I don't know how far we can regulate the MR portion.

MEMBER ZANZONICO: Yes. Again, I'm just thinking out loud.

MR. SHOBER: Sure.

MS. FRAZIER: Right.

MEMBER ZANZONICO: I mean, should that be built into the guidance? You know, I don't know how that would happen or what kind of mechanism, but, again, it just strikes me that, again, you have two advanced technologies. This is the first instrument of its kind. And the traditional AMP that's typically associated with radiation oncology may not have the breadth of experience nor really could, I think, to be expert in both of these technologies.

MR. SHOBER: Right.

MEMBER ZANZONICO: So it's just an issue I raise. I don't know what the solution is.

MR. SHOBER: Thank you.

CHAIR THOMADSEN: Thank you very much.

Dr. Suleiman?

MEMBER SULEIMAN: Is there vendor training? This guidance is not intended to substitute for that, I guess.

MS. FRAZIER: Right, right. There's a pretty extensive vendor training process that goes on.

MEMBER SULEIMAN: And I would assume they would get sufficient training with the MR system as well as the, I mean the entire system.

MR. SHOBER: Dr. Langhorst may be able to speak to that better about what that would involve.

MEMBER LANGHORST: Yes. There is vendor training. And, in fact, there is a lot of development going on with the vendor.

MEMBER SULEIMAN: So how do we know people will be trained? And will there be a train-the-trainer thing where they will get away from formal training and create an opportunity for deviating from what the manufacturer intends or will there be any qualification or certification program to ensure that the training is good and the people using this technology have been trained properly?

MS. FRAZIER: Well, we know right now the vendor may come out. They do get training on the

ViewRay device. So whenever they install the device, they will provide that training. They have committed to doing that.

MEMBER SULEIMAN: I mean it is in the best interest of these companies to provide the best possible training. Having said that, they don't always.

CHAIR THOMADSEN: Dr. Welsh?

MEMBER WELSH: A quick follow-up point to Dr. Suleiman's comment there is that is there such a thing as NRC-approved vendor training, as opposed to just vendor training? I'm thinking about the vendor training I received for the GammaKnife years back. I believe it's an NRC requirement. It made me believe that it was NRC-approved training. But I suppose the question has to be raised. I don't know the answer whether or not there is NRC-certified training or if there is just training for --

MS. FRAZIER: No. Well, I'll just answer for NRC. We do not have certified training, vendor certified training.

MEMBER WELSH: Yes.

MS. FRAZIER: But on a case-by-case basis, we go look at training that you submit to you know, it's in the review process, but it's not vendor

training. That's certified by NRC.

MR. SHOBER: And in this case, the vendor is a licensee of the State of Ohio. And I would expect that training program would have been reviewed by the State of Ohio, but I am not involved with that and NRC isn't involved with that.

CHAIR THOMADSEN: Mr. Mattmuller?

MEMBER MATTMULLER: Steve Mattmuller. I think to build on what Orhan was suggesting because I think this is somewhat of a lesson-learned from the rubidium experience is that there was initial very good vendor training provided, but then if that original authorized user moves on, can he provide the training to the next person following him? And would his training be as adequate or comprehensive as what the vendor provided? I think initially everyone will be fine, but it's what happens after people move on or new people --

CHAIR THOMADSEN: Dr. Langhorst?

MEMBER LANGHORST: I can speak to what we do at Washington University in St. Louis and Barnes Jewish Hospital in that, be it for GammaKnife Perfexion or the development of the ViewRay system, our physicians and our physicists go to vendor training.

In the case of ViewRay because we have got the ViewRay unit there, the training is happening on site. And, in fact, we're helping to develop the training. So it's kind of a special circumstance. But in our case, we require those potential authorized users and potential authorized medical physicists to go off and get training and I would imagine continue that. It's not necessarily a requirement by the NRC, but we are allowed to have our authorized users be trained by other authorized users.

CHAIR THOMADSEN: Dr. Suleiman?

MEMBER SULEIMAN: We have had some situations at FDA, not always, it's sometimes challenging where the user is required to undergo a certain amount of training, but it's the vendor's training. I would hope that something this technically challenging, something like that, could be done. In other words, maybe the vendor could say, "Look, we're not going to allow you to use this unless your personnel have undergone this level of training."

MEMBER LANGHORST: This is Sue Langhorst. I'll mention that this is about a $5 billion piece of equipment. So people aren't going to get one

lightly and just let anybody run off to use it.

MEMBER SULEIMAN: Trust me.

MEMBER LANGHORST: Yes.

CHAIR THOMADSEN: Dr. Van Decker, did you have your hand up?

MEMBER VAN DECKER: No, I did not.

CHAIR THOMADSEN: Okay. I'm seeing things today.

Dr. Welsh?

MEMBER WELSH: Thank you for that presentation. I was prepared to come in here today harshly criticizing the placement of this in 10 CFR 35.1000, but I think your presentation discussion about spot-checks, full calibration, electrical and mechanical stop, multiple heads has convinced me that maybe it can't fit into 600 at the moment and, therefore, has to go into 1000. My concern is that 1000 tends to be a wasteland that material stays in for too prolonged a period.

Clearly this belongs in 600. From my perspective, this is just a glorified teletherapy unit. It's new to NRC. It's new to the world of teletherapy, but it's compared to what we have been doing with linear accelerates with image guidance, intensive modulation, multi-leaf collimators, dynamic

multi-leaf collimators; this is nothing all that different. My concern is that once in 1000, things tend to stay in 1000 for too long a period of time.

The GammaKnife Perfexion probably belongs with the other teletherapy. The new Infini device that we didn't talk about today probably also belongs in 600.

I know it is difficult, but certainly not impossible to move things into categories that they really do naturally belong in. And I'm specifically thinking about how we have had the challenge of radium-223 dichloride the last year or two. And, with some effort, we were able to make accommodations so that it will fit in section 300. I just think that somehow 600 could be accommodated so that this device, which clearly is a glorified teletherapy unit, can fit into that teletherapy section.

CHAIR THOMADSEN: Thank you, Dr. Welsh.

Ms. Weil?

MEMBER WEIL: I'm Laura Weil. Going back to where you talked about physical presence, it's the AMP who needs to be in the department, not at the console. Is that what you said? I'm trying to remember specifically.

MS. SHOBER: The guidance currently

allows for an authorized user or an authorized medical physicist. It's an "or".

MEMBER WEIL: To be in the department, not at the console. What elements of patient safety are lost by what you call that acceptable compromise?

MR. SHOBER: As far as why we would require it in the first place?

MEMBER WEIL: You called it a compromise. That means that, you know, there are two points of view and you reach some sort of an accommodation, which is problematic in some way on either side. And I think Dr. Langhorst is able to answer that question.

MEMBER LANGHORST: I would be glad to try to answer that question.

CHAIR THOMADSEN: Dr. Langhorst?

MEMBER LANGHORST: I think patient safety is enhanced by allowing that. You have a team of people working to run the ViewRay system, just like you have for the Linac. The physicians and the physicists are able to look at other patients, to deal with other patients without just being tied and doing nothing but twiddling their thumbs because they have to be there.

That is a problem with GammaKnife

Perfexion right now. We are wasting resources, and it is impacting patient safety because other patients do not have access to those physicians.

MEMBER WEIL: Okay. So what is the flip side, then, having someone five minutes away, as opposed to right there at the console?

MEMBER LANGHORST: They are there if the technologist who is running the machine and taking care of the patient if there is something that happens that the machine is not working correctly, that physicist is right there to come help address that issue or if there is something that needs to be changed as far as patient plan or whatever, the physician is also right there and maybe doesn't even have to be there physically, can be at a remote console and have that same communication and be able to provide that direction.

MEMBER WEIL: So you feel there is adequate redundancy and --

MEMBER LANGHORST: Absolutely. Absolutely.

MEMBER WEIL: Thank you.

CHAIR THOMADSEN: Dr. Welsh?

MEMBER WELSH: I might take this opportunity to say that this discussion is perhaps a

segue to reopening the whole question of whether or not authorized user physical presence is truly necessary for the GammaKnife after all of these years of experience. And perhaps now that the new Perfexion device, which, as I mentioned, is in 1000, perhaps as we accommodate 600 to accept the new GammaKnife and these new teletherapy units, perhaps the question of authorized user; that is, physician presence, during these treatments is really in the best interest of patient safety, flow through in the clinic, and best use of physician time. I think it might be such

CHAIR THOMADSEN: So would you like to see that issue on the agenda next meeting?

MEMBER WELSH: I think I would, yes.

MEMBER LANGHORST: I would second that.

CHAIR THOMADSEN: Okay. Well, I think that can be arranged, then.

Any other questions? Yes, Dr. Suleiman?

MEMBER SULEIMAN: Since you've taken it an extra level, I think this also brings to the floor the issue of are the regulations too prescriptive or too general. In other words, Dr. Welsh was talking about this coming under the part 600. Maybe 600 is too prescriptive where it starts to exclude certain

other therapy-type devices. Maybe 600 needs to be tweaked to accommodate the other therapy devices, but then if you're not prescriptive enough to ensure safety, the default to me would be to ensure that the manufacturers' training addresses issues, alignment, [and] collimation. In other words, make these general safety requirements but not get so prescriptive that a new technology comes along and it has to be forced over into 1000.

I know the NRC is making these "We'll recalibrate the 600s and the 300s and whatever later on," but maybe those very prescriptive requirements need to be slack and not ignored. You know, if you're talking about a radiation shielding issue, if you're talking about alignment of the radiation feed, if you're talking about contamination anyway. Often require those as safety requirements, a little less detailed, but you don't ignore the training that the vendor should be responsible for, for assuring.

And if I were a company, I would say anybody who uses this device has to go through our training and there has to be some sort of sign-off qualification or whatever. Then you can sort of have it the best of both worlds. You've got the regulation there that if there is a problem, you come

in on the inspection. You say, "You know, you guys were ignoring this."

And the company says, "Well, they were trained properly. They followed, they took our training. They signed off on this" or the company says, "These guys are not trained. You know, they didn't undertake our training."

So by having a balance, you can sort of back off a little bit from some of the regulatory requirements but basically ensure that the safety component of the regulation is enforced. So I guess the key is the vendor training.

CHAIR THOMADSEN: I have on my notes for the agenda next time a discussion of Part 1000 and 600 and moving things and an adaptation of those.

Mr. Einberg?

MR. EINBERG: Yes. If I just may make one comment? You know, what Dr. Suleiman has talked about is revising 35.600 or revising Part 35 again. And that requires rulemaking. And, you know, this is a very lengthy process, and we haven't even gotten through this Part 35 rulemaking. So I just wanted to bring that to everybody's attention.

CHAIR THOMADSEN: Thank you. That's understood.

Member of the public?

MS. FAIROBENT: Thank you, Dr. Thomadsen.

Lynne Fairobent with AAPM. Two things. One, just to follow up on Mr. Einberg's last comment, although we're not through the current Part 35, I don't think that's reason to delay looking at what other additional changes might need to be made to Part 35 so that we're ready since NRC has a policy, at least right now, of only one rulemaking per part of Title 10 at a time, which personally I think ought to be reconsidered unto itself, but by the time we get through this current Part 35 rulemaking, there are also already other things that are not included in it. And we should not stop identifying things and working towards potential resolution just because there is a current rulemaking underway.

Secondly, I have concerns about Part 1000 and how it has been utilized and implemented since its conception, when Part 35 was revised in its totality previously. And a quote from the statements of consideration, "The NRC agrees with these comments and will take them into consideration in setting up a process for establishing regulatory requirements and for approving applications for emerging technologies. We intend to evaluate each technology on a

case-by-case basis and to work with the ACMUI, the medical community, the public, and the developers of the new technology, as appropriate, to determine the specific risk associated with the technology and any additional regulatory requirements for the medical use of the technology."

My reason for bringing this up is I don't believe that in the case of the ViewRay there was involvement by ACMUI prior to the guidance. There certainly was not involvement by the medical community at large. And I'm not aware of any public meeting that was held or conference call held in order to discuss this before the determination by the staff to put this device under Part 1000.

I would just like to urge NRC to go back and look at the statements of consideration from Part 35 on the creation of Part 1000 and to consider following what was stated during that statement of consideration.

I am also concerned with the same issues that Dr. Welsh raised. Things go into Part 1000. Nothing has come out of Part 1000. I have heard a lot of comments from NRC staff and others at various meetings that part of this is we have put something into Part 1000 and then the technology disappears or

it is no longer a viable technology. That may be the case, but there are other things that have been in Part 1000 that as the Perfexion GammaKnife unit is a good example to take a look at, when is it likely to come out of Part 1000? And how long does something have to be in there before a determination is made?

And just also, Dr. Thomadsen, AAPM did an extensive training session at CRCDP on ViewRay that addressed the medical physics and clinical use applications of the device. If you would like that done for ACMUI, we would be happy to consider repeating that.

CHAIR THOMADSEN: Thank you very much for that offer. Thank you for your comments, Ms. Fairobent.

Yes, Mr. Einberg?

MR. EINBERG: Yes. If I may respond to Ms. Fairobent? Thank you for your comments. And we'll certainly reexamine the statements of consideration. I wasn't personally aware of those. You know, there is knowledge transfer here and knowledge management. That is greatly appreciated. So we'll take a look at it.

CHAIR THOMADSEN: Thank you very much.

Last comment, I think.

MEMBER LANGHORST: Maybe two. Sorry. I really appreciate all the work that your working group has gone through and your careful consideration of all of these issues. The justification of why you went the way you went and chose the route you went, is that available in writing? Is it going to be available in writing? Will that be available for us to know as we move forward what was the thought process?

MR. EINBERG: I'm not sure other than the guidance, you know, whether there is --

MEMBER LANGHORST: I mean, you gave us some justifications today.

MS. SHOBER: Right.

MEMBER LANGHORST: But there is not a plan to have anything in writing to say why you came to the decisions you came to.

MS. FRAZIER: Right. We didn't have a plan for that. We do have that information, but it's not part of the guidance that is out on public domain. And I don't know. We had not thought about having that information out there.

MEMBER LANGHORST: I think that would be very helpful for those of us who have to implement this to understand more of the why. Just like Dr.

Welsh had mentioned, you know, some of the issues you brought up made a lot of sense as we heard them here today. The other --

MS. FRAZIER: I didn't know if Mike wanted to comment on that.

MR. FULLER: Yes. Mike Fuller. I was just going to say that you are absolutely right. I would just echo what others have said. There is absolutely no reason why we can't go back now and memorialize and develop a record of the basis of our decision and then make that publicly available, absolutely no reason why we couldn't do that.

MS. HOLIDAY: Dr. Langhorst, this is Sophie. I just wanted to follow up with what Mike just said. During our working group discussions, I did capture a lot of our discussions through the form of meeting summaries. So I do have those. It's just a matter of putting them into the official record system and making them publicly available. But, as Ms. Frazier indicated, we had not considered that prior to --

MEMBER LANGHORST: I would encourage you to.

MR. EINBERG: Chris Einberg. I would caution, Sophie, again. Those meeting summaries are

internal deliberations of staff.

MS. HOLIDAY: Absolutely.

MR. EINBERG: So those cannot be made publicly available. However, to echo what Mike said, you know, we can certainly develop a record or get a safety basis or get what the basis for that licensing decision was. We did something comparable for the radium-223. And so we documented what the evaluation was there.

MEMBER LANGHORST: My second comment is, just like for Perfexion GammaKnife license guidance, that that you have posted on the website, please number the pages and please date the guidance so that we know when it changes. Thank you.

CHAIR THOMADSEN: Thank you very much.

MS. FRAZIER: We've actually had a discussion on that. And I believe it's already been taken care of.

MR. EINBERG: Right.

MS. FRAZIER: So on the website, it should have the numbers and the dates.

MS. HOLIDAY: That will be posted shortly.

MEMBER LANGHORST: I encourage that for Perfexion GammaKnife, too.

MS. HOLIDAY: And staff has taken that recommendation. I know that you voiced that recommendation beforehand. And so we have planned to do that for future guidance and then eventually go back and correct the guidance documents that currently exist on the website.

MEMBER LANGHORST: Thank you.

MS. HOLIDAY: You're welcome.

CHAIR THOMADSEN: Thank you very much.

And, Ms. Shober -- whoa. You have another comment? Please?

MS. FAIROBENT: Lynne Fairobent, AAPM. One of the other things I did mean to mention also is that we need to keep in mind that Part 1000 because it's licensing under guidance is not subject to compatibility by the Agreement States. And although we would like to think that they may follow that, there is nothing to say that the State of California when they start licensing ViewRay for UCLA is going to follow that guidance document. There is nothing requiring the State to do so.

CHAIR THOMADSEN: Thank you, Ms. Fairobent, for that comment. And, Ms. Shober and Ms. Frazier, thank you very much for your report. And thank you very much, Ms. Shober, for coming all the

way from Wisconsin.

Dr. Van Decker? We are now going to hear about iodine-123 mIBG imaging, a new frontier in nuclear cardiology with cardiac sympathetic innervation imaging.

MEMBER VAN DECKER: Thank you, Dr. Thomadsen and staff, for allowing me to present. I realize I stand before lunch. So I'll try to be north Jersey-sharp.

MEMBER VAN DECKER: You know, as my time grows shorter at the table, I recognize that I had a five-fold responsibility while here. Number one was to represent my constituents' viewpoints on the issues of the time in a collegial and collaborative manner with the other stakeholders and staff; to hear from NRC and the people at the table to bring back to the constituency base, number two; to serve on subcommittees for the common goal of radiation safety, which was number three; participate in a commissioner briefing if that opportunity presented itself; and then, number five, to do a little update on the field as a part of the stakeholder community so that the NRC has some concept of why things are being done, what kind of activity they are seeing on their licenses. And so, with this little

presentation, I consider myself personally full and appreciate it except I have to get the slide to work.

Okay. So here's my quick perspective on nuclear cardiology from 25 years in the practice of the field. You know, 80 percent of what is going on in nuclear cardiology in this day and age is myocardial infusion imaging depending on which flavor of radiopharmaceutical you like to use. It has proven to be the most robust, reproducible, and most studied way to try to sort out restrictions in flow through coronary arteries to myocardium. And it has done incredible patient outcome improvements over the last 30 years, for which the cardiovascular community I think is quite pleased.

You know, the other two pieces of what is done in nuclear cardiology/myocardial function are looking at the water pump for squeeze. And while this is nice, there are a zillion different competing modalities that do the same thing. And the third thing has essentially been after heart attacks how much muscle is still really alive in the myocardium or the questioned myocardial viability, which is frequently done by the perfusion agents themselves, although sometimes done by metabolism through FDG. But those three kind of represent what has been

traditional nuclear cardiology over the last 25 years.

Now, having said that, nuclear cardiology, just like everyone else's position at the table, is not stagnant. There have been multiple research interests as to what other kinds of radiopharmaceuticals could answers pointed questions in the clinical care of cardiovascular-ill patients. We have done some infarct avid imaging, hot spot imaging through a variety of radiopharmaceuticals. And, even though the current state-of-the-art is biomarkers, there may still be some realm in this down the line.

We have done a lot of research work in radiopharmaceuticals for apoptosis imaging, which is programmed cell death without inflammatory necrosis, which is something that the myocardium undergoes and there is still work ongoing in this.

There has been a lot of metabolism imaging to look at how the heart handles substrates. Most of that has been with I-123-labeled compounds and long chain fatty acids. I would point out that the heart is a little bit of an unusual organ. It likes the extra kilocals per mole of fats, rather than glucose, which is common in the peripheral

muscles.

But the last piece of this, which is going to be the focus of what I like to talk about for a few minutes, is actually imaging the autonomic nervous system of the heart, which is a frontier we really haven't been in. The heart is an organ driven by autonomic nervous system control. And to have some better knowledge of that, especially in the arrangements and certain very severe clinical conditions, would be incredibly helpful. And the most common clinical condition of major import is really congestive heart failure.

The bottom two chambers of the heart, the ventricles, are highly innervated by sympathetic innervation. And that innervation changes quite traumatically when the water pump doesn't function quite so well.

So congestive heart failure is the clinical realm that we're looking forward to the use of I-123 mIBG in present. It's a situation suffered by over five million people in the United States of America. Unfortunately, once you acquire the diagnosis, you have a 50 percent chance of passing away at the 5-year mark. So it is quite a severe illness. It has a lot of costs associated with it, a

lot of therapy options that it would help to be able to try to get a better sense of what to use when. You know, clinically it is mostly marked by congestive fluid backup in the patient, into the lungs and the legs of water, and then forward output problems of being unable to deliver enough oxygen to the forward tissues.

Both of these situations, just like the body is such a miracle, undergo compensatory changes from other parts of the body in an attempt to try to get things to work better. And those compensatory changes are obviously something of major import here.

Within the past few months, the FDA has expanded the indication on the use of I-123 mIBG. Pat pointed out to me yesterday he is very familiar with this radiopharmaceutical. It's been around for a variety of years now for use in neuroblastoma and pheochromocytoma imaging. And so, you know, it has been out there. But the use in cardiology will be a little bit new in its focus.

It's currently indicated for nuclear medicine assessment of the innervation of myocardium by measurement of the density of the sympathetic nerves in the heart to the mediastinum, of which there is very little innervation, so that we have an

objective numerical evaluation.

In patients whose pump function is significantly reduced, the heart usually pumps much more than 50 percent of the blood in it with any beat. But when you start getting clinical decompensations, the amount of blood released is obviously less with each heartbeat, which leads to symptoms, the New York Heart Association classification, where one is no symptoms and functional limitation and four is essentially being chair or bed-bound and then two or three being more mild and moderate limitations due to inappropriate water pump function essentially.

And the radiopharmaceutical through a variety of trials, including a recent pivotal phase III trial, has been shown to be possibly useful in identifying patients with lower one and two-year mortality rates. And it just becomes one more marker or one more integrated data point in a clinician's mindset of where a patient may fit in therapeutic needs. And we'll have to see how some of this plays out over the next few years, but having a new independent marker is actually quite exciting for the field of cardiovascular care.

So from the NRC perspective, obviously,

and for the table, you know, the iodine-123 is a radionuclide. It is cyclotron-produced. And it does decay by electron capture. I would point out in that regard that it's no different than thallium, which has been a major player in the radiopharmaceutical component of nuclear cardiology practitioners for decades and decades, a physical half-life of about 13.2 or 13.3 hours depending on how you want to look at it.

That half-life obviously makes this a potentially unit dose-deliverable compound from commercial radiopharmacies. The radiation peak is 159 keV, somewhat similar to technetium at 140, although the line spread function is a little bit different and so the safety issues of half value layers similar for lead.

You know, this is a commonly used isotope in the general nuclear medicine realm in the 35.200 class for imaging and localization. The radiation safety knowledge is similar to the radiation safety knowledge that every 35.290-trained user gets in radiation safety of clinical radioisotope handling.

The nice thing about I-123, which it does well radiochemistry-wise with organification, is that it can be imaged with SPECT crystals and not

necessarily a PET agent.

The biologic excretion is renally excreted, which has the effective T 1 half-life and will be off somewhat in renal dysfunction. The effective dose for a ten-millicurie activity deliverable is about 5.07 millisieverts, which is in the realm of general nuclear medicine-type technologies. Besides the obvious organs I should have put here, the organs receiving the highest dose by the ICRP calculation chart is the liver and the urinary bladder. And most of these people are hydrated well in that regard.

So just to give a feel for clinically why this interest is here and where we are going with all of this, I-123 is a meta-iodobenzylguanidine. It's essentially a fake-out of the neurohumoral system excuse my north Jersey-isms which is norepinephrine, which is the major whip to beating the heart to create activity and is used in the autonomic innervation of contractility in heart rate. By having a neurotransmitter that doesn't undergo metabolism, we can kind of track norepinephrine and, therefore, indirectly assume norepinephrine neuronal innervation density essentially.

Alright. So this is a little schematic

of autonomic nerves as they sit on top of your ventricle and some of the fine pathways that are involved, but norepinephrine coming out of these nerves essentially tells the heart something about its performance. Beta one receptors tell you how fast your heart rate goes. Beta two tells you how strong your heart muscle squeezes. Alpha one is a little bit of the vasoconstrictor component of the coronary tree, but norepinephrine is a major driver in trying to auto-regulate some of the stuff that is going on with the heart.

And in the field of heart failure, the fact that the pump is starting to fail, the impetus of the body to correct is to hit harder with the whip. And that hitting harder with the whip causes a variety of different things to occur. And having some feel for that would certainly be helpful for understanding where a patient fits in his long-term prognosis and what is going on.

So mIBG gets taken up by the norepinephrine transport site on the presynaptic junction. So it helps us mark presynaptics. And there are going to be changes in both receptors and presynaptic uptake based on the neurohumoral dysfunction of the failing heart. And this is going

to allow us to track it essentially.

So to talk a little bit about the catecholamines, of which norepinephrine is one, in heart failure, you know, I wish I could do this as good as Doug Mann, an old friend and colleague of mine at Wash U., who is a Temple boy, by the way, but, you know, essentially as pump function decreases, either by ischemic or non-ischemic causes, the body goes into a neurohumoral overrun to try to get it to do better. And there is up-regulation of the renin angiotension aldosterone system and the sympathetic nervous system, almost kind of in an adrenal flight symptom, to try to get the heart to be more efficient. That causes an initial increase in the release of norepinephrine to the synaptic junction to get the heart to perform better. But the chronic stimulation of the sympathetic nervous system essentially eventually causes depletion of norepinephrine at the synaptic junction and, therefore, down-regulation of the norepinephrine system and the neurohumoral regulation. So that you essentially eventually get to this down-regulation of response and down-regulation of receptors and, therefore, down-regulation of norepinephrine uptake and down-regulation of mIBG uptake as the false

neurotransmitter essentially.

I would point out that, like all good technologies, if there is scientific data in it, then there will be multiple ways to try to track it. So we should point out that, nuclear medicine being a molecular technology, there are many potential radiopharmaceuticals in the pipeline to do this. Several of them, obviously you could tell from this quick chart, involve PEP-type agents that are norepinephrine kind of analogs.

There is some interest, obviously, in parasympathetic innervation as well in the EP community. And we'll have to see how that defines over time.

In any case, meta-iodobenzylguanidine is an analog of guanethidine. Guanethidine is similar in structure to norepinephrine. Once uptake into the presynaptic nerve terminal, it competes for entry into vesicles and transmittal out to cause activity. And this allows us to track the amount of innervation in the heart.

The attempt over the last couple of years to quantify this has been an attempt to get some relationship of density, of nerves to the ventricle, and on an uptake basis, rather than visually, which

is obviously going to be by radiographic characteristics normalized. So in this regard, there are regions of interest drawn over the heart. And then where there should be lots of innervation and lots of uptake and then a region of interest drawn over the upper mediastinum between the lungs, where obviously there is very little innervation, it should count essentially as the background mode to give you a relationship between the innervation of the ventricle and the background that you see. And a ratio is derived.

So in the normally innervated heart, there is lots of uptake. And that ratio is usually well over two. And it tells you that there has been no down-regulation of the autonomic nervous system and that the heart believes that there should be no need for feedback mechanisms from the adrenal system.

So if that ratio goes down, then it reflects a decrease in receptor density, some problems with the integrity of the presynaptic nerve terminal, and some ability to take up norepinephrine, which is usually the case.

So this is what this has looked like in the '90s or early 2000s, I would say, when people were first playing with this, you know, trying to get

a density of counts within the myocardium to the mediastinum and give some sense for what is the density of innervation.

I would point out that as this field develops somewhat further, there may be some findings in the regional uptake of innervation that may be helpful in understanding the pathophysiology of the patient so that eventually SPECT imaging may play a bigger role while the majority of the current numerical calculation is essentially planar imaging, but there are clearly findings of matched and mismatched perfusion images to innervation of areas of the heart.

There are some people in the EP community that believe that that may be sites for arrhythmic reentry. You know, a lot of that will need to be sorted out down the line as far as what that means prognostically. This is just an example of that from a slide from overseas, with the left images being mIBG uptake and the right images being a perfusion, where you can see an innervation regional defect without a perfusion defect.

You know, recognize that although these look like perfusion images with a tech agent, that the image on the left side is essentially acquired

because the tracer has been taken up by the presynaptic junction and not really by the myocyte. This happens to be sitting on top of it. And that is probably the key piece of molecular imaging.

I would just point out, just give a feel for why the excitement is in the clinical trial realm of this. The ADMIRE heart failure trial was probably a phase III pivotal trial that was presented to FDA and did look at patients with class II and III heart failure for whether indeed this numerical assessment of innervation may give us some insights into prognosis of different patient classifications.

The primary endpoint was trying to find a presumed cut line, although it's not quite as black and white as everyone would love, and to see whether a cut line would give us some idea of adverse cardiac events above or below, once again, you know, the usual ratio being well above two of heart to mediostinal ratios, using an endpoint of heart failure progression, so worsening functional classifications, potentially life-threatening arrhythmias, which are common in this patient population and especially ventricular tachycardia or cardiac death.

You know, there are a variety of ways

that this has been looked at over the past few years. We have tried to come to some consensus on what information would be most useful in patient care, whether that would just be plain R imaging, whether it be initial plain R imaging, after the initial injection, whether it be late imaging about four hours after the injection to see if there is washout because integrity will have less washout, less integrity of the nervous system will cause a little bit more washout in addition to less initial uptake, and you can see the combination of that four-hour imaging later. And the cut point on this trial at least was to use the four-hour plain R image as a quantitative assessment. There was a presumed, you know, line of what might be a bad or good prognostic outcome of about 1.6, which is essentially developed over initial trials that were done overseas to try to see if we can at least get some sense for whether this will give us some differentiation and prognosis between patients.

And, you know, just in summary once again, this was essentially endpoint progression. There were well over 900 patients involved in the study. Because this is a very sick patient population to study, there were a lot of events these

patients, unfortunately, clinically are pretty sick and don't always do so well and looked at composite endpoint. At the two-year composite endpoint, the group with relatively good heart-to-mediastinal ratios did still have an event rate. It's not zero. But that event rate compared to the event rate of those people below a certain line was certainly way less than half and at least gives us some prognostic data information when we integrate all of the information about a given patient and where we might make independent decisions.

The demographics are very, very common for this type of patient population. And that two-year mortality is pretty consistent.

You know, I would just point out that since all of these people by definition had bad hearts with EFs less than 35 and were functionally restricted, that a good majority of these heart-to-mediastinal ratios were nowhere near over 2, but there was some differentiation in the patient population to kind of look for.

And this is kind of the clinical outcomes of this trial through the FDA and its decision process, showing Kaplan-Meier curves, where looking at all of the endpoints, there is some degree of

independent differentiation in prognosis from one set to the other and in all-cause mortality. And this is what has caused some degree of excitement in the community looking for independent markers or something beyond coronary blockages and pump function, something from the nervous system perspective that we might be able to image and might be able to make some decisions on.

This is essentially showing three different patients who have significantly different heart-to-mediastinal ratios. You can see from the far right that the heart clearly is taking up some mIGB, even without a calculated ratio, which could be there, which was about 1.7, and the far left, where you can't see any cardiac uptake whatsoever, where the heart-to-mediastinal ratio here was really .96. And, as you can imagine, there were more events in the left group than in the right group essentially.

I would point out that, obviously, this is early FDA approval, a lot of excitement because it is a new mechanism target. And, obviously, new mechanism targets are kind of important when you are trying to do disease assessment and disease preparation. But, you know, the ability to add another marker of prognosis to try to see if we can

define intensity of services and targeting of services in people who are pretty sick is kind of exciting to the community.

The nuclear cardiology community recognizes that it is part of the educational part for its practitioners. There is already work undergoing in trying to make sure that we have guideline standards out there in acquisition and reporting and that we have some degree of societal representation of what would be appropriate use of the technology as a piece of the puzzle across many different assessments. But certainly this would be an assessment that is not gotten by left ventricular function or by perfusion and certainly holds some promise in that regard. Certainly we want to make sure on a lab accreditation basis that we have everybody doing this in an appropriate manner.

And we realize that, you know, in all life, education, education, education. And, so, you know, we're making sure that there is discourse among the community about the clinical use of the radiopharmaceutical and the clinical isotope handling of the radiopharmaceutical in a culture-safety manner that would do good for patients. And hopefully this will grow the armamentarium of the nuclear cardiology

community in helping all cardiovascular specialists take better care of a fairly growing percentage of disease process in the population.

And I will just end this with one quick comment. And hopefully I will be able to say my thank you's later. I am glad this slide made it past the cut, actually. This is not an institutional advertisement but a comment from my colleagues around the table, whom I have greatly enjoyed over the last eight years. You know, I wish while our mascot can sometimes be emotional, I wish both the Committee and the staff the continuing wisdom of the owl. You know, the owl is an unemotional bird that we assign wise wisdom to. It doesn't move quickly at first. It absorbs data. It thinks about it. It looks like it's just sitting there. And then it makes motions that are usually decisive and quickly. And it usually at that point sits back and tries to decide what it should do better the next time. And so I wish for everyone in the room the wisdom of the owl.

And I thank you very much for the opportunity to present.

(Applause.)

CHAIR THOMADSEN: Thank you, Dr. Van Decker.

Do we have questions or comments on the presentation?

MEMBER ZANZONICO: I just have

CHAIR THOMADSEN: Yes?

MEMBER ZANZONICO: -- an academic question. So would the idea be that this would identify CHF patients earlier or different patients? In other words, how would it affect the management of these patients?

MEMBER VAN DECKER: I think the hope is to try to identify people who need a more rapid intensification of their therapy, rather than an intensification of therapy that may not necessarily be necessary at that moment in their life span, you know intensification of the diuretics, the beta blockers, the transplant list, the devices, versus, you know, sitting tight on some lower-level meds.

You know, obviously, you know, with cut points, this is going to be still a clinical judgment kind of issue. But the concept of having a newer independent marker different than some of the traditional markers we have used as a piece of the integrated definition of intensity of services and prognosis I think we're all hopeful for. And hopefully as the phase IV data starts to come out and

we start to gather some more experience, you know, hopefully we'll be able to put some more specific bullet points to that, obviously.

CHAIR THOMADSEN: Dr. Suleiman?

MEMBER SULEIMAN: Yes. I think this is exciting. I mean, you are basically looking at a standard uptake value or a ratio in this case. And hopefully that correlates with some clinically valuable indication, you know.

The horror that I have experienced over the years is the complete lack of imaging standardization, where they don't know what they are administering and how you choose the regions of interest is almost arbitrary. Forget equipment sensitivity and variation and whatever. And then a lot of these trials fail. And I said, "What sort of standardization did you use?"

And "Oh, we looked at it." You know, so

MEMBER VAN DECKER: I think the community is very keen on sizes of regions of interest and positioning of regions of interest. And I think part of our guidelines that we are hoping to get out relatively quickly and standardized so that the field works as a unit is to try to standardize those types of things and bring a numerical piece to it. And

that's the strength of the technology.

CHAIR THOMADSEN: Dr. Welsh?

MEMBER WELSH: I want to agree with Dr. Suleiman that this was very exciting. So, Dr. Van Decker, if I heard this lecture a zillion years ago, when I was a medical student, I probably would have been a nuclear cardiologist.

(Laughter.)

MEMBER WELSH: I had no idea how exciting this was. But my question to you --

MEMBER VAN DECKER: That would be nice if the owl always knows when to

(Laughter.)

MEMBER WELSH: But you mentioned that this is a new mechanism target. And new mechanism here is catecholamine analog, specifically norepinephrine. Therefore, I wonder what would be the impact of mimetic drugs, beta blockers, inotrophic agents, on the uptake. And how does that uptake alteration in the presence of those drugs that are used in CFH patients compared to the traditional agents?

MEMBER VAN DECKER: Well, you almost could have been a cardiologist. That's good.

I think that that is great, interesting

stuff. So, you know, we have obviously patients who are on home inotropic support with milrinone and dobutamine because we are essentially creating artificial whips to the heart because we run out of stuff. You know, can we identify people who need that extra whip earlier or not? In the early down-regulation process, is there some way to track utility of beta blockers to slow the degree of down-regulation? You know, I think that you ask a variety of excellent questions that we have to some degree empirically treated by our gross understanding of the neurohumoral interaction and heart failure, but the potentiality of targeting pieces of that in a more scientific manner I think, you know, shows some hope and some promise for the field in the care of cardiovascular patients.

CHAIR THOMADSEN: Well, thank you very much for the moment of glory.

MEMBER VAN DECKER: Thank you guys for the opportunity.

CHAIR THOMADSEN: And we are running almost a half-hour behind schedule at the moment. We are going to lunch. Maybe we can try to be back here as close to 1:30 as you can.

(Whereupon, a luncheon recess was taken

at 12:27 p.m.)

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

1:34 p.m.

CHAIRMAN THOMADSEN: Welcome back after the break. We'll have a presentation now from Dr. Zanzonico on regulatory aspects of germanium-68/gallium-68 generators.

Dr. Zanzonico?

MEMBER ZANZONICO: Thank you. Welcome back, everyone.

Okay. So as the title indicates, I'll be talking about -- my presentation is germanium-68/gallium-68 generators, and I must first acknowledge our colleague on the ACMUI, Steve Mattmuller, who provided a lot of information and input, and in particular raised some of the key regulatory issues. And to a large extent I'll be parroting what Steve has already presented to us.

I think it's worth noting that there's really been widespread growth in the clinical applications of gallium-68 and of these generators in connection with radionuclide. That would be of somatostatin receptor-overexpressing tumors, the neuroendocrine tumors and so forth.

Largely outside the U.S. these radiopharmaceuticals, which have been used very

productively and very actively outside the U.S., really haven't established themselves in the States. But for example, there have been two recent international symposia on gallium-68 and on imaging in therapy of somatostatin receptor-overexpressing tumors. So in this respect we're a bit behind the times. We're a bit behind the rest of the world.

This is simply the outline of what I'll be presenting this afternoon, and I'll begin with the physical properties. So the germanium-68/gallium-68 generator is an example of secular equilibrium between the long-life parent, germanium-68 with a 287-day half-life, and the short-lived daughter, gallium-68 with a half-life of just over an hour. And the germanium-68 decays by electron capture and really only emits very low energy, very soft characteristic X-rays. The gallium-68 is a positron emitter of 90 percent positron emission with a very small abundance of high-energy protons. So it's really the gallium-68 daughter which dictates the shielding and most of the other radiation safety precautions.

Currently generators are available in activities up to 50 millicuries of germanium-68 and they have a source of no-carrier-added gallium-68 so

that you can get very specific activity and therefore low mass dose radiotraces labeled with the gallium-68, which is an important point since the molecular targets that these radiotraces are directed to our saturable targets, our somatostatin receptors. So it's important to be able to have high-specific activity.

Now you can calculate that based on a five-millicurie administered activity per patient. And the fact that you can easily elute the generator up to twice a day, if you look at the ingrowth curve of the gallium-68 by four hours, or about four daughter half-lives, the maximum amount of gallium-68 has grown in. So you can easily elute twice over an 8-hour work day or up to 6 times over 24 hours and you can easily get a 50 percent radiochemical yield at the various traces.

And based on about a two-year useful lifetime of these generators, or slightly less, and a cost about $1,000 per millicurie of the germanium-68, you can estimate a cost per patient administration of the gallium-68 of as low as $5 to $10. So it's a very economical source of a positron emitter.

These are examples of the current commercially-available gallium-68 generators, one

manufactured by Eckert and Ziegler and another by iThemba.

And again, you would need extra shielding because of the relatively high 511 keV annihilation photons emitted by gallium-68 and its low abundance of 1 meV photons. In its structure and operation it's a fairly conventional looking generator, analogous in many respects to the molybdenum-99, technetium-99M generator with the parent germanium-68 absorbed onto a metal dioxide resin and then eluted with a dilute acid, dilute hydrochloric acid and collected in shielded evacuated collection vials. So again, it's a fairly standard design.

This shows the profile of germanium-68 where the black bars identify the amount of gallium-68 activity. And that's on the left ordinate axis. And those activities are in megabecquerel. And the white bars represent the breakthrough of the germanium-68 parent. And that activity is indicated on the right ordinate scale. And note that that activity is indicated on the right ordinate scale. And note that that activity is in kilobecquerel.

So you see that about 90 percent of the activity gallium-68 is eluted in the four to six-ml of eluent with the germanium-68 breakthrough of about

0.0025 percent. And you can assay the germanium-68 breakthrough either by radioassay of the eluent after any gallium-68 has decayed away. So you're about a day or so, even 12 hours, as short as 12 hours after the elution. So you really couldn't do a breakthrough assay immediately post-elution for each eluent, but perhaps at the end of the preceding day you could elute a generator and then assay the activity of that eluent the following morning for that day's work.

There is also a method based on a cation exchange chromatography column for assaying the germanium-68 breakthrough immediately post-elution, but that may be more onerous than most sites would want to get involved with.

One of the attractions of gallium is that it's a trivalent or +3 metal chemically analogous to indium, which means it can be stately bound by so-called bifunctional polydentate chelates. And by "bifunctional" we mean that it has binding sites for the gallium metal, but also a second site for covalent binding to proteins or peptides. The original such chelate that was widely used in radiochemistry was DTPA, which is a so-called linear or open chelate. And more recently DOTA,

which is a cyclic or closed chelate is used more widely because of the greater stability of the metal binding that sort of forms a closed cage around the ion and gives you greater stability. And it's been demonstrated, for example, that there is very little, if any, trans-chelation of the gallium when gallium DOTA radiotraces are administered.

And the main form that gallium has been clinically, again, almost exclusively in Europe, has been to link the gallium-68 via the DOTA chelate to a somatostatin analog identified as TOC for short. I'll show you that again a moment. And this somatostatin analog binds with high-affinity and specificity to the somatostatin receptor itself, which is overexpressed on neuroendocrine tumors, neuroblastomas and so forth and is the basis of somatostatin analog imaging and radionuclide therapy of these sorts of tumors.

These somatostatin receptors are expressed, overexpressed on the tumor cell membrane, so they're readily accessible to systemically-administered traces of this type.

Here is shown the two types of somatostatin analog traces that have been used. Indium-111 DTPA octreotide, or OC for short, and

gallium-68 DOTA tyrosine octreotide, or DOTA-TOC, for short. And shown are the inhibitory concentrations, 50 percent inhibitory concentrations, which are in the nanomolar range. So these are very high-affinity binding traces.

And on the right is shown the kinetics of labeling of these traces once they've been covalently decorated with the chelation agents. And notice that under mild conditions 80 [inaudible] pH of 4 you get near complete labeling within about 5 minutes of incubation. So it's a very straightforward, very efficient labeling procedure.

And so a number of manufacturers have already market radiochemical synthesis modules analogous for what's available commercially for various PET radiotraces, and this allows rapid automated preparation of gallium-68 radiopharmaceuticals. So the point is although these generators are not approved for human use in the States, the technology, the practical technology is readily available for the efficient clinical application of this nuclide and these types of traces.

And I'd just like to step through some of the clinical applications. Here we're looking at a

PET/CT scan of a 16-year-old with a small bowel neuroendocrine tumor imagined with gallium-68 DOTA-TOC. And you see in the images on the left column transverse PET images, and then at the bottom a CT image, and then in the middle a PET/CT image and a high uptake focus of activity. And this was also shown on the sagittal MR image. And this demonstrates high-contrast specific localization of this agent in this tumor. And so it specifically identifies it as a somatostatin receptor-overexpression lesion.

And as shown on the left-hand side of this slide, DOTA-TOC is able to identify with really remarkably high sensitivity and specificity these lesions. And there's a statement from this paper basically saying that in literal terms, documenting the high specificity and sensitivity of these traces for identifying these types of lesions.

Another application besides staging and characterization of lesions with gallium-68 somatostatin receptor analogs is theranostic; that is, a treatment plan. Here on the left you see a whole body PET image of gallium-67 DOTA-TATE, which is just a slightly altered analog coronal view showing you uptake in lesions throughout the body, as

well as the liver and spleen and kidneys. And on the right is shown the therapeutic analog lutetium-177 DOTA-TATE following 200 millicurie administration. And the point is that the gallium agent successfully identifies all of the lesions and more at therapy, as well as the normal organ distribution. So it could be used for not only identifying treatable tumors, but also for lesion and normal organ dosimetry.

It can also be used on treatment monitoring. On the left-hand side is shown two pre-therapy PET/CT scans where the arrows are identifying the uptake in these tumors. And on the right after lutetium-177 DOTA-TATE therapy and the uptake has been completely eliminated by the therapy. And given the quantitative imaging capabilities of PET, one can also quantitatively follow therapy response. And in this particular paper a parameter called the molecular tumor index, which is basically a measure of the total tumor uptake is shown to decrease with time post-lutetium-177 DOTA-TOC therapy.

So an important advantage obviously of gallium-68 DOTA-TOC is that it's a positron emitter and compared with single-photon emitters like indium-111 DTPA-TOC you have much higher spatial resolution, much more accurate activity quantitation, its binding

affinity to the target molecule is much higher, the radiation dose because of the short half-life to normal tissues is much lower, and it can be done in a single visit. That is, the patient gets the tracer administered and within one hour, by necessity, the imaging is done. So it's logistically simpler, more cost-effective and so forth.

And this is just a table of different types of radiotracers already labeled and used in man in investigational context with gallium-68. And I'd point out in particular that an antibody label trace of a HER2/neuaffibody has been labeled with gallium-68. The importance of that is that nowadays antibodies and antibody fragments can be developed against almost any molecule overexpressed on tumor cells. So even though up to now gallium-68 has been used in connection with neuroendocrine tumors with the ability to raise antibodies against virtually, as I said, any overexpressed epitope and label that via a DOTA chelate with gallium-68, you now have a much, much wider range of applicability of gallium-68 in oncology and other disciplines.

In terms of radiation safety germanium-68/gallium-68 is already very widely used in practice as sealed sources for PET QC and calibration in

amounts of 10 to 20 millicuries. As I said, the generators are relatively low in activity, but very practically useful, very cost-effective, 10 to 15 millicuries compared to up to 1,000 millicuries for widely-used moly generators. The exposure rates are only about 0.5 mR per hour per millicurie of germanium-68 at the surface, or 10 mR per hour for 20 millicuries at a 20 millicurie generator surface. And these are the self-shielded generators.

The transport index is no greater than Yellow II. So you would, as I said, what to introduce additional shielding at the final site because of the 511-keVs plus that low abundance of 1 meV photons. Patient doses and the patient dose symmetry is very favorable. Five millicurie administered activities, less than 1 rem effective dose, which are both less than the corresponding FDG parameters.

Contamination issues would be minimal because of the short half-life of the gallium-68. So overall the radiation safety of these generators and of gallium-68 is very manageable in a manner consistent with current best practices in typical nuclear medicine and PET facilities.

One issue, and Steve alerted all of us to

this, is the disposal/decommissioning issue. Now of course the ideal scenario would be to return spent generators to the manufacturer, and that's certainly what we're doing at Memorial, using these in a pre-clinical setting. But there are some regulatory issues. And in particular, in 30.35, Financial Assurance and Record Keeping for Decommissioning, this states that each applicant for a specific license authorizing the possession and use of unsealed byproduct materials of half-life greater than 120 days and in quantities exceeding 10 to the 5th times the applicable quantity of Appendix B in Part 30 shall submit a decommissioning funding plan, I guess in case the vendor goes out of business, as described in paragraph E.

Now, according to Appendix B to Part 30, germanium-68 is not listed. So for any radionuclide other than alpha-emitting is not listed. The amount is 0.1 microcuries. Ten to the fifth times that would be 10 millicuries, which would be greater than even the lowest-activity germanium generator. So this would necessitate a de-commissioning funding plan. And there's a number of methods of doing this.

One would be a surety method by prepayment of a CD or bond or line of credit, a self-

guaranty if the institution or site passes certain financial test criteria. Now these are not problematic, frankly, for large hospitals or universities, but are potentially onerous for certain private practices and non-hospital-based practices. And it's sort of a catch-22 because part of the attraction of gallium-68 generators is extending PET much more widely into the community and into practice like non-hospital-based practices. So it seems that in order to promote the use of this very promising radionuclide that some regulatory relief related to a decommissioning funding plan is needed.

So just to conclude, the combination of generator-produced gallium-68 and very well-established chelation chemistry which is applicable across a wide range of molecular targets could really extend very cost-effectively the applicability of a PET. As I indicated, a single generator could perhaps be used for up to two years and eluted multiple times each day. It would provide a ready supply of inexpensive rapidly-produced high-specific activity PET traces. Certainly the short half-life of gallium-68 is compatible with the targeted kinetics of peptide and other small molecule traces with very favorable patient dosimetry. And it's

already been established in Europe that gallium-68 radiopharmaceuticals are important in diagnosis and personalized treatment of neuroendocrine tumors, but potentially through antibody-based radiotraces, many, many other cancers and other diseases.

As I've also pointed out, the radiation safety issues of these generators and of gallium-68 are easily manageable with current best practices widely established throughout nuclear medicine and PET facilities. The licensure would be under Part 300. But again, in order to promote this very promising radionuclide and the radiopharmaceuticals it could be used for, some regulatory relief is really needed for smaller facilities that perhaps most profitably can use it from the point of view of clinical efficacy from the potentially onerous financial requirements associated with the decommissioning funding plan.

So with that, I thank you for your attention. I'll be happy to take any questions.

CHAIRMAN THOMADSEN: Thank you, Dr. Zanzonico.

Comments and questions? Dr. Suleiman?

MEMBER SULEIMAN: Very nice presentation. I just want to clarify that this has not --

MEMBER ZANZONICO: Not --

MEMBER SULEIMAN: -- been approved --

MEMBER ZANZONICO: It's not approved, correct.

MEMBER SULEIMAN: -- in the U.S.

MEMBER ZANZONICO: Correct.

CHAIRMAN THOMADSEN: Dr. Palestro?

MEMBER PALESTRO: Chris Palestro. I have a couple of questions for you, Pat.

On one of the early slides you indicated that you'd estimate the cost to be somewhere between 2 and 5 or $10 per patient. And that's based on an estimate of how many patients per day?

MEMBER ZANZONICO: Well, it's --

MEMBER PALESTRO: Or total?

MEMBER ZANZONICO: We could go back and look at it, but it's based on a five millicurie administered activity. It's based on eluting a generator twice a day. And it's based on a 50 percent radiochemical yield. So in other words based on those parameters you would get X number of doses per day. And then over two years, if you divide that number into the cost of say a 20-millicurie generator, you would come up with 5 to 10K. So in other words, it's assumed that every dose you could

produce, every patient dose you could produce was actually being administered to a patient.

MEMBER PALESTRO: So then the concept would be that this is a commercial generator as opposed to having one in house, because virtually no institution does these numbers of studies for neuroendocrine --

MEMBER ZANZONICO: No, I agree. And I think if you were to base this entirely on neuroendocrine tumors, this would not be viable. But I think the longer term -- and I showed that one slide with non-somatostatin receptor targeting tracers that have already been produced, but in particular the ability to generate antibody fragments -- you couldn't use whole antibodies with this because their targeting kinetics are much too slow for the 60-agent at half-life. But there's a lot of genetic molecular engineering being done with antibodies and antibody fragments. And I'm continuously impressed with the specificity and ease with which these antibody-based molecules and be produced to target virtually any epitope overexpressed on tumors.

So like HER2/neu would be directed against breast cancer, which obviously is a very big

cancer. There's A-33 overexpressed on colon cancer. So there are any number of big cancers that potentially could be targeted with antibody fragments labeled with gallium-68. And I think that's where the real payoff lies, not neuroendocrine tumors.

MEMBER PALESTRO: I have second question and really sort of clarification. You were talking about checking for germanium-68 breakthrough.

MEMBER ZANZONICO: Right.

MEMBER PALESTRO: If I understood you correctly, you elute the generator today and then you test the --

MEMBER ZANZONICO: Well, that was one possible scenario, because the photons emitted by the gallium-68 are higher energy than those emitted by the parent. So you couldn't use kind of differential shielding to assay it. And with only a 68-minute daughter to half-life, you know, you have to do your radiochemistry in your administration quickly after the elution. So one scenario I was suggesting was that you elute the generator maybe at the end of the preceding day and then the next morning assay that. And the only residual activity in that eluent by that point should be the parent germanium-68, if there was any present.

MEMBER PALESTRO: But don't you want to know the breakthrough before you inject the patient --

MEMBER ZANZONICO: Ideally you would. It's somewhat analogous to the situation. You know, you can't do the same exact thing, for example, you would do with the rubidium generator because the half-life is too long. So I'm trying to come up with some compromise.

The other option is a cation exchange chromatography system. It's a little more involved than most radiopharmacies do, but it's not difficult. You know, there are any number of traces that have been developed that rely on set pack columns prior to administration or some simple chromatography, and I think this would fall into that category.

MEMBER PALESTRO: Just one last question. It's off the topic of radiation safety and regulatory, but you're quite enthusiastic about the radiolabeled antibodies.

MEMBER ZANZONICO: Yes.

MEMBER PALESTRO: Given the abysmal performance of single-photon radiolabeled antibodies, and we have a history of 20 years of all sorts of different antibodies that have been abject failures,

what is it that you see that's changed? Are they different types of antibodies?

MEMBER ZANZONICO: I think the big advance is the development of these molecularly-engineered fragments. I think the big limitation of not only intact antibody, but the larger fragments like FAB prime fragments and FAB fragments, the kinetics were just incompatible. The kinetics of targeting and clearance from normal tissue were just incompatible with sufficiently high tumor to background ratios for imaging and for therapy. But I think with these very small, which these much smaller fragments that have much more rapid targeting and clearance kinetics a lot of those limitations potentially may be overcome.

You know, in our facility we're doing an enormous amount of work with antibody-derived radiopharmaceuticals and some of the images obtained in pre-clinical models, which is not always predictive of clinical performance -- but some of the images obtained at early times post-injection compatible with the half-life of gallium-68 are really spectacular. And I think that is a bit advance, not simply the conventional fragments, FAB and FAB.2, right along the intact antibody, but much,

much smaller molecularly-engineered fragments.

CHAIRMAN THOMADSEN: Well, thank you very -- oh, we do have a comment. Dr. Welsh?

MEMBER WELSH: Pat, I think you might have already answered my question in your answer to Dr. Palestro. I think this is fascinating.

Has the DOTA-TATE been used for diagnosis of acromegaly or carcinoid? And, you know, if it has, does that open the therapeutic option with the lutetium analogous to what you showed --

MEMBER ZANZONICO: I'm almost sure it's been used in carcinoid tumors and I think the lutetium-177 has been used therapeutically, almost exclusively in Europe at this point, and the Europeans are very enthusiastic about it.

CHAIRMAN THOMADSEN: Yes, Dr. Suleiman?

MEMBER SULEIMAN: Two questions I have in mind. I know with the animal research you're dealing with small animals, and so the advantage of PET may go away, you know, with a human, so some of the non-PET longer-lived nuclides, you know. I mean that's always give and take.

The other question I've heard people raise regarding this type of generator is sterility over a long period of time. Most modern day

generators are gone within a week or two, so I mean I think it's a surmountable --

MEMBER ZANZONICO: Yes, I think it's --

MEMBER SULEIMAN: -- concern.

MEMBER ZANZONICO: Right. And I mean as shown in my diagram, I mean the eluent is always passed through a sterile filter. You know, you still have issues of pyrogenicity, which would not be taken care of by that. And that may ultimately be a limitation, but you know, you're also eluting the generator with typically four normal HCl, and I think that may clean up a lot of stuff --

MEMBER SULEIMAN: Yes.

MEMBER ZANZONICO: -- that obviously would subsequently have to be brought to physiologic pH, but that may be a blessing in disguise, the fact that it's eluted with an acidic mobile phase.

CHAIRMAN THOMADSEN: Mr. Mattmuller?

MEMBER MATTMULLER: Yes. Great presentation. In simple terms you might think of this as FDG production without the cyclotron in that you've got gallium in a can, but you still run it through a synthesis module likely used for the production of FDG and you still have to do your quality control testing for sterility for

pyrogenicity of your final product before it goes to the patient. So all those steps are still there. And I believe your cost estimate is really just for the gallium.

MEMBER ZANZONICO: Just for the gallium, not the --

MEMBER MATTMULLER: Not the --

MEMBER ZANZONICO: -- radiochemical, correct.

MEMBER MATTMULLER: -- radiochemical or the module, and hopefully maybe the pharmacist might get paid in there, too. But I always have to put that plug in. It's not a given anymore.

So also because of the short half-life of the product this isn't something that Mallinckrodt or Lantheus is going to take interest in because there's no way they could produce this in a single site and then ship it all over the country. This is going to be more successful in current PET production centers or in a large centralized nuclear pharmacy around the country because they'll be able to have the setup for production quality control testing and then ship it to local hospitals because of the relatively short half-life.

Last time we met we talked about getting

some sort of regulatory relief, and I know -- and that was very timely, Dr. Howe, in that -- I'm sorry -- was encouraged by the Enforcement Guidance Memorandum and how that provided regulatory relief for conditions that can't be met for rubidium generator, that something along those same lines could be developed for the germanium/gallium generator. Something along the lines of what we've proposed in the past is that once a generator is used and we're finished with it we ship it back to the manufacturer as a way to avoid the triggering of the DFP for a particular site.

CHAIRMAN THOMADSEN: Thank you for that comment. Other comments?

MEMBER ZANZONICO: Can I just --

CHAIRMAN THOMADSEN: Yes.

MEMBER ZANZONICO: -- follow up on Steve's comment about the -- you know, people might think, well, F-18 with 110-minute half-life, which is not that much longer than gallium-68, is shipped regionally. So wouldn't that be amenable to gallium-68? The issue of course is that you can make much, much larger amounts of F-18 in the cyclotron, so even if a significant amount of it decays during transport over several hours, there still would be an ample

amount delivered to the final site. That's not the case with gallium-68. Not only is it a shorter half-life, but the smaller amount you would start out with necessarily would be prohibitive. So it really is not amenable to transport regionally.

CHAIRMAN THOMADSEN: Dr. Howe?

DR. HOWE: I just wanted to remind ACMUI that Sophie talked about yesterday the list of recommendations that the ACMUI made and Mr. Mattmuller's recommendations on that. Sophie said that we were going to be sending it to another group at the NRC because the decommissioning questions are not part of our group. And so that's part of our resolution of your comment last time. So just reminding the ACMUI.

CHAIRMAN THOMADSEN: And thank you for the reminder.

Further comments? Suggestions?

(No audible response.)

CHAIRMAN THOMADSEN: Thank you very much, Dr. Zanzonico.

MEMBER ZANZONICO: Okay.

CHAIRMAN THOMADSEN: And is Dr. Cool here?

MR. EINBERG: Yes, he's here.

CHAIRMAN THOMADSEN: And next we have Dr. Cool, who'll give us a status update on 10 C.F.R. Part 20.

DR. COOL: Good afternoon, ladies and gentleman, Sophie says I have to be labeled, so I suppose I'm labeled. I don't know what the half-life is, however.

(Laughter.)

DR. COOL: This is about a different a topic from your previous one as is possible to obtain, but for the next little while what I wanted to do is provide the Committee with a necessarily very brief overview of the current NRC staff considerations looking at possible revisions to the Radiation Protection Standards.

We've talked about this before, so some of these topics are not necessarily new, however, since the time that we have last met together there have been some developments, so this should be interesting for you.

For those who some have forgotten, and I don't manage to get that luxury, we've been actually looking at this for quite a period of time. The ICRP's revised recommendations, ICRP Publication 103, noticed in December of 2007. A year later the staff

went to the Commission and said, yea, verily we think there are some things that probably deserve possibilities for updating. The Commission came back and said, yes, you're probably right. Go off and start exploring those.

We did that for several years, including exploring with you, and went to the Commission now a year and several months ago with a set of directional recommendations to determine whether or not we should proceed with some topics and have some notion, because in order to get to a final regulatory basis and proposal, eventually we need to dig into the specific details. And it's very nice to talk about generalities, but that doesn't actually a rulemaking make.

So we went to the Commission in April. They took until December. Gave us a Christmas present of last year with a Staff Requirements Memorandum. And that's what I'm going to be providing you today. The short version of that is the Commission approved in part and disapproved in part. We'll sort of go through what those things were.

At this point the staff has actually divided up the work into sort of four major areas.

I'm principally going to talk about the first two; that is, methodology and terminology and the activities related to Part 20. Recognize that there is a parallel effort looking at Part 50, Appendix I, which is specific guidance related to the effluents from the power reactors, in itself a very complicated topic which has connections to this activity, as well as a variety of other issues that don't actually touch the Part 20.

And then the Commission in addition in their wisdom said, yes, staff, not only do we think it's a good idea to work on that, but we want you to go off and look at all of the other places that still use the very old methodology and terminology and work on bringing them up to date, which if I reflect on it from a historical perspective is probably a good idea. We didn't do it last time in 1990. What makes us think we'd get around to it this time around sooner or later?

So we have yet another set of things. And again, I won't get into some of those. Some of those will be handled by separate rulemakings and considerations because any time you open up a part; for example, Part 61 on low-level waste, you introduce a bunch of other issues into the equation.

It's not a simple matter of take this word out and put that word in, hardly ever.

So there are three major categories of issues from an overarching standpoint that we're going to have to look at as we develop what will become a regulatory basis.

Cumulative effects of rulemaking. The Commission has for many years been specifically asking the staff to look at cumulative effects as in the fact that we're doing this year and somebody else is doing that there and somebody else is doing this over here. And they all come together. I see Susan shaking her head up and down. They call come together on a licensee. And she goes, oh, my -- you can fill in the blank. So we actually try to take a look at what those implications are in timing and space and activities, or conflicts of those.

The regulatory impact itself. In preparing a regulatory document we will have to have an analysis of regulatory impacts, cost benefits implications with quantitative and qualitative.

And the state implementation. While there are 103 reactors, there are 22,000 materials licensees. Only about 4,000 of those are NRC's. There are 33 Agreement States. So they are a major

partner in this and moving forward. And certainly Part 20 is a major player in all of those regulatory areas.

So let's start with the first area, the updated methodology and terminology. The Commission's direction to us was to go ahead and develop a regulatory basis to align with the most recent methodology and terminology for dose assessment. All very nice. Sort of sounds simple. Yes, sort of sounds simple. There are a set of proposals that we're not looking at.

The first one perhaps is simple. We update the terminology to match the current international terminology that's used. That change in terminology also happens to align with underlying changes in some of the calculational details, so a new term applied with a new calculation approach, new tissue-weighting rating factors allows you to sort of figure out who did what to whom when. Well, that makes sense. The new tissue-weighting factors and radiation-weighting factors are in place. They were in Publication 103. That's all very nice. It's translating those into all those little details of annual limits of intake, derived air concentrations, dose coefficients to various organs and tissues from

internal radionuclides and from external radionuclides. That takes a wee bit of time.

There is now something like 1,200 radionuclides in the calculation table. So you have to look at a variety of external exposure scenarios, and that's one set of numbers. And then you take each of those radionuclides and you run it through new biological models, updates of nuclear decay data. You crank it into what our friends down at Oak Ridge call the cluster. It processes and processes and processes; and they've burned out a cluster of two over time, and eventually generate the Monte Carlo calculations, which give you new sets of numbers. All of that can be done and is sort-of straightforward, but it's taking time. It's going to continue to take time and effort. Those numbers are not actually ready that. That's one of the timing pace issues that we will eventually have to deal with. In the meantime, there are some other details which are not necessarily quite so neat. As you know, the models that are used to model the body constantly evolve over time. You actually have to say we're going to do that particular set of models, pick a point, and they continue to evolve. ICRP is moving to a set of what they call voxel phantoms,

voxel being a 3-D pixel. So imagine your entire body pixelated or voxelated to using MRI and CT and other data. Wonderful specificity, but in fact there are certain tissues, GI wall and some other things, that are actually too small to be represented by a voxel. So in fact the models will remain some combination of mathematical and voxel-types of phantoms and they continue to evolve.

Right now at Oak Ridge there is a very detailed set of mathematical phantoms. They will be working to bring in the voxel phantoms. The staff's understanding at this time is that the differences when they bring in those over the next several years will be within a few percent, although it's not possible ahead of time to predict exactly what the differences between going from a pure mathematical set to the voxel mathematical combination will be.

Our friends at the Environmental Protection Agency, in looking to move forward with the development of guidance which they use in their Superfund programs and other programs, has determined that they could wait and they could continue to wait and they could continue to wait or they could ask Oak Ridge to go ahead and take the set which is essentially in place now and move forward. It

incorporates the ICRP 103 tissue-weighting factors, radiation-weighting factors, the new lung model, GI model and all of those sorts of things, and, as I said, is understood to be within several percent.

The NRC and the Department of Energy are working closely with EPA, and one of our goals, perhaps a bit optimistically, was the thought that perhaps someday we could have all of the federal agencies using more or less the same set of models at the same time, including our friends in FDA who have their own needs for assessing certain issues in new drug evaluations and things, the organ-specific models. And so we are examining going ahead and leveraging the work that Oak Ridge will be going ahead and having Oak Ridge do over the next year or so.

That gives us an advantage of consistency with the federal family. It gives us an advantage of hopefully having products within another year or so so that there's actual technical basis, because everyone wants to know what their favorite radionuclide's annual limit of intake will be. It runs the bit of a risk that eventually numbers that would come out in ICRP Publication 1-something-something-something might be slightly different, and

therefore there might be slight differences between the U.S. version and the international version.

The staff plans to go to the Commission sometime early next year with a more detailed look at this and our recommendation, although at this point the staff's leaning is that there are advantages to national consistency and being able to move forward. As I said, we can wait forever. About the time we have the voxels done, the modelers would be off having created yet another new set of models.

And a second interesting issue is the calculation of a member of the public. In the existing Part 20, Appendix B, Table 2, the Effluent Concentrations, the member of the public numbers were derived by taking an occupation-exposed individual and ratioing it for the number of hours of breathing, breathing rate, time, those sorts of things, because back in the day there was only an adult model.

Now there is a newborn, and a 3-month-old, and a 1-year-old, and 5-year-old, and a 10-year-old, and a 15-year-old male and female, and adults males and females. All of them have their own model. There's a whole family of models now. And there have in fact been efforts that have already been done to take that set and to use age and gender-weighted

averaging of the set of dose coefficients to create a member of the public which would represent the spectrum of people in the population.

So you take the census data, 2001. You know how many one year olds, three year olds, five year olds in the population, the males and females. You can ratio each of those dose coefficients by that amount and you create a statistical reference individual, which is certainly a better representation of a member of the public than simply taking an adult and ratio-ing them down. In fact, you will see differences depending on the kind of radionuclides. So iodines would be different from uraniums and some of the other things. So it actually does provide a more realistic representation.

The staff is considering that approach. It has in fact already done documented and public using the older ICRP-60 coefficients. It was done by the Department of Energy several years ago and is available publicly in DoE Standard 1196, 2011.

DoE is quite interested in partnering with us to updating that to the 103 methodology so that again there might be consistency in the federal family between that which gets used in the DoE area

and within the commercial side. So that's another possibility that we're wanting to look at.

Yet another question of course is so what's the target dose for effluence? Today the dose limit, we simply divide it in half. We've got half for air and half for water. Well, okay, that makes logical sense if that's what you want to do. But other people will say, well, why do you do that? Because, well, I've got some air and I've got some water. What about the stuff coming directly from the site? So there are some issues that we need to consider since it could be argued that someone could be exposed by all three pathways, yet we've only accounted for two in a particular effluent stream.

And then of course as I mentioned, the time frame for calculations. If the staff moves forward with a recommendation of using the set of models Oak Ridge is beginning to work through now, we would hope we would have technical basis numbers by sometime in early 2015, which could support discussion and possible development of a regulatory basis by the end of 2015.

If we decided to wait for ICRP's actual publications to come out, we could easily be in '17 or '18 before it was all done and published and we'd

still have to crank through. Okay. Nice set of dose coefficients. Crank it through. So what's an ALI? What's a derived-air concentration and things? So there's work to be done.

So a number of questions. You've got all of these on the slide. In the interest of time I'm not going to try and read all of them, but there are a number of things that we're going to be asking.

This is probably a good time to note that we are in the process of developing a detailed *Federal Register*, which might look and sound a whole lot like an advance-notice-proposed-rulemaking-type of thing, the next step in the series, that we've published before, which will lay out the issues and lay out very specific questions that we're trying to get information and feedback on so that we can go into the next round of development of the regulatory basis.

So let's go to the next major issue; and this is the humdinger of the group perhaps, Individual Protection ALARA. There was great cheering in certain sectors of the commercial community when the Commission gave its direction to leave the total effective limit at 5 rem (50 millisieverts). Having said that, the Commission

said, yes, we don't see a need to just change the limit, but we understand the rationale upon which the international recommendations were based, which is that you don't want cumulative exposures starting to get up towards perhaps a sievert under rem at which point you have five percent or more potential induction.

So staff goes off and consider alternative approaches for dealing with protection at or near the current limits. That gets to be rather interesting and complicated. So as the staff looks at this and starts to engage in this discussion, starting from the objectives that we've laid out to try and ensure that the cumulative exposure is examined, the progressive restrictions can be taken. That's a nice generalized statement of what we'd want to do. Turning that into regulatory language is, as I'm sure you realize, perhaps a bit more complicated.

There are several possibilities that we're going to be asking questions on. The first is to consider adding a requirement to actually do ALARA planning. Now that probably sounds like a what? After all, today the reg says to reduce exposures as low as reasonably achievable using procedures and

engineering controls. Okay? Doesn't actually say "plan." We in fact had individuals in our public meetings on the record say it's impossible to plan. That got some of us just a wee bit upset.

Okay. But one thing that might be a useful tool to look at those issues is to actually require planning, to do some documentation and planning. Another would be to consider requiring the licensee to establish a mechanism to examine cumulative exposure and take restrictions. Now, at the most performance-based level that might be the requirement, and let licensees sort of figure it out and improve it on a licensee proposal sort of basis.

Or you could be a little more specific and say we want you to plan and we want you to have an administrative control level, a planning level, which you're going to take some actions on so that that's firmly in place in a license condition so there's something to inspect and benchmark against all of that.

Also under consideration, whether there should be some additional requirements associated with concurrent sources of occupational exposure. And the medical community is one of those places where we see the possible potential for that, as in

you might have practice privileges at several different institutions and you may be receiving exposures in several places concurrently. It's not clear the extent to which that may or may not be occurring, but it's certainly something that we want to look at and which today we do not have information on except in the reactor community where we have really good details because they're required to report. But we'll put reporting aside. I'll get back to that in a minute.

So the staff thought about what kind of things -- so if you establish a performance-based requirement and say go off and establish a mechanism and maybe go off and establish an administrative control level -- by the way, if you're wondering where that phrase came about, that is the existing language in the Occupational Federal Guidance signed by President Reagan in 1988 as a very strong suggestion. It was not picked up in Part 20 itself, but is something which is already out there. It's in fact implemented in the DoE system already.

So a licensee could decide -- and these are meant as possible things that the staff could consider as acceptable. They're not must do all of the above, but perhaps one of the above might be an

acceptable approach depending on your mechanism.

You could simply say I'm going to keep everybody below 20 millisieverts and everybody would be happy. Yes, okay.

I'm going to keep track of things over a five-year period. So so long as I'm averaging 20 millisieverts over five-year periods all well and good. That's the ICRP's recommendation.

I'm going to sort of track everybody to a 10-millisievert level with age, which was actually the NCRP's recommendation for how to deal with this exact same cumulative issue, looking at the exact same one-sievert end point to try and avoid.

Or perhaps you could say, well, I'm going to establish an ACL, but I'm not going to worry about them until they get to some total cumulative exposure. Means you have to keep track of the cumulative exposure. So but as long as they're below 500 millisieverts, 750 millisieverts, 50 rem, 75 rem, then, okay, they're cumulative. It's not something I'm going to worry about. But if they get up in that level, then I'm going to have to pay more attention and do something else to control them.

Now that potentially has some interesting values, at least in the data set we have today

because there's precious few people that actually get up that far. We do have some in the database, but not a lot of them. So that perhaps has virtue for some types of licensees.

Of course there is a downside. If you wanted to do something like that, then you'd also have to have the records in place to be able to demonstrate that you are tracking cumulative exposure. And one of the things that we've heard over time is, gee, it's really nice to only worry about this year. So there are pros and cons that we're asking people to explore.

The next two slides actually are questions that are associated with this that we're going to be trying to ask in terms of the implications, how different approaches might or might not work in different types of settings. We recognize that industrial radiographers, medical facilities and reactors are all very different. And what works very nicely in a reactor does probably not translate so well to some of your facilities. So you're looking at a variety of possible options to consider what might work to help you improve radiation protection and deal with this issue.

Are there other mechanisms? I mean we've

tossed some stuff out on the table that's been in various international recommendations for guidance, but I don't claim to have a corner on the knowledge in this particular set of things. And so there might be some other possibilities which also might become acceptable options. And what other sorts of things should be looked at?

And to what extent should the States be required to be similar to or be allowed to be different from what the NRC might decide to put in place? Dose guards, the 5 rem, 50 millisievert is a compatibility B. Essentially identical. Is there a reason to require the States to do that, or could they be more restrictive? They could for example as I -- we want people to do one or two certain ways because that's what we would like them to do. Is that an acceptable approach from a state-to-state basis, which could introduce some variations?

And of course we know that the medical community also happily crosses jurisdictional lines. It wouldn't surprise me at all for someone to have practice privileges at Fairfax and NOVA and GW and somewhere up here in Maryland all simultaneously. Three different jurisdictions, three different regulatory agencies, as well as three different

licensees. So there are some pros and cons and we're looking for discussions on how to do that.

So let's talk about the lens of the eye, another rather interesting issue. The Commission's direction was to continue the discussions about possible reductions. At the time we went to the Commission, we didn't not make a specific recommendation. The ICRP had only more recently come out with its findings that there was -- I guess the simplest way to say it is the threshold for possible induction of cataracts, the post-subcapsular cataracts that radiation typically induces, maybe with a threshold more like 50 rem total cumulative exposure rather than the several hundred rem upon which the previous 15-rem high-dose equivalent was based.

So the ICRP changed their dose limit recommendation, actually numerically the same numbers as their effective dose. So the ICRP's recommendation was two rem average/five rem maximum lens dose equivalent. I'll use the traditional units here since I'm in the United States at this moment.

Given that the Commission said leave the five rem effective dose number alone, staff doesn't quite see how we could possibly reduce the lens dose

number to something smaller than that because lens doses would then automatically be controlling any time there was a relatively uniform full-body exposure. Lens dose would be different from whole-body dose if you had varying asymmetric fields or, for example, in a number of your areas, not necessarily of the byproduct material, but all the interventional work if you're wearing the lead aprons and things. Some of the lens dose might be significantly greater if you don't have the leaded glasses and things. So the staff is asking questions related to a proposal to reduce the number to the same number lens dose equivalent to 50 millisieverts (5 rem) as the effective dose number.

Obviously there are a number of questions. Is this the right kind of proposal? We still have lots of people who are not entirely fond of the underlying data set. They also raise a very interesting question, which I suppose sooner or later we're actually going to have to deal with, which is, okay, so this is induced. Most of us will probably have cataract surgery if we hang around long enough. I know certainly my wife is facing it in another year or so if her cataracts continue to erupt. She was never involved in radiation exposure otherwise,

but it's one of the hazards of growing older. It happens to be outpatient surgery. You go home the same day. And by the way, your vision's improved. Maybe you'll need reading glasses after things settle down after a few days. So do we wish to consider this sort of effect in the same way that we look at the induction of cancers?

Now if you take that logical philosophical extension on it, at some point you get to the question do we worry about cancer induction or do we worry about cancer fatality, and should our considerations change over time because we're getting better at curing things? At the moment I don't really want us to go all the way out there, but it is an interesting philosophical discussion. We are interested in the underlying viewpoints on the health end point.

There are a number of issues associated with assessment and dose recording if you're wearing leaded glasses. So what kind of protection factor do you lack? And it's probably very different if it's wraparound because some of the significant doses may be scattered rather than direct in. So it's coming in from the side. Do you have the side shields in place or otherwise some of those other associated

things? How you do the measurements. Some people are getting smarter with little dosimeters which they might put inside the leaded glasses and a variety of other things. What are the impacts on the licensees and state regulatory programs?

Moving on to the next one, recognizing that we don't have a lot of time here, the dose limit for the embryo/fetus/declared pregnant female.

That number in the current regulation, 500 millirem (5 millisieverts), was not changed with the final rule for Part 20 in 1990, even though the public dose limit was lowered. I don't know exactly why at the time it was left there, but that's where we are. But in fact is a fact where you have what is ostensibly stated as a level of protection comparable for that member of the public getting all the legal debates.

So the staff's proposal, as agreed with the Commission, is to look at a reduction to the one millisievert. That has some implications, of course. The current regulation applies over the entire gestation period. The ICRP's recommendation applies only post-declaration. As we've discussed before, that makes a whole lot of difference in terms of possible protection that's afforded. The dose limit

for the embryo/fetus of a declared pregnant woman is the only dose limit which is in fact variable depending on an individual's right to choose and their decision on what they're going to do and when they're going to do it.

So if you have a regulation that is set up only post-declaration, you have a very protective rule if she chooses to declare very early. You have a not very protective rule if she decides to wait until halfway or more through it.

On the other hand, if you apply it across the entire gestation period, as it does today, you have to go back, calculate and look and see where you are. There needs to be a provision if you're already close to or exceed the current value. Those would have to be put in place.

There are of course issues associated with how you go about measuring it. If you do monthly reporting on a lot of the typical detectors at 10 millirem a month you're squeezing the minimum detectable levels. So the question becomes mis-dose and otherwise and how significant that becomes in the analysis. So again, impacts on activities and programs.

We know that there are some types of

licensees -- I understand for example some of the nuclear medicine pharmacists, which may run 300 or 400 millirem typical lab exposure in a year, end, finis, done. They've never been worried about any of it because they were below the limit. It was never an issue, but suddenly might become an issue with the new regulatory requirements.

Moving onto the next issue, traditional versus SI units. You've noticed that I have sort of waffled back and forth between talking about rads and rems and curies and talking about millisieverts and sieverts and becquerels. The Commission disapproved eliminating the traditional units. So those of you who are from the Health Physics Society, I'm sorry. The Commission chose not to agree with the position which the Society posted, which was just do it, but instead to continue with both set of units.

Now, that continues the sort of who does what to whom when and the communications issues. The staff, given that direction, would propose to do exactly what it was actually thinking about, which is to implement the current Commission policy statement on metrication, which is that rules should be written with the SI units first and traditional units in parentheses. That's a reverse of what Part 20 is

today. Part 20 was finalized before the whole metrication thing came into play. So, that's sort of nice.

And question No. 1: So what impact does that have? If I flip-flop it and everybody continues to behave the way they are, perhaps there's no impact. But you might decide to, well, gee, if you've listed SI first, shouldn't I be allowed to report in SI, or least keep my records in SI? Licensees are required today to report in traditional units. Should we change that? Should we allow there to be a difference?

Should we allow there to be keeping the record so long as the records are in one place, but for emergency preparedness or certain other functions continue to require only one set of units? Because when we start talking about two sets of units and emergency preparedness and some of those sorts of things, really bad things happen in a hurry, as the Fukushima Daiichi accident very rapidly pointed out where they were all reporting in SI and the reporters were talking in SI, and here's the good on U.S. still mired back in traditional units and everybody's what's that? How does it relate? So there are certainly communication issues that we need to try

and look at in order to try and avoid massive confusion.

Of course in the end I suppose the question is will the U.S. ever just become metric? That's a question that I luckily don't have to answer myself.

So let's get to reporting of occupational exposure. This is the other potentially really big deal lurking in these sets of things.

The Commission was actually very explicit in its direction: Go improve reporting of occupational exposure by NRC and agreement state licensees, some of which currently do not submit reports. Regulation today requires seven categories of licensees to report. Reactors, industrial radiography, low-level waste disposal sites, spent fuel storage facilities, fuel cycle facilities and a couple others, general processing. Notice that there were no medical uses in there, or a variety of other things. Add to the complicating factor that this is a compatibility D. So for the States it is optional. So in fact is not required by most all of the States. So when we go about looking to try and find, so, what are the exposures in industrial radiography? Well, I've got the data from the few licensees that

remain NRC licensees. And due to the good graces of a few of the States I've got some of the other data, but we don't have all of that data. And we certainly don't have any data in the medical area because nobody is required to report that data. So the proposal that we are examining is the question of adding categories of licensees perhaps as broad as licensed under Part 35, or perhaps more specific licensed under 35.100, 200, 300, 400, 500, 600. That gets it all or some subsets if there is a rationale that is associated with including or excluding some of those on the basis of possible incurrence of occupational exposure. We're looking for information on that.

The question of how we look at adequacy and compatibility with States, perhaps moving from optional to something which is a little more restrictive so that we actually gather the information.

Looking at mechanisms for how to try and get all that information into one place so we can actually share it with each other. I'll go back to the same analogy I did a little bit ago: So what about the physician who has practice privileges in Maryland, D.C. and Virginia, three different

organizations? If we're not sharing data amongst each other, we still don't have a good way for anybody to cross-check what might be going on, unlike the reactors today where I can go and if I have your name -- it's a Privacy Act system, there are safeguards associated with it -- I can pull your entire dose record. And we have people on the staff who have worked in the industry who do QA checks by going in and checking themselves, all the different places that they've been and times that they've been, and seeing how it all adds up. And we can do dose trends.

So there are certainly a whole bunch of questions that are associated with that. Could we add? Why do we add? How does it look at occupational exposure? Are there specific reasons for including or not including certain types of uses for otherwise? How about other groups besides just Part 35? There's lots of other things licensed in the byproduct material world.

So what do we do with the other half of medical, which is only licensed by the States, the machine-produced radiation and otherwise? Last I know the dosimeters were not very discriminating with regards to whether it came from a byproduct material

atom or whether it came from a machine. So it's a bit tough for many licensees if individuals are working in both to know what was contributed, one or the other. But in fact what we understand via anecdotal information, which is probably a good thing because otherwise I'd have to regard it as an allegation, about badges being left behind, exposures exceeding dose limits and otherwise in some of those categories and sort of how do we get a handle on that in a reasonable sort of way working with the States? I will tell you that the States have been quite interested in working on this. They see the need for moving in this direction, which was a hopeful sign. But certainly a whole bunch of issues.

So with that incredibly rapid run-through, what are the next steps? We're trying to talk to everybody who will listen to us, federal, States, licensees, advisory committees, public stakeholders. We do hope to have a *Federal Register* notice out there eventually. It's taking a bit longer. But one of the advantages of talking to a lot of people and every time we come away from a meeting coming back and saying we heard this question, this question. Ooh, that's a good question. Add it to the *Federal Register*. So it's

evolving over time. Issues are being added. That will get out. There will be formal notice and comment. The docket, which has been open previously, is still open.

We are seriously thinking about one or more Webinars to engage people to get people thinking about it, if not get feedback at that point, provide further opportunities for discussion and proposals.

The staff's proposal is still to try and do probably a second round actual draft regulatory basis document for comment maybe late in 2014 or early 2015, still at that point not having all of the specific dose coefficient numbers available, but for another round of discussion.

At this point in time the staff is due to take the regulatory basis as a voting matter to the Commission in December of 2015.

Now, certainly that timeline, while etched in the Commission's tracking system, may be impacted by the availability of whether we actually have all the information and can complete that process or not, but that's the current timeline.

And with that, I've talked long enough. Questions?

CHAIRMAN THOMADSEN: Dr. Zanzonico?

MEMBER ZANZONICO: So is there any consideration about a stratified dose limit system? Because what I'm thinking of is, as you pointed out, interventional radiologists, especially with respect to a lens dose. You know, typically you have the upper limit of occupational doses in a medical setting. And that's one group where reducing those things really impacts the patient care. Because, you know, yes, in a large academic medical center there may be any number of interventional radiologists. Those smaller centers or rural centers, they may be much fewer and far between. So that those things could really impact delivery of care.

So I was just wondering if there's any thinking in that respect, that for certain groups or subgroups among medically-exposed. occupationally-exposed individuals there might be one dose limit. For another group it might be a different dose limit. I mean, obviously there's many things wrong with that, but I'm just curious if that's at all being thought about.

DR. COOL: The answer is yes, but without using the word "limit."

MEMBER ZANZONICO: Yes.

DR. COOL: As the staff is looking at it,

the limit, the magic bright red line at which we get our Office of Enforcement to come bang on their head, remains at the 50-millisievert level.

The staff's discussion has been, so, if we tell licensees to establish a system to look at these exposures, one of the possible options which we think could perhaps be acceptable would in fact be to allow them to have a stratified system and to allow a licensee to create their own particular system which would work for them.

A rural clinic licensee might be able to establish a much more simple system which would be in keeping with the work that they do, the workload, the kind of exposures, whereas your facility with a huge number of different things and activity might see an advantage to requesting a specific license amendment and set of procedures whereby you have several different strata for different groups with justifications and approaches, and that that could be looked at.

So the staff sees that as a possibility. We haven't at this point locked down on yes, or no, or within certain parameters. That's part of what we're trying to get feedback on as to the extent to which that could work, what kind of flexibility might

be necessary and how such a system, which would then become more licensee-unique, could fit within us having confidence that the overall system is generally providing adequate protection with this flexibility.

CHAIRMAN THOMADSEN: Dr. Suleiman?

MEMBER SULEIMAN: I have a couple of points, or you'll hear some of my feedback.

I agree with you on the models. I call them realistic models. The ability to generate literally patient-specific models, we're going there. It's just a matter of time with the technology. I mean there's a whole movement in medicine to know what the patient doses are with other philosophical issues that they're not really relevant right now. But I think we're going to be there. And in the future people will know the doses that they've received.

In terms of what do you do with that, I'm a firm believer people should know what they get and at that point they can decide what's appropriate. And you can't discuss risk unless you know the age, the gender. And, you know, let us get philosophical and say, you know, you've got an illness or you don't have an illness. You know, you're willing to take

more risk.

So I think the key thing is to know what the dose is and worry about what your trend is. If you're getting high doses all the time as an occupational worker, you ought to be concerned. I'd be less concerned about the number as much as the trend and the consistency and the standardization.

A couple of years ago I remember that reactor workers were basically going around from one site to another getting their maximum and then going to another. I thought the NRC addressed that. Was that ever resolved?

DR. COOL: Yes, you certainly have a cadré of individuals who will work several outages in a year. The reactor community has a whole series of call them administrative control level planning values where a site will not take an individual to more than a small percentage of the total and they carry an ongoing call it passport or whatever. They know exactly where they are. They know exactly how much they've got left.

In fact, I understand that sites will not let somebody on the site for an outage unless they've got X amount of buffer for work that might be done under that outage and that all of that is geared to

keeping all of the folks below 20 millisievert. In fact, many of them are using a rem-and-a-half (15 millisievert) otherwise. And they're not taking people over that.

It is a very detailed system. The planning there by outage, by individuals, by radiation work permit is astounding. They've got the system. They can do it. And they know exactly what their people are. They know every single person and they've got them tracked. We can compare theirs with ours and we know exactly.

MEMBER SULEIMAN: Okay. And the last thing I wanted -- I sit on a Society of Nuclear Medicine Molecular Imaging Task Group and an AAPM Task Group dealing with dosimetry, and the thinking right now is -- because we're going to require standardization across. You can't talk about DTDI or radioactivity. You need to know what the absorbed doses are. But the thinking is people should use whatever reference model they want as long as they reference it. And the thinking is that all else being equal, you know, if you type in, you know, 67 kilograms and you give some dimensions, it's very, very likely that whichever model you use, the numbers you're going to get are going to be with an

experimental uncertainty.

So rather than try to -- it probably would be problematic to come up with one standard, but I think from an occupational standard, you know, for federal agencies, it's probably better to maybe go with something right now that would be a standard. But I think eventually the models will be so similar and you can change what you want with it in terms of variables.

DR. COOL: In fact what we would be looking at for prospective radiation protection for purposes of Part 20 would be a picked model, a picked reference person, a specified set of parameters. Does such a person exist? Nope. Because none of us are hermaphrodites, for example, the average male and female roles. But for purposes of prospective protection you pick a reference and you set some numbers for compliance. If you're going back doing the retrospective assessment, then you can get in all the details and information and use all of the individual models.

MEMBER SULEIMAN: And also FDA, the thinking there as well is that we really want to minimize error. So I'm an advocate of moving forward and trying to advocate SI. I've been doing that for

decades. You know, but I think we see all sorts of confusion when you eliminate one unit, let alone the prefixes, you know, which vary by profession anyway. So I would encourage using the two systems for now, but making a little bit more difficult to access, you know?

DR. COOL: The Commission's direction in that case was actually pretty clear.

MEMBER SULEIMAN: Yes.

DR. COOL: Keep both sets. So the regs are going to have both sets. Our proposal is to have the SI first. And then you get to the interesting questions of do we allow people a little more flexibility in what they report?

And the one I didn't mention, a formatting nightmare. So Appendix B, all those pages and pages of numbers which are all in traditional units now. Are they SI units? Do I have both and make the table twice as big? So we have some interesting little details to work through including what is even of use to licensees, because there's no point in me chewing up pages in the *Federal Register* if nobody wants it, or if they can just have it on the CD, or a stick.

CHAIRMAN THOMADSEN: Dr. Welsh?

MEMBER WELSH: Thank you for the presentation. I have a few comments.

One I won't even pose as a question, but I'm curious how you know who's a hermaphrodite and how you know everybody's not one.

(Laughter.)

MEMBER WELSH: But anyway --

DR. COOL: I'm making an assumption so as to not be gender-biased.

MEMBER WELSH: Regarding the units, traditional versus SI units has always been an issue that we have to wrestle with. Scientifically I think everybody would agree that SI units are superior. From a practical perspective when we're talking about regulation and safety issues in particular, I'm not so sure. I think everybody agrees that the metric system is so logical and scientific. Why don't we adopt it? I say that all the time in spirit. But if I went home tomorrow and I saw the traffic signs in kilometers per hour, I'd probably have an accident or a ticket. So I've of mixed mind on that.

Regarding the point you brought up about the radiation worker, for example, a physician or a physicist working in say D.C., Virginia and Maryland, I thought that this is a very interesting scenario

and it's a very realistic scenario. It presents a challenge, but obviously it's not an insurmountable challenge. But it raises some interesting questions.

I don't want to contradict myself from my presentation this morning, but it dawns on me that the NRC is concerned with all forms of ionizing radiation exposure here, and maybe I would have thought that they'd focus on, you know, byproduct-related exposures. Apparently not the case. Very interesting.

DR. COOL: If I can put a little parenthetical in that, all to the extent that an individual who is receiving exposure from licensed material. The licensee must account for all of their exposure that's under the licensee's control, both licensed and unlicensed sources. So if you're in nuclear medicine and you're also getting exposure from the CT machine or fluoroscopy or otherwise, the licensee has an obligation under the regulation today to account for all of your exposure and demonstrating compliance.

If you are only in the interventional suite and there is never any byproduct, or you're only CT, and there's no PET/CT or no other exposure, then that is a State regulatory issue and is not

involved with the NRC and the Agreement State. So it depends on whether there is a nexus of where you're receiving the exposure from in the regulations today.

MEMBER SULEIMAN: Appreciate it. I understood the comment.

But nevertheless, the licensees are keeping tab of their total radiation doses. And I know I've said this many times before, my personal opinion, professional opinion is that I urge caution when tightening the limits because of the possibility, however remote, that it could limit patient access to certain medical procedures. And the example comes from my own past professional experience in rural parts of the State of Wisconsin where there are no cardiologists. There were no interventional radiologists for 50 miles or so. And if that individual 50 miles from where I was wound up not being able to practice, patients would have to drive 100 miles. And it makes me just wonder if that really is necessary based on the data that we have that we're debating and analyzing that would suggest possibly adjusting these limits. So that's just my comment and reason for reservation.

DR. COOL: I would reflect back again. One, we're not suggesting at this point changing the

limit, but rather consideration of some additional criteria which at this point we are thinking about in a very preferment sort of way for each licensee to look at how the individuals are being exposed and their cumulative exposure within that limit boundary on an annual basis. And we're looking very much for feedback on the sorts of mechanisms that would work to address the issue without being restrictive within a limit framework.

I quite firmly believe that there are going to be some reasonable variations in the approach that we should look at. But that's the Donald Cool view of the world, not an NRC staff view.

CHAIRMAN THOMADSEN: Dr. Van Decker?

MEMBER VAN DECKER: Couple of comments, if I could. Always appreciate this discussion, as it keeps coming back.

Number one, on a pragmatic basis once again, although the NRC looks at the non-nuclear component of exposure only because of their piece of it, recognize obviously that on a pragmatic basis, you know, institutions use this as their overall Radiation Protection Program because they have to have some number to work by and they never know when there could be, you know, exposure from the byproduct

material side. And so everybody in the fluoroscopy realm is kind of held to the same global numbers. And that's how radiation safety committees look at things and that's how things get reported. And so it is kind of an overarching kind of outlook on the use of ionizing radiation.

Having said that and having sat on radiation safety committees for well over two decades, it's clearly true that on an exposure basis those people involved in the fluoroscopy units and the machine-produced are more likely to be our higher exposed people. And so obviously the stakeholders for that number, because they're held to it, really belongs in the Societies of SIR, Society of Interventional Radiologists, SCAI, Society of Cardiovascular Angiography and Intervention, and HRS, Heart Rhythm Society for fluoroscopy and EP lab. And they look at this with much different viewpoints because it's their daily life and what they do and the access that patients get the care through them. So that's point one.

Point two is this concept of cumulate dosing or cumulative over short periods of time and God knows the radiation biology on that. We can get all kinds of different viewpoints around the table.

But recognize that when we talk about the population I'm talking about; is as a personal protection issue I probably have the most interest, you're talking about 30 and 40-year careers. Right? And so by the time you're talking about cumulative dosing that you're going to start the mark on, the biologic unit's reactivity to what you're looking at at that point in time is actually less.

So I guess you can look at this two ways: You can tell people you can't start until you're much, much older, or you have to have early forced retirement. And you can look at it in either modality and you can kind of make a decision on that. They may not look at it that way, you know, and that's the way stakeholders go. But, you know, those are the realities of some of the pieces of that.

The other point, the third point is I'm personally a little bit nervous about this concept of individual licensees making tiered structures for their people, which would obviously be the diagnostic realm and then the interventional realm, because that's where the numbers end up splitting out. Right? Because this is workplace OSHA stuff and, you know, a center and a city which has more options for people looking for jobs may be able to press the

boundaries a little bit more. Someplace else may press it a little bit less. And what we're really looking at is within a given profession no matter what institution they're at, what's their professional protection? What's their professional standard, rather than the standard at a local building? And I think that's the way those societies I just talked would look at it as well. So I think you need to do some exploration with the stakeholders, you know, in that regard.

And then my last comment, other than because I have to always follow Dr. Welsh, I'm not convinced why we lost Delaware, Pennsylvania and New Jersey as practitioners going among three states all the time.

In either case, the last comment would be, you know, on the reporting basis, you know, I'd be quite impressed obviously if the reactor community looks at this differently, but you know, the regulated stakeholders, beyond the stakeholders at this table that are in this, may look at reporting and mandated reporting in a variety of different ways. And I think that, you know, they need to be a piece of the discussion. And even if the majority of their exposure is coming from non-byproduct/non-NARM

material, you know, their outlooks and where this is going needs to be a piece of the puzzle if indeed these standards are in some ways generalized to the overall medical community and its different exposures. And, you know, somebody talked in the last few days about, you know, sharing of information between different regulatory agencies involved in different pieces of ionizing radiation and how we get that together and how, you know, the weighting factors may vary, and how we really looked at that in a global sense, you know, in the FBI/CIA kind of sharing of information world may be an important piece of this and, you know, as you look at an overall national policy.

And then my last comment because my time grows short, is my idea of national policy is always compatibility B, because getting over from Delaware to Pennsylvania sometimes takes me an hour, but I know I can almost walk there in that period of time and I shouldn't have to be setting up two different sets of direction just because I crossed the line.

DR. COOL: I very much appreciate that and would encourage you both now and as you move forward to help us engage those societies and those organizations, because that's the discussion which I

would hope we can have just to try and flesh out whether there may in fact be benchmarks for certain types of use that would allow us to be more standardized. I know I don't have that information now. If such information were available and could be brought forth and could have some dialogue/discussion that would help to inform that such that what might be an acceptable set of approaches can be honed in, that would make me very happy.

Am I happy with, hey, licensee, propose what you want and I'll let the reviewer -- within some parameters. And the more you can define those parameters so that there can be some comparability -- I'm not sure we can go to compatibility B or not; that's a different discussion -- I think the better off we might be. But it needs to have that sort of dialogue on the range, on the flexibilities, on the options, and on the implications.

CHAIRMAN THOMADSEN: Dr. Langhorst?

MEMBER LANGHORST: I just wanted to follow up a little bit on what Dr. Van Decker had said, and I had had that same thought, too. But the challenge from a radiation safety officer's point of view is we haven't been tracking lifetime doses, so this will be a challenge if we would move to

something like that. And if as a licensee you have this system of cumulative dose control, well, will I not be able to hire this one physician because they don't fit, their history doesn't fit that model and so I can't hire them now in a medical environment?

So there's a lot of intricacies of how you deal with cumulative dose that impact a lot of different areas.

DR. COOL: Yes, Part 20 became much simpler when we went to annual.

MEMBER LANGHORST: Right.

DR. COOL: When we got rid of the 5n - 18 in the tracking, there was great rejoicing. And going back to that has sorts of implications including the dose histories.

MEMBER LANGHORST: Right.

DR. COOL: What assumptions you are allowed to make when there are gaps in the history and otherwise.

MEMBER LANGHORST: Yes.

DR. COOL: That is certainly an important set of questions in looking at the viability of those systems. I agree with you completely.

CHAIRMAN THOMADSEN: Any other comments or questions?

(No audible response.)

CHAIRMAN THOMADSEN: Thank you very much. And at this point we're scheduled for a break. As we've been doing today, we're running a little bit late. Maybe we can try and pick up five minutes and just have a 10-minute break as opposed to 15.

(Whereupon, the above-entitled matter went off the record at 3:11 p.m. and resumed at 3:24 p.m.)

CHAIR THOMADSEN: It's the last session of the last meeting.

We now have Ms. Cockerham and Ms. Howe talking about the status of revisions to NUREG-1556 Volume 9

MS. COCKERHAM: Good afternoon. My first slide here shows the process for revising the NUREG-1556 series. I don't know if you can see all this very well.

But the bar represents the number of individual NUREG values at a given stage in the revision process.

So you can see in 2012 there were ten of the - I believe we have 21 - 21 total that were in the draft development part of the process and then as you go along to the right it goes through technical

editing, steering committee reviews, additional reviews, public comment periods.

So the majority of the volumes are in the draft development phase and that was in 2012.

The numbers here aren't really important. What I want you to see is in 2013 the bars start moving to the right. There are only three volumes that are in the draft development process versus there were ten last year. So that means the volumes are moving along. They're going through concurrence.

We're getting public comments on them. I believe the first three have already been published for comments and those comment periods have all closed, maybe even the first four.

So we are making progress. I thought it was a good visual to see here's where we were last year. Here's where we are this year. We'll continue to see things move along to the right.

For Volume 9 specifically if you look at the red arrow on the bottom it's still at the first bar. It's in the draft process and that's currently what my presentation is going to focus on today.

So we have two different working groups that are working in parallel. I'm leading the Volume 9 non-rule making working group along with an

individual from the Agreement State. Mary Burkhart is from Illinois and then I have Jackie Cook from Region IV, Penny Lanzisera from Region III and Toye - I'm sorry, Penny Lanzisera from Region I and Toye Simmons from Region III.

So our group is looking at the overall document. A lot of our items are comments that were submitted after the EPACT when the NARM information was incorporated in 2008. There were comments that were received that were outside of the scope of NARM and so those have gotten passed along to me.

So I have those sorts of comments. We've also issued information notices, regulatory issue summary documents, things like that that would be incorporated into this document.

We have just general administrative changes, comments that I've received from regional staff and from agreement states from various avenues.

We also have some changes that are being made for consistency across all of the volumes so if a change is being made in Volume 2 and they say we want to make the same change across all of the volumes, that's being incorporated into Volume 9 as well. And then the last part is security and the items related to 10 CFR Part 37. Changes from that

are being incorporated into Volume 9 as well.

And so Donna-Beth is going to talk about things that are rule making related so I don't have anything to do with those at this time.

DR. HOWE: So I have a different working group and my working group is - consists of Dr. Said Daibes, Dr. Sandy Gabriel, Dr. Ron Zelac and myself and we are the same people that are working with the rule making group to develop the rules. So we have a one-to-one correspondence with the rule making and the guidance development.

And we are looking only at changes that need to be made to guidance based on the rule making.

As you know, this particular Part 35 rule making also extends into pharmacy issues which will be Volume 13 and it extends into other issues that are not associated with requesting a license or amending a license.

And so with this presentation I'm only looking at Volume 9. We've got Qs and As which deal with non-licensing issues but implementation. We have Volume 13 - that's for the pharmacy. And where are we in the process?

We're further along in the process. We've already assimilated - the ACMUI did review the

draft reg guide. Didn't give us any actionable comments. They made comments but no actionable comments.

At the same time, we got comments that we had to take action on from a number of agreement states and also the regions. And so we have been incorporating the draft comments into the reg - into the NUREG and our NUREG is ready to go and is sitting with the commission paper.

The commission paper - not really saying it was a commission paper. The Commission paper has the draft rule that went to the Commission.

At the same time, the Commission is interested in knowing that the guidance is ready and so we've provided the commission with our ADAMS number that says where the guidance is so that they can look at it as they're going through the rule.

So our - we will be publishing the Part 35 proposed rule and guidance at the same time for public comment and after the end of the public comment we'll be resolving the public comment questions.

The first thing we have to do is we have to resolve the rule making question. So once we resolve the rule making questions then we can go and

resolve the guidance questions and the changes to the guidance based on any changes in the rule making.

Once we've got those comments completed from the public comment period and then we will send the draft final rule back out to the ACMUI and the regions for comment and when we get those comments we'll go into a final management review and then our guidance will be finished and will be ready to be published with the Part 35 rule.

Our guidance has to be published with the Part 35 rule and so we are keeping this part of Volume 9 separate from Ashley's part, and Ashley will show you her scale on the next slide.

MS. COCKERHAM: So this next slide shows Donna-Beth's time line along the bottom and my time line is along the top. So you can see that they're working in parallel. We're both in different phases.

The solid boxes are things that are already done or are being done right now and then everything that has a dotted line around it is in the future.

As you know, for the rule making things it's really driven by a rule making schedule and nothing to do with inside the division whereas I'm working towards division deadlines, internal

deadlines that have to do more with the overall revision for all of the NUREG series - the NUREG-1556 series.

So we're currently in the Volume 9 working group draft development section. We have to finish that up in the fall and then it will immediately go to tech editing. Tech editing is expected to go through really spring 2014. It's a very, very large volume.

There's a lot involved and needs revisions, and then the steering committee will have several months through next summer to look at it. The fourth box is that we go back into comment resolution to incorporate all the changes that have been suggested from tech editing and the steering committee, and at that time it will go to the ACMUI and I'm hoping it just depends on how the rule moves along.

But if the rule making piece is done and the guidance has been revised and is back into final form and it's ready to be fed into us whenever they are ready to hand it over to us you can kind of see the two arrows going up through a big gap there.

Any time in that time frame along those boxes we could get the rule making guidance. In an

ideal world I would put it in before and you would - before it even comes to you to see any of the changes and you would have one great big document, and if not then you'll just see the changes that I've made separately and I'll feed the rule making changes in later.

So we'll publish the draft guidance in the Federal Register. It is planned for fall and winter of 2014 to have a comment period. We'll do comment resolution again, go back to tech editing and have the final management reviews in approximately fall of 2015.

So our goal is to publish the final document fall/winter of 2015. This may or may not coincide with the rule making time line. I know right now they're well ahead of us.

But we can't predict what the commission says or how long the - you know, we had a discussion this morning about how long the comment period will be. Things like that could push that bottom time line out to shift more over to the right.

So there's a lot of leeway here but hopefully you can at least see from 2013 to 2016 that there's a lot involved in the process and that it is moving even if it is a very slow and deliberate

process. It's very thorough.

DR. HOWE: And if our rule gets delayed for any reason then it could actually delay Ashley's production of the final document.

MS. COCKERHAM: Absolutely.

DR. HOWE: Any questions?

CHAIR THOMADSEN: Any questions or comments from the - we have one. Dr. Langhorst.

MEMBER LANGHORST: I think I've said this before but I really like the NUREG-1556 series and it has helped me greatly now with two license renewals. I don't see Ms. Frazier anywhere around but so I thank you all for that.

I have mentioned this I think to a few of you too. There are some questions as to where to put these regulatory guidance documents.

For instance, in the 1556 Volume 9 there's the patient release guidance which is Appendix U, I believe, but we also have that in Reg Guide 8.39. Am I right? Oh, gosh. I am a geek for these regulations.

So it's always good to have one guidance one place but I know we were asked at one point oh, we should maybe put - we should use the 8.39 Reg Guide and point people to the NUREG, and I didn't

feel that was a good one because I thought the regulatory guys are open to, it seems, more people and they don't have to go through a 512-page document to get that little piece.

So I know this is always a challenge to try to figure out where to put your regulatory guidance and to try to have just one version of it rather than trying to keep up multiple versions.

So I thank you for all your efforts and I know it's not easy to keep up with all of it.

DR. HOWE: And I think I'd make a slight comment on that. Our intent, because we've got a very large rule research element going full page and release, is Ashley will be updating the patient release minimally.

MEMBER LANGHORST: Right. Right.

DR. HOWE: Minimally. Not getting into tables, not getting into the questions that we're going to be getting answers to hopefully from research.

And at the point where we do get answers back from research the intent is to then update the Reg - the Reg Guide. Not the NUREG, the Reg Guide. That will be the fundamental document.

MEMBER LANGHORST: This is Sue Langhorst

again. I think them - you may want to consider in Appendix U pointing people to the Reg Guide rather than having it published in two different versions that might get out of sync.

It's a challenge to try to keep those guidance the same. I'm done.

CHAIR THOMADSEN: Yes, Mr. Fuller.

MR. FULLER: This is Mike Fuller. Thank you for those comments, Dr. Langhorst. I will say this.

When we get to that point and it will happen where Reg Guide 8.39 and Appendix U are not aligned, assuming that there are some substantive differences as a result of the research that's conducted, one of the things that we have already asked research - the office of research to do is if needed, you know, to update 8.39. So at some point in time it's likely that those two will be different.

So at that point in time what we will do until we can get the Appendix U and NUREG-1556 Volume 9 updated is we will simply do our best and use every possible avenue available to us to communicate to the community through the medical list server, through RIS's, through newsletters, through meetings like this.

We will say, you know, until we get Appendix U updated use 8.39 and then eventually we expect to be back to where we are currently where the - when the Reg Guide which is consolidated - that's why we call it consolidated guidance - is consolidated into the NUREG. Then we'll be fine again.

But there is likely to be a point in time when they're inconsistent and we'll just make it - make it our priority to make sure that folks understand.

CHAIR THOMADSEN: Dr. Langhorst.

MEMBER LANGHORST: This is Sue Langhorst again. You may want to consider just pointing people to the Regulatory Guide when you update your Volume 9 and not have two locations of the same guidance that are then out of sync.

So I offer that up as a possibility. I don't know if you feel it's workable.

DR. HOWE: I think we have some guidance that we want to put in to Appendix U that's not the type of level that's going to be in the Reg - that's in research's project.

So there will be a time early on where there will be slight changes but not the tables, not

the equations, none of that. There might be some other information included.

CHAIR THOMADSEN: Other questions or comments? Okay. Thank you very much. Do we have Mr. McDermott?

Now, in that case, Ms. Holiday, could we go to the end with the administrative closing while we're waiting for Mr. McDermott?

MR. EINBERG: That's a good suggestion.

MS. HOLIDAY: Okay. So at this time, we are moving on to administrative closing and saving the special presentation at last.

So this is the part where we go over our selection for the next meeting date and we review the recommendations and actions that were put forth during this meeting.

So the newest item came from yesterday where Dr. Thomadsen added Dr. Christopher Palestro to the medical events subcommittee.

Dr. Palestro's role in the subcommittee will be to review and provide input to the subcommittee on iodine-131 medical events. Are there any comments on that?

Okay. Moving on, the next item is that Dr. Thomadsen created a subcommittee to review the

proposed amendments to the ACMUI bylaws. The recommendations will be - I'm sorry, that should be will be presented in the spring 2014 meeting.

Subcommittee members include Dr. Palestro, Dr. Suh, Dr. Suleiman, Ms. Weil and Dr. Zanzonico, chair. I have you for later.

The next item is that the ACMUI recommended to reestablish the rulemaking subcommittee to review and address staff's response to the subcommittee's recommendation and comments to the draft proposed expanded 10 CFR Part 35 rule making.

That comes as preparation for Dr. Zanzonico's presentation during the October 18th Commission briefing.

The next item is that today Dr. Thomadsen added Mr. Mattmuller to that ACMUI bylaws subcommittee. In addition to that for item 27, Dr. Thomadsen added the following additional charges to that subcommittee.

One, discuss, address and make your recommendation to the reporting structure - for the reporting structure of the ACMUI. That would be to review if the committee wants to continue to report to the MSSA director or directly to the commission.

Two, discuss, address and make a recommendation for the consideration of budgeting for an additional face-to-face meeting at headquarters.

And three, consider the feasibility of conducting means using the Go-to-meeting or Go-to-webinar function.

Are there any comments on that?

MEMBER ZANZONICO: Also, was it in connection with that item Ashley was going to recirculate her document on the pros and cons of that?

MS. HOLIDAY: Yeah, that's item 28.

MEMBER ZANZONICO: Oh, okay.

MS. HOLIDAY: So item 28 is that Dr. Thomadsen requested that staff provide the committee with the SECY paper that was transmitted in 2011 that discussed the pros and cons of restructuring the reporting structure of the ACMUI. I will provide that this evening.

Item 29, Dr. Welsh asked or recommended that the next year's agenda include the physical presence requirements for authorized users for the GammaKnife Perfexion device. Are there any comments on that?

Okay. I think that covers all the

recommendations that were made thus far. Okay.

So now is our favorite part of the meeting where we select our spring meeting date. As you can see from your calendar - let me switch it for you.

So you'll notice on the last page of your handout that the months of April have a lot of Xs in it and I've sent out a meeting wizard scheduler to all committee members and staff members to inquiry which days would be best for the next meeting and it appears that our meeting dates fall - our options fall in May of 2014.

The best date for everyone - there is only one member that had a conflict. He and I have discussed it and it's been resolved is May 8th and 9th. That is on a Thursday and a Friday. Are there any issues or conflicts for any other members?

VICE CHAIR GUIBERTEAU: For the 12th and 13th - I mean, normally we pick a couple of days. Is that - is that open or not? I can't -

MS. HOLIDAY: Yes. I was just offering this up as the first set of dates.

VICE CHAIR GUIBERTEAU: Okay.

MEMBER LANGHORST: For me the 8th and 9th is much preferable to the 12th and 13th since I keep

missing radiation subcommittee meetings and I try not to.

VICE CHAIR GUIBERTEAU: Sophie, what is wrong with the 5th and 6th?

MS. HOLIDAY: There's nothing wrong with the 5th and 6th but that there was only one person that had a conflict on the 8th and 9th.

VICE CHAIR GUIBERTEAU: Oh, okay. Okay. That's fine then.

MS. HOLIDAY: Right. And then alternatively another set of dates was the 5th and 6th or the 12th and 13th. There were two members that had conflicts on both sets of dates.

So I offered up the 8th and 9th as possibly the first choice since there was less conflict on that date.

VICE CHAIR GUIBERTEAU: What are the - so the Xs are not -

MS. HOLIDAY: Are not an option.

VICE CHAIR GUIBERTEAU: Those are which?

MS. HOLIDAY: Not options.

VICE CHAIR GUIBERTEAU: Not options because -

MS. HOLIDAY: Because there are other conflicts that have been brought up either through

staff or from other members.

VICE CHAIR GUIBERTEAU: So they're major reasons why.

MS. HOLIDAY: Yes, and I think in particular I know for example May 15th and 16th because this room is not primarily ACMUI's room so we have to also take into consideration the ACRS's meeting schedule.

Okay. So I don't think I see any other conflicts. Can we put May 8th and 9th down as the first choice? Okay.

Now, for your second choice we have May 5th and 6th or May 12th and 13th. So I guess we can start with seeing does May 5th and 6th work for everyone.

MEMBER SUH: That's not going to work for me. I'm going to be out those days.

MS. HOLIDAY: Okay. Is May 12th and 13th a conflict for you?

MEMBER SUH: That would work. That's better, a lot better.

MS. HOLIDAY: Does anyone else have a conflict with May 5th and 6th? Okay. Now, what about May 12th and 13th? Does anyone else have a conflict for May 12th and 13th other than Dr.

Langhorst?

So I leave it up to the discretion of the chair to choose between May 5th and 6th or May 12th and 13th as a backup date.

MEMBER SUH: I may be able to make it. I'll be out of the country so I think I fly back on the 4th.

MEMBER LANGHORST: Mr. Chairman, I can make the 13th work if absolutely I have to. You know, I don't change my radiation subcommittee. I have physicians on that. Sorry. It doesn't change. It might get cancelled but it doesn't change.

CHAIR THOMADSEN: Well, I would - I would say it sounds like we maybe should do the 12th and 13th with apologies to Dr. Langhorst for having to miss one meeting for another.

VICE CHAIR GUIBERTEAU: But that's just a backup.

CHAIR THOMADSEN: Right. I was going to say that is a backup and it sounds like 8th and 9th is very promising.

MS. HOLIDAY: Perfect. So for the record, I have the first choice down as May 8th and 9th with the backup date as May 12th and 13th. That will wrap up my - yes, Mr. Mattmuller?

MEMBER MATTMULLER: Just curious. Does ACRS ever have to adjust their schedule because of our meeting schedule?

MS. HOLIDAY: No. Unfortunately, they trump us. They have monthly meetings so their meetings are scheduled way in advance and they've already booked which days they need the rooms. And since it's their meeting room we can't exactly kick them out.

CHAIR THOMADSEN: So the subcommittee should also look into buying our own room for our meetings.

MEMBER MATTMULLER: I think there's space available across the street.

CHAIR THOMADSEN: Thank you very much.

MS. HOLIDAY: Thank you.

MR. EINBERG: And Dr. Thomadsen, I got an email from Mr. McDermott. He's on his way and so he said ten minutes ago he's in the other building so -

CHAIR THOMADSEN: We will have a slight informal break right now. I will pause and we will resume momentarily.

(Whereupon, the above-entitled matter went off the record at 3:51 p.m. and resumed at 3:55 p.m.)

MR. MCDERMOTT: Well, thank you very much. I'd like to take this opportunity to make a special presentation to Dr. Van Decker. He has served as nuclear cardiologist on the committee.

He was appointed back in October of 2005 and served two terms, and his role has been very important to the committee and to the advice that we provide to the Commission.

As you heard in Ashley's opening presentation, many of the recommendations of the committee go directly to the Commission so it's supportive of the staff and I think that speaks volumes to the staff's, to you on the quality of the recommendations and diversity of views that the committee members bring to the issues.

I did want to note that Dr. Van Decker was key in a briefing of the Commission back in June 2009 on the perspectives regarding the clinical benefits of diagnostic nuclear medicine.

And he also provided valuable assistance to the staff on a variety of topics over his term - issues such as the medical isotope shortages, two subcommittees dealing with, in the first instance, the relevance of board certification pathway but other alternatives to that to deal with the diplomats

becoming authorized users after completion of their T&E.

Also on the subcommittee that reviewed the ICRP Publication 103 recommendations. We appreciate his service to the Commission in a way that NRC wouldn't otherwise have those views from our staff, and so that's been very important to us.

We have a couple of items for you to recognize your service. If you'd come up and join me. The first for you is an NRC lapel pin.

(Off the record comments)

This United States flag has been flown over the nation's capital and accompanying it is a letter from Chris Van Hollen, a member of Congress, and I'll read you the letter.

"Dear William, I'd like to extend to you my heartfelt congratulations on your retirement from the federal service." I don't think this is your only retirement - from your federal service.

"You have played an important role in the operations of our government, particularly for your service to the Nuclear Regulatory Commission.

I am grateful for the commitment that you have shown to federal service for more than eight years. I'm proud to represent dedicated federal

employees like you who give so much of themselves for the good of our community and our nation.

At the request of your agency, an American flag has been flown over the United States capital in honor of your service. Again, my congratulations and thanks for all you've accomplished.

I wish you the best of luck in all of your future endeavors. Sincerely, Chris Van Hollen, Member of Congress."

And a flag - everything's got to come with a certificate of authenticity so it really did fly over the capital.

From NRC Chairman Allison MacFarlane we have a certificate of recognition that says, "In recognition of eight years of service as a nuclear cardiologist to the advisory committee in the medical uses of isotopes, which has resulted in significant contributions to the work of the U.S. Nuclear Regulatory Commission" - a certificate.

I'd like to, you know, just add to, you know, I think it's a very special individual who makes the time to participate in an activity such as serving on the ACMUI.

We understand that the compensation that

you will all receive from being special government employees may hope to offset a small fraction perhaps of your time and then it's really a largely volunteer service, and with your expertise that's very central to us.

We do appreciate, you know, you making the time to provide this report to the government to make sure we get it right the best we can and I just want to say thank you for that.

(Applause.)

MEMBER VAN DECKER: Just three quick comments because people are getting out. Number one, I just want to say thank you to the NRC staff. I think I said yesterday I met most of this group in 1996 at the first opening town hall meeting on 10 CFR 35 in Philadelphia.

In over 17 years the staff, as they've come and gone on with their career activities, have been smart. They've been interactive and they have been well-meaning to get things right.

I think that, you know, it's a good sign of the government at work. I want to thank all my colleagues, both here and the ones that have passed before me. I've enjoyed the interaction very, very much. I've learned a lot.

I want you to know the nuclear cardiology community values its seat at this table. We see ourselves as stakeholders. We want to be a piece of the process and we appreciate the opportunity to do so.

And then the third piece of this is in reflection, looking back, I think it's kind of neat the way the process works. Despite what everyone says, you know, there is outlier events that show up in a variety of different things and they get analyzed and they get dealt with.

But the stakeholder community's input to consensus and regulation to the mainstream of what creates patient access and good patient care may take a while, but it has clearly worked over time.

In that regard, I wish the committee and the staff continuing wisdom of the owl in good decisions for the future and the opportunity to help participate.

(Applause.)

MEMBER MATTMULLER: Actually, we have one more presentation inspired by your last slide and we have found almost in NRC. I'll be with you.

(Applause.)

CHAIR THOMADSEN: I would just like to

say on behalf of the committee that in your presentation you gave five goals for somebody on this committee and you pointed out quite nicely that you satisfied them all and you've been a valuable member on this committee as somebody who always listens very carefully and then cuts right to the heart of the matter.

Sometimes you would expect that from a cardiologist, I guess. And your comments are always insightful and creative.

You're the voice of compatibility. Above all, you've always been very pleasant to work with, a wonderful member of this committee. Thank you very much.

(Applause.)

And with that, we're done with our business and thank you all for coming.

(Whereupon, the above-entitled meeting concluded at 4:00 p.m.)