Official Transcript of Proceedings

NUCLEAR REGULATORY COMMISSION

Title: Meeting of the Advisory Committee on the Medical Uses of Isotopes

Docket Number: (n/a)

Location: Teleconference

Date: Tuesday, April 5, 2022

Work Order No.: NRC-1900 Pages 1-254

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NUCLEAR REGULATORY COMMISSION

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ADVISORY COMMITTEE ON THE MEDICAL USES OF ISOTOPES

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SPRING 2022 MEETING

+ + + + +

TUESDAY,

APRIL 5, 2022

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The meeting was convened via Video Teleconference, at 10:00 a.m. EDT, Darlene F. Metter, ACMUI Chair, presiding.

MEMBERS PRESENT:

DARLENE F. METTER, M.D., Chair

VASKEN DILSIZIAN, M.D., Vice Chair

REBECCA ALLEN, Member

John F. Angle, Consultant

RONALD D. ENNIS, M.D., Member

RICHARD L. GREEN, Member

HOSSEIN JADVAR, M.D., Ph.D., Member

JOSH MAILMAN, Member

MELISSA C. MARTIN, Member

MICHAEL D. O'HARA, Ph.D., Member

ZOUBIR OUHIB, Member

Michael Sheetz, Consultant

MEGAN L. SHOBER, Member

HARVEY B. WOLKOV, M.D., Member

NRC STAFF PRESENT:

CHRIS EINBERG, NMSS/MSST/MSEB, Designated Federal Official

MARYANN AYOADE, NMSS/MSST/MSEB

HIBA AHMED, R-I/DRSS/MLAB

KRISTEN BONDS, R-I/DRSS/CIRDA

ANDREW CARRERA, NMSS/MSST/MSEB

ANGELA COGGINS, OGC/LHE/MFW

SAID DAIBES FIGUEROA, NMSS/MSST/MSEB

ANNE DEFRANCISCO, R-I/DRSS/MLAB

LISA DIMMICK, COMM/OCM

DANIEL DIMARCO, NMSS/MSST/MSEB

CHRISTINA ENGLAND, OGC/LHE/MFW

CINDY FLANNERY, NMSS/MSST/MSEB

MONICA FORD, R-I/DRSS

CASSANDRA FRAZIER, R-III/DNMS/MLB

ROBERT GALLAGHAR, R-I/DRSS/MLAB

FARRAH GASKINS, R-I/DRSS

VINCENT HOLAHAN, NMSS/MSST

IAN IRVIN, OGC/LHE/MFW

RICHARD JERVEY, NMSS/DFM/FFLB

KEITH LASSMAN, R-III/DNMS/MLB

SARAH LOPAS, NMSS/MSST/MSEB

DON LOWMAN, NMSS/MSST/MSTB

JOHN LUBINSKI, NMSS

ED MILLER, NRR/DORL/LPL2-1

KATHY MODES, NMSS/MSST/SLPB

JANICE NGUYEN, R-I/DRSS/MLAB

NETRA PATEL, R-I/DRSS/MLAB

GRETCHEN RIVERA-CAPELLA, NMSS/MSST/MSEB

KEVIN ROACH, OGC/LHE/MFW

SHAWN SEELEY, R-I/DRSS/MLAB

VALERIE STOWELL, OCHCO/ADHRTD/NRANB

KATHERINE TAPP, NMSS/MSST/MSEB

CELIMAR VALENTIN-RODRIGUEZ, NMSS/MSST

KEVIN WILLIAMS, NMSS/MSST

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

10:06 a.m.

MR. EINBERG: Yes, good morning. As the Designated Federal Officer for this meeting, I am pleased to welcome you to this public video conference meeting of the Advisory Committee on the Medical Uses of Isotopes. My name is Chris Einberg, I'm the chief of the Medical Safety and Events Assessment Branch. And I have been designated as the federal officer for this advisory committee in accordance with 10 CFR Part 7.11.

This is an announced meeting of the committee. It is being held in accordance with the rules, and regulations of the Federal Advisory Committee Act, and the Nuclear Regulatory Commission. This meeting is being transcribed by the NRC, and it may also be transcribed, or recorded by others. This meeting was announced in the March 10th, 2022 edition of the Federal Register, Volume 87, page 13765.

The function of the ACMUI is to advise the staff on issues, and questions that arise on the medical use of byproduct material. The committee provides counsel to the staff, but does not determine, or direct the actual decisions of the staff, or the Commission. The NRC solicits the views of the committee and values

their opinions. I request that whenever possible we try to reach a consensus on the various issues that we will discuss today.

But I also recognize there may be a minority or dissenting opinions. If you have such opinions, please allow them to be read into the record. At this point I would like to perform a roll call of the ACMUI members participating today. Dr. Metter, Diagnostic Radiologist, and Chair?

CHAIR METTER: Present.

MR. EINBERG: Dr. Vasken Dilsizian, Vice Chair, Nuclear Cardiologist?

VICE CHAIR DILSIZIAN: Present.

MR. EINBERG: Dr. Ronald Ennis, Radiation Oncologist?

MEMBER ENNIS: Here.

MR. EINBERG: Mr. Richard Green, Nuclear Pharmacist?

MEMBER GREEN: Present.

MR. EINBERG: Dr. Hossein Jadvar, Nuclear Medicine Physician? He was having issues calling in. Mr. Josh Mailman, Patient's Rights Advocate?

MEMBER MAILMAN: Present.

MR. EINBERG: Ms. Melissa Martin, Nuclear Medicine Physicist?

MEMBER MARTIN: Present.

MR. EINBERG: Dr. Michael O'Hara, FDA Representative?

MEMBER O'HARA: Present.

MR. EINBERG: Mr. Zoubir Ouhib, Radiation Therapy Physicist? Mr. Ouhib? Ms. Megan Shober, State Government Representative?

MEMBER SHOBER: Present.

MR. EINBERG: Dr. Harvey Wolkov, Radiation Oncologist?

MEMBER WOLKOV: Present.

MR. EINBERG: And Ms. Rebecca Allen, Healthcare Administrator?

MEMBER ALLEN: Present.

MR. EINBERG: I confirm that we do have a quorum of at least six members present. All members of the ACMUI are subject to federal ethics laws, and regulations, and receive annual training on these requirements. If a member believes that he, or she may have a conflict of interest, as that term is broadly used with 5 CFR Part 26.35, with regard to an agenda item to be addressed by the ACMUI, this member should divulge it to the Chair, and the DFO as soon as possible before the ACMUI discusses it as an agenda item.

ACMUI members must recuse themselves from

participating in any agenda item in which they have a conflict of interest, unless they received a waiver, or prior authorization from the appropriate NRC official. NRC staff members who are participating today are Mr. Kevin Williams, Dr. Celimar Valentin-Rodriguez, Dr. Katie Tapp, Dr. Said Daibes Figueroa, Maryann Ayoade, Don Lowman, Cindy Flannery, Daniel DiMarco, Sarah Lopas, and Ian Irvin.

Members of the public who notify Mr. Lowman that they will be participating in the teleconference will be captured as participants in the transcript. Those of you who did not write prior notification, please contact Mr. Lowman by email at donald.lowman@nrc.gov at the conclusion of this meeting. Today's meeting is being transcribed by a court reporter.

We are utilizing Microsoft Teams for the audio of today's meeting, and to view presentation material in real time. The meeting material in agenda for this meeting can be accessed from the NRC's public meeting schedule. Dr. Metter, at her discretion, may entertain comments, or questions from members of the public who are participating today.

Individuals who would like to ask a question or make a comment regarding a specific topic

the committee has discussed should please use the raise hand function in Microsoft Teams to signal our Microsoft Teams host, Sarah Lopas, that you wish to speak. If you have called into Microsoft Teams using the phone, please ensure you have unmuted your phone. When you begin your comment, please clearly state your first, and last name for the record.

Comments, and questions are typically addressed by the committee near the end of a presentation after the committee has fully discussed the topic. We will announce when we are ready for the public comment portion of this meeting, and an NRC staff member will assist in facilitating public comments. At this time, I ask that everyone who is not speaking, to please mute your Teams microphones, or mute your phones.

I would also ask everyone to exercise extreme care to ensure that the background noise is kept to a minimum, as any stray background sounds can be very disruptive on a conference call this large. I will now be turning the meeting over to Mr. Kevin Williams, Director of Division of Material Safety Security State and Tribal Programs for some opening remarks. Mr. Williams?

MR. WILLIAMS: Thanks Chris. First of

all, I'd like to welcome everyone to the ACMUI spring 2020 meeting. As Chris stated, my name is Kevin Williams, I am the Director of the Division of Material Safety Security State and Tribal Programs. I want to first begin by thanking ACMUI for all of your hard work, and support for the NRC, we truly value your contributions, and expertise as we continue to address new issues related to medical use of radioactive material.

This is the ninth remote meeting that we've held at the ACMUI, I truly hope that you all are remaining safe, and healthy, and I look forward to when we can conduct these meetings again in person in the fall. I have found it extremely helpful, and beneficial to meet in person, and while the remote aspect has served us well, I definitely look forward to when we can get back together and have more in-depth conversations.

So, I'd like to highlight a few items that may be of interest to ACMUI, and the meeting participants. From an organizational perspective, Dr. Celimar Valentin-Rodriguez was recently selected as the Medical Radiation Safety Team Leader. I congratulate Celimar on her selection and look forward to her leadership in this area.

Ms. Lisa Dimmick, who I believe is on the phone as well, has accepted a position in our Chair's office as a Technical Assistant for Materials, and she did that back in February. So, congratulations to Dr. Valentin-Rodriguez, as well as Lisa Dimmick. I also want to recognize that this will be Dr. Dilsizian's last meeting as a member of the ACMUI.

And I know we will be talking later with Dr. Dilsizian, but I truly wanted to thank him for his contributions, I found them to be very helpful as we navigated through the medical use of isotopes. So, thank you Dr. Dilsizian. His second term ends on May 11th of this year. We have made a selection for the next ACMUI Vice Chair and will announce shortly pending the Commission's approval.

We've also made a selection for the position of Radiation Safety Officer, and we'll be announcing this selection shortly as well, once the Commission has provided its consent. The NRC staff is working to fill the Nuclear Cardiologist representative position, which we'll be making once Dr. Dilsizian's term ends in May. Nominations for the position are being accepted until May 5th of this year.

Things related to Commission, and activities, February 1st of this year, SECY 2022-0009,

proposed limit revision to the policy statement criteria for reporting abnormal occurrences was issued. The NRC staff requested Commission approval to publish for public comment in the Federal Register notice, they proposed limited revision to the Commission's policy statement on criteria for reporting abnormal occurrences in the areas of medical use, and source security.

There are a number of NRC activities that I will be providing an update on, the reporting of nuclear medicine injections extravasations as medical events associated with a petition for rulemaking, and a medical team evaluation of extravasations. Currently we are finalizing a package that will be provided to the Commission to recommend an approach to the disposition of a petition for rulemaking received in 2020, which was PRM-35-22, and to move forward on extravasations.

The package should be issued to the Commission in the next few weeks. The emerging medical technologies rulemaking, the staff received approval from the Commission to initiate a rulemaking to address rubidium-82 generators, and the current well established emerging medical technologies, and create additional flexibilities in 10 CFR 35 to accommodate

future emerging medical technologies.

A joint NRC/Agreement State working group started meeting in February of this year. The first task on the schedule will be the issuance of a regulatory basis in March of 2023. Training and experience for unsealed byproduct material, the Commission recently voted to maintain the current training, and experience requirements for users of unsealed byproduct material.

The staff is completing an assessment of medical specialty boards and will develop implementation guidance for training and experience requirements as directed by the Commission. The draft implementation guidance will be issued concurrently with the proposed rules for the emerging medical technology/slash rubidium-82 generators.

With respect to phase 2, further revision of Regulatory Guide 8.39, we are currently addressing stakeholder's comments on the draft of phase 2 revision to Reg Guide 8.39, which deals with the release of patients administered radioactive materials. In the December time frame, the ACMUI subcommittee provided comments to the staff on this draft, and the staff has been considering those comments in concert with comments from the Agreement States.

The staff plans to issue the draft regulatory guide for public comments in the summertime frame. Alpha DaRT, on March 10th of 2022, we issued the 10 CFR 35 1000 licensing guidance for Alpha DaRT manual brachytherapy, a technology developed by Alpha Tau. The draft licensing guidance was previously shared with ACMUI for review and comment.

This was the first licensing guidance issued under the staff's new streamlined process for evaluation, and licensing guidance development for emergency medical technologies under 10 CFR 35 1000. A couple things I want to talk about since the fall meeting we had in 2021. On December 15th, two subcommittees presented the draft reports to the full ACMUI.

The Alpha DaRT Subcommittee presented its draft report on the NRC's draft licensing guidance. Reg Guide 8.3 Subcommittee presented two draft reports to the full ACMUI: The draft report on the NRC's staff additional considerations memo for CivaDerm, and the draft report on the NRC's proposed revision to Reg Guide 8.39. Items of interest, the following presentations will be discussed today.

Mr. Daniel DiMarco will provide an overview of medical events for fiscal year 2021. Ms.

Cockerham and Ms. Thompson will provide overviews of TheraSphere Y-90 glass microspheres – SIR-Sphere, I could be messing up that title -- Y-90 resin microspheres. Dr. Angle, an interventional radiologist to the ACMUI, will provide an overview of institutional processes, and team approaches to reducing errors.

Mr. Guastella will discuss a request that NIST facilitate the restart of NRMAP, and provide sufficient resources to NRMAP, and the radioactive measurements group. Dr. Zimmerman will provide an update on the NRMAP program and provide an overview of NIST plans to reorganize the program. Mr. Sheetz will provide an overview of non-medical events for fiscal year 2021.

Dr. Valentin-Rodriguez will provide an update on the NRC's medical team ongoing efforts. And in closing, I would say thanks for the opportunity to open the meeting. I wish you a productive session today. For myself, I will be in and out of the meeting, but I definitely appreciate the opportunity to be before you, and I look forward to the continued conversations. And at this time, I will turn the meeting over to Mr. Don Lowman.

MR. LOWMAN: Thanks Kevin. I'm not sure

what's showing on the screen, I think I'm also having Teams issues.

MR. WILLIAMS: It's the agenda.

MR. LOWMAN: You see the agenda, okay, so it is working now. Celimar had to pop in here, so let me bring up the slides.

MR. EINBERG: Don, before you get started, do you want to turn it over to Dr. Metter, to see if she has any opening remarks before you go through the action items?

MR. LOWMAN: Yes, that's fine. Dr. Metter?

CHAIR METTER: Well, thank you Mr. Einberg and Mr. Williams for your opening remarks, and beginning Spring 2022 ACMUI meeting. I have a welcoming to everyone, and I hope everyone is well. We open up with some of the old business, and Mr. Williams reviews the past ACMUI recommendations, and provide the NRC responses. Mr. Lowman?

MR. LOWMAN: Thanks Dr. Metter. Good morning everyone, my name is Don Lowman, and I'm the acting ACMUI Coordinator. I will be providing the old business report, and giving a status, and update on some of the items from the ACMUI's recommendations and action items. Kevin's covered quite a few of these,

so this is just for us to propose to keep open or propose to close these items.

So, beginning with 2019, item 17, the ACMUI endorsed the Appropriateness of Medical Event Reporting Subcommittee report and recommendations provided therein. We're proposing to close this. The recommendation from the subcommittee suggests that the NRC staff should provide additional information to NMED users regarding the best practices when preparing NMED reports.

Best practices document was completed and will be attached to the annual NMED report published and will be publicly available. Estimated date of publication is May 2022, and the annual NMED reports are posted on the NRC website. And again in 2019, item 18, the ACMUI endorsed the evaluation of Subcommittee on Extravasations report as amended to note that under future revisions to Part 35 rulemaking, extravasations be captured as a type of passive patient intervention in the definition of patient intervention. We recommend this one stay open; the staff has drafted the SECY package that includes a rulemaking plan for the Commission's consideration. The SECY package will be provided to the Commission mid-April, we will close the item when the Commission votes on the rulemaking

plan.

So, items from 2020, the ACMUI endorsed the Patient Intervention Subcommittee report as presented, and the recommendations provided therein. To reinterpret current definition of patient intervention, and to report medical events resulting from patient intervention which results in unintended permanent functional damage under 10 CFR 35.3045B. We recommend this to remain open. The staff presented its evaluation of PRM-35-22 to the ACMUI, and the ACMUI unanimously approved the staff's recommended option, which was option four. We will close the item when the Commission votes on the rulemaking plan, which again is spring 2023 most likely.

As part of item 11, as part of the non-medical events report, the ACMUI recommended to the NRC staff, and, or NMP to evaluate the issue of detection of short-lived medical isotopes in municipal waste, waste from nuclear medicine patients that might be triggering the landfill alarms and provide some level of guidance, best practices, or additional instructions. We also recommend that this remain open; the staff presented to the Organization of Agreement States board, and they agreed with a survey to the Agreement States. Next steps are to draft the State Tribal Communication and

the survey question. Target date is spring 2023.

So, for the 2021 recommendations, number one, the ACMUI tentatively scheduled the fall meeting for October 4th through 5th, 2021. We propose to close this, as the meeting has already occurred. Number two, the ACMUI endorsed the ACMUI Abnormal Occurrence Subcommittee report, and the recommendations provided therein. We propose to close this, the best practices document was completed, and will be attached to the annual NMED report when published and will be publicly available. Estimated date of publication is May 2022. Annual NMED reports are posted on the NRC website.

Item three, the ACMUI formed a new Subcommittee on Radionuclide Generator Knowledge and Practice Requirements. The subcommittee is expected to provide a draft report, and any recommendations at the fall 2021 ACMUI meeting. We propose to close this, as the report was presented at the fall 2021 meeting.

Item four, the ACMUI formed a new Subcommittee on Emerging Radiopharmaceutical Therapy Knowledge Training. The subcommittee is expected to provide a draft report, and any recommendations at the fall 2021 ACMUI meeting. We also propose to close this, as it was presented at the fall 2021 meeting.

Item five, the ACMUI formed a new Alpha DaRT Subcommittee on the defusing alpha emitter radiation therapy, or DaRT, manual brachytherapy source. The subcommittee is expected to provide a draft report, and any recommendations at the spring 2022 ACMUI meeting. We propose to close this, the subcommittee presented its report during a public teleconference on December 15th, 2021.

Item six, the ACMUI endorsed the Subcommittee on Extravasations report as amended to support options for the subcommittee report. We recommend this remain open, the staff has drafted a SECY package, which includes a rulemaking plan for Commission consideration. We will close this item when the rulemaking plan is voted on by the Commission.

Item seven, the ACMUI formed a new Liberty Vision Subcommittee for the Y-90 manual brachytherapy source. The subcommittee is expected to provide a draft report and any recommendations at the Spring 2022 ACMUI meeting. We recommend this remain open. NRC staff is currently drafting the 35.1000 licensing guidance which the subcommittee will receive for review and comment in the Spring 2022. The NRC staff plans for a public teleconference in the Summer 2022.

Item eight, the ACMUI tentatively

scheduled a spring meeting for April 4th through 5th, 2022. We propose to close this as we're presenting this meeting currently.

Number nine, the ACMUI formed a new subcommittee to review the NRC's draft proposed revision to Reg Guide 8.39, release of patients administered radioactive materials, and reviewing comment on the NRC staff's additional draft patient release licensing guidance for CiviDerm. The subcommittee is expected to provide a draft report, and any recommendations at the Spring 2022 ACMUI meeting. We propose to close this as the subcommittee presented its report at the public teleconference on December 15th, 2021.

Item ten, the ACMUI endorsed the Subcommittee on Radionuclide Generator Knowledge and Practice Requirements report, and the recommendations provided therein. We're recommending this remain open. The NRC kicked off the rulemaking working group on February 23rd, 2022. The working group will prepare a regulatory basis which is due to the Commission at the end of March 2023. The final rule is due by March 2026.

Item 11, the ACMUI endorsed the Medical Events Subcommittee report and the recommendations

provided therein. We propose to close this, the ACMUI established the subcommittee during the 2021 fall meeting. The subcommittee is working through its charge and may be ready to present its report by spring 2022. The staff will consider any recommendation from the Y-90 Medical Event Subcommittee's report.

Item 12, the ACMUI formed a new Y-90 Medical Event Subcommittee. The subcommittee is expected to provide a draft report, and any recommendations at the Spring 2022 ACMUI meeting. We recommend this remain open, the subcommittee will plan for a public teleconference in the summer of 2022, or to present during the fall 2022 meeting.

Item 13, the ACMUI endorsed the Subcommittee on Emerging Radiopharmaceutical Therapy Knowledge Requirements and Theranostics Subcommittee report and the recommendations provided therein. We propose to close this as the staff will consider any recommendations from the Y-90 Medical Event Subcommittee's report.

Item 14, the ACMUI endorsed the ACMUI Alpha DaRT subcommittee report and the recommendations therein. We propose to close, the staff considered the subcommittee's comments, the final guidance document was issued on March 10th, 2022.

Item 15, the ACMUI endorsed the Subcommittee on Regulatory Guide 8.39, "Release of Patients Administered Radioactive Material" report on CiviDerm and recommendations therein. We recommend this to remain open. The NRC staff considered the subcommittee's comments, the staff is currently revising the CiviDerm memo and expects to issue in the summer of 2022.

Item 16, ACMUI endorsed the ACMUI Subcommittee on Regulatory Guide 8.39, "Release of Patients Administered Radioactive Material" report on the proposed provisions on Reg Guide 8.39, and the recommendations therein. We recommend this remain open. NRC staff is addressing the subcommittee's comments, as well as regional staff, and Agreement State comments. The reg guide will go out for public comment in the summer. The NRC staff will provide a revised document to the ACMUI for a 60- day review in the fall of 2022.

That is the end of the report, and let me pull up -- I guess do we have a motion to approve the report?

MR. EINBERG: Don, maybe ask if there's any questions regarding the presentation that you can clarify, and then somebody will make a motion to close

the report.

MR. LOWMAN: Okay, yes. So, any questions on the report? Hearing, or seeing none, do we have a motion?

MEMBER WOLKOV: Harry Wolkov, so moved.

MEMBER MARTIN: Melissa Martin, second.

MR. EINBERG: Dr. Metter, do you want to take the vote?

CHAIR METTER: Yes. So, we have a first, and a second, all in favor of the motion?

(Chorus of aye.)

CHAIR METTER: Any abstentions or opposition? Hearing none, thank you very much, Mr. Lowman. The report has been unanimously approved by the ACMUI.

MR. EINBERG: Thank you Dr. Metter.

CHAIR METTER: Now, I'd like to go ahead, and move on to the next item on the agenda, which is the open forum, where we'll have the ACMUI, and NRC staff identify medical topics of interest for further discussion. Any topics, or items of interest to discuss briefly?

MEMBER ENNIS: This is Dr. Ennis.

CHAIR METTER: Yes, Dr. Ennis?

MEMBER ENNIS: More of a regulatory issue

that I just heard about, that the ABR has an intention to change their practice of designating graduates with an authorized status eligible certification. I'm not quite sure all the details of this, and in particular, wondering what the NRC's view on that is. I don't really know the regulatory back, and forth between ABR, and NRC on eligibility of authorized user status.

So, I'm interested in hearing more from NRC staff on that, and possibly something that we at ACMUI have to consider discussing.

CHAIR METTER: Thank you Dr. Ennis, Mr. Einberg, is there a comment from the NRC?

MR. EINBERG: Yes and thank you Dr. Ennis. Yes, we received a letter from ABR indicating, as you indicated, that the plan on not recognizing, or issuing authorized user status, we're evaluating that request right now, and what the impacts may be. I would note that the alternate pathway is still available, and so there should be, I don't want to say minimal impact, but it should not impact the practice of medicine.

Ms. Ayoade of my staff has been interacting with ABR. Ms. Ayoade, do you have anything to add?

MS. AYOADE: Thanks Chris. I think you covered it all. The only other thing I would add is that really the license reviewing process for our staff

would just include more of reviewing documentation of the training, and experience of individuals that would have used the ABR certificates under the alternate pathway. So, that's the impact I guess on our end as well.

MR. EINBERG: Okay, thank you Ms. Ayoade.

CHAIR METTER: Yes, thank you. Would it be possible for our next meeting to just have an update on that status if it has been laid out for us really clearly?

MR. EINBERG: Absolutely.

CHAIR METTER: Thank you. Any more topics of interest for the upcoming meeting for further discussion?

MEMBER ENNIS: Dr. Metter, just one more comment. I don't know, do we as ACMUI want to interact with ABR about this to understand their motivations, and how it impacts our kind of safety of radioactive materials?

CHAIR METTER: Thank you Dr. Ennis. I think the ABR will put, and the NRC will work together with the ABR, and we'll put together an update on this. If that's it for this, Mr. Einberg, does that sound reasonable?

MR. EINBERG: Yeah, that sounds

reasonable. Later when Dr. Celimar Valentin gives her presentation on the status of NRC activities, she'll then discuss the medical specialty boards, and we are going to report to the Commission on our evaluation of all the medical specialty boards, and of course we will be interfacing with the ACMUI on this issue as well.

CHAIR METTER: Thank you. I would just like to (audio interference) that we did get a letter from the (audio interference) and a document for one of the decisions we made regarding the NRC, ACMUI, and additionally.

MR. EINBERG: We plan on appending that letter to the transcript, so it'll part of the record.

CHAIR METTER: Thank you. Are there any other items of interest for discussion by the ACMUI or NRC staff? Okay, hearing none, let's move on to our next item of business, which is the medical related events. Mr. Dimarco will be presenting the NRC staff assessment on the Status of Medical Events.

MR. DIMARCO: Hello, good morning, Dr. Metter. My name is Daniel Dimarco, I'm the health physicist here on the medical radiation safety team, and as you heard, I'm here to report on the status of medical events for the fiscal year of 2021. Next slide

please. Just as a little background, the dose threshold for diagnostic events precludes a report of events for most years, and each year there are approximately 15,000 therapeutic procedures performed utilizing radioactive materials.

Next slide please. Just as a little overview of the previous years, for fiscal year 2016, we have 50 events reported, 43 for fiscal year 2017, and 48 for FY 18'. Here you can see all of the events broken down into the different regulatory -- where, what events were recorded. And as you can see in the parenthesis there, if the total number of patients involved were the greater than the number of reports, then those were in the parenthesis.

Next slide please. And here we have a more recent update, where 56 medical events were reported in FY 2019, 48 in FY 2020, and 64 for FY 2021. And again, you can see the breakdown within each of the different modalities there. Next slide please.

So, getting into the events themselves, for FY21, we had four medical events in the 35.200, one FDG overdose, and three instances of the wrong radiopharmaceutical.

Next slide please. For the FDG overdose the patient was prescribed 0.37 gigabecquerels, and

was administered 3.85 gigabecquerels, and the technician had realized he administered the wrong dosage after the treatment. Unfortunately, I do not have much more information about this. I have reached out to get more information about the events, but I have not been successful in getting that yet.

Next slide please. This event involved iodine-123, where a patient was prescribed 7.4 megabecquerels of iodine-123 but was instead administered 5.55 gigabecquerels of iodine-131. When the hospital realized their mistake, the patient was called back, and was given potassium iodide, and had stayed at the hospital for four days under their iodine-131 safety protocols.

The planned dose to the thyroid with the iodine-123 was only 2.3 centigray, but early estimates of the dose actually received range from 1,220 centigray to 155,000 centigray, which is a pretty big range, but it's because the dose estimates did not accurately account for the administration of the potassium iodide. Afterwards, the patient unfortunately lost their sense of taste, and was given Synthroid medication.

Next slide please. The root cause was determined to be several errors caused by the NMT.

The appearance, and the size of the iodine-123, and iodine-131 capsules are very different. The containers themselves, that they're in, are also visibly very different, and are kept in separate rooms. The patient's name, and date of birth are visible on the outside labels.

And the doses are checked in a dose calibrator to ensure the correct dosage prior to administration. Now, all iodine procedures will require two NMTs to sign off before administration, and the NMT initial competency will be evaluated between diagnostic, and therapeutic doses. The involved NMT had their employment terminated, and a safety event analysis was scheduled to review the incident.

Next slide please. In this event, where a patient was prescribed 1.11 gigabecquerels of Tc-99 Sestamibi but was instead administered 4.42 gigabecquerels of Tc-99 sodium pertechnetate. The effective does was estimated to be about 5.74 centisieverts, and unfortunately, I have not been able to -- I reached out but have not received any additional information about this event. Next slide please.

This event is an anonymous allegation that a patient had been injected with MDP during a stress

test, and that the same patient was also injected with a Tc-99 Sestamibi at a later time. Again, this event had very little information in the event report itself, and I have requested more information, and I will send that back to you when I receive it. Next slide please.

And with that we get into the 35.300 medical events, of which there were ten this year, which you can see here on the slide. Next slide please.

This first event involved a targeted thorium therapy, where a patient was prescribed 0.0405 millicuries of thorium-227, epidermal growth factor receptor 2 target thorium therapy. But instead received 0.046 millicuries of the mesothelin, (MSLN) TTC.

This was an investigative study involving a novel TTC event intended to deliver radioisotope to the HER2 antigen expressing tumor tissue. The manufacturer had incorrectly labeled the radioisotope, but both drugs are processed the same in the body, so they were able to get some estimated doses to the liver of 609 centigray, 164 centigray to the small intestine, 174 to the kidneys, and 85.3 centigray to the red marrow.

And after six weeks of monitoring, no toxicities were noted in the patient. Next slide

please.

Can you go back to the previous slide? Yes. This event was a patient overdose, where a patient was prescribed 1.11 gigabecquerels of sodium iodide, iodine-131, but instead received 3.7 gigabecquerels. There was an estimated, expected whole body dose of 26.64 centisieverts, and a dose to the bladder wall of 225.7 centigray.

In this event, the dosage of 3.7 gigabecquerels was verbally given to the technologist, who did not check the written directed prescription of 30 millicuries. The NMT was using a worksheet that had the incorrect dosage of 100 millicuries on it. And so, the root cause of this event was determined to be human errors, and the corrective actions included new personnel hires, improved supervision, and procedure modifications. Next slide please.

This event also involved iodine-131 sodium iodide, this was a patient underdose, where the patient was prescribed 7.4 gigabecquerels, but received only 2.22 gigabecquerels. For this event, the dose was divided into two capsules, and the patient only received one of the two capsules. The radiopharmacy discovered the second capsule stuck in a shipping vial after the hospital returned the vial to the

radiopharmacy.

A subsequent dose was administered however, to complete the thyroid cancer treatment. Next slide please. This is another patient underdose involving iodine-131 sodium iodide, where the patient was prescribed 3.7 gigabecquerels, but received only 0.7215 gigabecquerels. The dose prescribed was 10,000 centigray but administered was only 3,900.

Again, the patient only received one capsule of a two-capsule treatment, and they found the remaining capsule in the original vial. Again, the root cause was determined to be human error, they did not follow the written handling, and survey procedures. So, corrective actions included procedures updating for radiotherapy isotope administrations, and DOT has training, and supplemental radiation technical training administered to all technologists. Next slide please.

For this event, this involved lutetium-177 Dotatate. A patient underdosed, where the patient was prescribed 7.4 gigabecquerels, but received only 5.06 gigabecquerels. During the treatment, a leakage was found in the adapter needle connection. However, no personnel, or area contamination was found, and no adverse effects on the patient were expected.

Subsequent investigation determined that the root cause was a defective part of the assembly, specifically the dual male adapter, and the lack of a vacuum seal with the septum from repuncturing with the new assembly setup could also have been an intervening factor. Next slide please.

This was also a patient underdose involving lutetium-177, this time being Lutathera.

Where the patient was prescribed 7.4 gigabecquerels, but only received 14 percent, or 1.04 gigabecquerels of the prescribed dose. The procedure was stopped prematurely after the patient had stated they had a chemotherapy injection the day before, instead of the day after the radiopharmaceutical therapy, as it was intended to be. The prescribed dose was 479 centigray, but the estimated delivered dose to the kidney was only 67.

No medical impact was expected, and the root cause was determined to be an inadequate review of patient records by the authorized user. Next slide please.

This was also another patient underdose involving lutetium-177 Lutathera, where the patient was prescribed 7.4 gigabecquerels, but only received 0.666 gigabecquerels. During the treatment, the

technician had difficulty establishing IV injection site, and flow.

However, no adverse effects were noted, none were expected, and the cause was determined to be a poor venous access, and incorrect gauge needle. Next slide please.

For this slide, this is an event involving the iodine-131 Iomab-B underdose, where the patient was prescribed 414.4 megabecquerels, which was measured at the time to be 388.5 megabecquerels but was delivered only 212.38 megabecquerels.

This was determined by measuring the residual activity in the vial, and tubing, which was 176.12 megabecquerels. A considerable error in the tubing required a replacement of the infusion set, however the problem persisted with the second set of tubing, so the administration was stopped. Next slide please. Only 38 milliliters of the 43 milliliters dosage were administered, and there was an approximately 0.111 sievert difference in the prescribed, and actual effective dose.

No re-administration of the diagnostic dose was required, and the therapy dose was readministered without incident, and corrective actions included procedure modifications. Next slide

please. In this event, this was a patient underdose involving I-131 Iomab-B. Patient was prescribed 35.11 gigabecquerels, but only received 18.76 gigabecquerels, with a dose administered of 1900 centigray. During the treatment, a leaking tube from the infusion system was noticed.

A nurse had inadvertently removed the tube occluding clamp and opened the roller clamp on the flush bag line at the beginning of the infusion. No adverse effects were expected, and the bone marrow dose was considered to be sufficient. Supplemental training was provided to the radiopharmacist, and the nuclear medicine supervisor on operating, and setting up the infusion pump.

And the nuclear medicine supervisor was solely responsible for setting up and operating the pump for all patients. They also developed a checklist for the pump operation. Next slide please.

This event involves a radium-223 Xofigo event, where the patient was prescribed 3.47 megabecquerels, but only received 0.63 megabecquerels. The procedure was canceled due to low blood pressure in the patient, and the dose was kept in the hot lab for decay.

They had ordered a new dose for a repeat

treatment, however, the decayed original dose was delivered, instead of the new dose that they had ordered. And so, after the event, the patient was brought back, and delivered the remaining dose. And administrative actions were taken to prevent reoccurrence. Next slide please.

With that, we get into the 35.400 medical events, of which there were four. Three involving prostate treatments, and one involving a MammoSite treatment. Next slide please.

The first involved an Iodine-125 prostate treatment, where the patient was prescribed 1.013 gigabecquerels across 54 seeds with a prescribed dose of 14,500 centigray. After the treatment, the follow up CT revealed that all of the seeds were implanted in the penile bulb.

During the investigation afterwards, and the option of the ultrasound was ruled out, and a review indicated that the Foley catheter was not fully visible on the ultrasound images, it could result in incorrect implantation. And so, the root cause was determined to be human error. There were changes to the prostate brachytherapy protocol implemented, and an additional step was added to ensure a clearer identification of the prostate gland, and the surrounding anatomy in

future treatments.

Follow up scans from previous cases involving this type of procedure indicated that this was not a repeated event. This was instead, a onetime event for this. Next slide please. This event involved a cesium-131 prostate therapy, where the patient was prescribed 7.34 gigabecquerels, but received 1.14 gigabecquerels to the prostate. Where the prostate D90 dose was 26.26 percent of the prescribed dose.

And the perineal region received a V100 dose of 11,500 centigray. The urethra, and the rectum also received approximately 50 percent of the expected dose. The plan was to insert stranded seeds around the prostate periphery, and individual seeds at the apex base, and interior of the prostate. However, the ultrasound probe was not accurately advanced on the sagittal imaging to see the prostate.

And so, 63 of the 78 stranded seeds were implanted in the perineum below the prostate, while 15 loose seeds were implanted in the prostate. Next slide please.

So, corrective actions implemented included a frame of reference establishing using the stepper position to identify the base, and the apex

of the prostate. During the procedure, a time out will be performed to identify both the prostate, and the bladder.

A retraining program was planned to include retraining, and proctoring by a qualified oncology physician, and physicist. For this event, external radiotherapy was performed to boost treatment to areas that received less dose, and the patient was scheduled for long term follow up. Next slide please.

This event is a patient overdose involving I-125 prostate therapy, where the patient was prescribed 845.38 megabecquerels of total activity through 64 prostate brachytherapy seeds.

The authorized user discovered that they had made a mistake when they put the prescription into the treatment planning system, where they had inadvertently entered the seed strength of 13.21 megabecquerels into the air-kerma strength field. This increased the prescribed dose, or the delivered dose from the prescribed 110,000 centigray to 140000 centigray.

However, no negative effects were expected from this, because it was the start of a two-part treatment plan, where the second part was a linear accelerator treatment. So, that was able to be

adjusted to accommodate the overdose. And corrective actions included procedure revisions. Next slide please.

This event involved a wrong patient with a Mammosite treatment, where the wrong patient received this breast cancer treatment.

This was a previous event, an event that occurred in 2001 that in 2001 had been determined not to be a medical event but had been reevaluated after inspection. However, because it was over 20 years ago, no details of the event had been saved, except that the patient dose exceeded five centisieverts EDE, or 50 centisieverts to organ or tissue, or 50 centisieverts SDE to the skin.

Unfortunately, all of the other events were past the record potential period, and so no further information was able to be acquired about this event. Next slide please.

That brings us to the 35.600 medical events, of which there were five. Four involving gynecological treatments, and one involving a skin cancer treatment. Next slide please.

This is a patient overdose involving a 216.56 gigabecquerel iridium-192 HDR unit.

The patient was being treated for skin

cancer, where they were prescribed 5,000 centigray, 20 fractions at 215 per fraction. This treatment was involving a 35 millimeter cone, where the treatment occurred at the correct site, but without the cone for one fraction. And so, the unintended skin dose was approximately 70 centigray above the expected.

No additional effects were expected for the patient, and the corrective action included advanced preparation of the treatment room with the correct cone sizes, a physicist verification of applicator size, and treatment site. The cone being physically placed onto the skin, and the outline drawn by the physician, or the physicist prior to treatment.

And that this treatment outline, and placement of the applicator are reconfirmed before treatment is administered. Next slide please.

This next event involves an HDR treatment where the patient was being treated with fraction two of three with a vaginal cylinder. After the treatment, the physician that the cylinder had been displaced about six centimeters.

The exact cause of this was unknown, but could have been due to patient movement, or loosening of the cylinder holder. The estimated dose difference was approximately 558 centigray, however the patient

did not experience any irregular toxicities, and the corrective actions included removing the device that this occurred on from service. Next slide please.

This event involves an iridium-192 HDR treatment where the patient was being treated with the 190.04 gigabecquerel source. The storage transfer tube was 12 centimeters too long, and so a maximum shallow dose of 800 to 900 centigray to the vagina occurred. The root cause was determined to be failure of the medical staff to follow the established procedures, and a failure to identify a difference of a planned measured transfer tube lengths. And no adverse health effects are expected. Next slide please.

The corrective actions included the addition of the expected lengths of different channels in the HDR pre-treatment delivery checklist. And they also added a measured length with the source position check ruler for each channel to the checklist, to be completed, and signed off on by the treating team prior to physicist review for all HDR treatments.

This checklist has to be approved by a physicist prior to treatment to allow enough time for the physician to verify the accuracy. Next slide please.

This event is a wrong site event involving a 256.41 gigabecquerel iridium-192 HDR unit. Where a patient was prescribed five fractions of 600 centigray during an HDR gynecological treatment. After the third treatment, it was determined that a 125 centimeter transfer tube was used instead of the expected 113 centimeter transfer tube.

And so, the dose was delivered 12 centimeters away from the expected site. The exposed tissue was largely fatty tissue, and the max dose to any tissue was at 600 centigray. The authorized medical physicist did not identify the correct tube length during the verification process, and so corrective actions included the removal of all 113 centimeter transfer tubes, and only 125 centimeter tubes will be used for all future treatments at this facility.

And that all physicists were reminded of mandatory checks before all of the treatments and reeducated on procedural process for these treatments. Next slide please.

This event was an underdose involving a 462.87 gigabecquerels HDR unit. Where the patient was prescribed a single 700 centigray fraction but received only a 525 centigray dose.

Sometime during the planning process, the dose scalar was adjusted by 25 percent, which most likely occurred when the user was rotating, or panning through the images. And the root cause was determined to be human error. No adverse effects are expected, and corrective actions included modifying procedures to include an additional step in the precheck procedure to verify the correct dose and dwell times.

Training was also conducted on the incident, the procedure's changes with all staff included. Next slide please.

And so, we get to our 35.1000 medical events, of which there were 41 this year, all of which were involving Y-90 microspheres. The ratios of which between TheraSphere, and SIR-Spheres, you can see in front of you. Next slide please.

Our first event involves a Y-90 TheraSphere to the wrong location, where the patient was prescribed 2.55 gigabecquerels to the left lobe of the liver but received 2.48 gigabecquerels to the right lobe of the liver. The catheter placement was verified prior to treatment using angiography, and fluoroscopy, and the AU believes the catheter was kicked out during the treatment, but no definitive cause was able to be determined.

No adverse effects were expected, and corrective actions included a new written procedure. Next slide please.

This next event is another Y-90 TheraSphere event to the wrong location -- that is the previous slide, there we go. This event involves a Y-90 TheraSphere overdose, where the patient was prescribed 3.841 gigabecquerels, but received 4.751.

This event was discovered by the RSO after a records review, and involved the dose being calibrated for the administration the day after the administration actually took place. And so, the resulting activity was higher at the actual administration. The root cause of this was determined to be human error, and the corrective actions included a secondary review of the written directive. And the addition of another pre-administration form, and updated procedures. Next slide please.

This event is another Y-90 TheraSphere overdose, where the patient was prescribed 1.75 gigabecquerels, but received 2.224 gigabecquerels. Again, this event was discovered by the RSO after review of the therapies, where the dose again, was administered a day too early, it was calibrated for the day after it was actually administered. Next slide

please.

For this, several corrective actions were taken, the operating procedures were revised to clarify the responsibilities of all the involved participants. A dose will now not be ordered until a microsphere treatment window illustrator is received, a complete written directive is received, there are no discrepancies between the two.

The NM verifies that the written directive is complete and confirms that the dose is appropriate for the ate, and time of the administration. Also, a second verification was included after the receipt of the dose. A time out process was formalized, the nuclear medicine staff, and AUs were trained on all of these changes. All of the AUs received a memo reminding them of their reporting responsibility. The Office of Radiation Safety continued their quarterly audits, and refresher training was performed. Next slide please.

This event involved a Y-90 TheraSphere underdose, where a patient was prescribed 1.73 gigabecquerels, but received only 0.9324 gigabecquerels. During the treatment the physician noted that the microspheres were visibly clogged in the catheter and discontinued the administration.

He requested a larger catheter but was only able to find the smaller catheters that they were using and noted that the full dose might not be able to be delivered but elected to continue. This was prior to the administration. The manufacturer's review of the equipment found that microspheres were dispersed throughout the device, and there was high back pressure, and low flow rate. No adverse effects were expected and follow up treatment was successfully delivered. Next slide please.

This event involves a Y-90 TheraSphere underdose, where the patient was prescribed 72,000 centigray, but received only 36,620. A post event review found that the remaining microspheres remained in the microsphere kit, but the physician stated that the patient received an adequate therapeutic dose. Next slide please.

For this event, a Y-90 TheraSphere underdose, a patient was prescribed 1.23 gigabecquerels, but received 0.88 gigabecquerels. There were no personnel, or area contamination noted, and so leaky connections were ruled out, and no root cause was initially determined. However, later inspection showed that the microspheres were likely clumped up in the vial because the saline was

administered successfully.

And scans show that the bulk of the material remained in the vial. And so, the cause may be due to inadequate tilting of the vial, tapping on a firm surface, or not taking these actions immediately prior to administration. Next slide please.

For this event, the patient was prescribed 12,000 centigray, but received only 9200 centigray, a Y-90 TheraSphere underdose.

No personnel, or area contamination was noted, and there was a suspected kink in the delivery system. Later inspection determined that the root cause to be tortuous anatomy of the patient. This patient was also receiving chemotherapy treatment, which is not recommended by the vendor representative, and no corrective actions were taken. Next slide please.

For this event, a Y-90 TheraSphere overdose, the patient was prescribed 4.05 gigabecquerels to liver lobes five and eight, and 5.66 to lobes six and seven. However, they received only 2.53 gigabecquerels to lobes six, and seven. During the event, a blockage occurred in the microcatheter, which was unable to be cleared. Post survey included that the residual activity was in the microcatheter.

The microcatheter used was smaller than the recommended size, and so corrective actions included using a larger catheter for subsequent treatments. Next slide please.

For this event, a Y-90 TheraSphere underdose, the patient was prescribed 547.6 megabecquerels, but received only 344.84 megabecquerels. No adverse effects were expected, it was likely that the tumor was adequately treated.

A post event investigation identified a possible kink in the microcatheter as the root cause, and corrective actions included additional checks for kinks in the catheters and tubing. Next slide please.

This event involved Y-90 TheraSpheres, an underdose. A patient was prescribed 2.876 gigabecquerels, but received only 1.34 gigabecquerels, and it was also noted that .027 gigabecquerels to the lungs.

Prior to the treatment, the saline flush had a slight resistance, but all of the flush had gone through. But during the procedure, the pressure increased appreciably, and administration was stopped. Post treatment survey of the catheter indicated greater than normal radioactivity, and the cause was determined to be a kink in the catheter. However, after the fact,

the AU also stated that the treatment area was tortuous.

No corrective actions were taken, because proper procedures were followed. Next slide please. This event is another Y-90 TheraSphere underdose, where the patient was prescribed 1.14 gigabecquerels, but received 0.8094 gigabecquerels. During the event, a blockage occurred in the delivery system, and all of the material had been contained in the delivery system, the lines to the patient, so there was no leakage determined.

Post treatment imaging indicated that there was activity remaining in the vial, however no adverse effects were anticipated. Next slide please.

This event was another Y-90 TheraSphere underdose where the patient was prescribed 1.067 gigabecquerels, but received 0.522 gigabecquerels. The microsphere vial after the treatment was empty. And so they determined that the microspheres were likely held up in the catheter.

And the AU also believed that the high residual waste reading was due to a slower infusion of treatment dose, and flushing saline. The normal flow rate was not able to be attained due to the small patient vasculature, and investigation afterwards determined that the delivery set worked as intended.

Next slide please.

This event is another Y-90 TheraSphere underdose, where the patient was prescribed 2.31 gigabecquerels, but received only 1.572 gigabecquerels. Afterwards, the microsphere vial was empty and was likely held up in the microcatheter. The AU noted that they needed more saline flushes than normal to complete the procedure, more versus the typical one to two. Afterwards they noted that the apparatus that they were using was completely new, this was their first time using, and the manufacturer issued a product advisory concerning a possible leak point near the catheter connection to this apparatus. Next slide please.

For this event, a Y-90 TheraSphere underdose, the patient was prescribed two equal doses of 2.4 gigabecquerels, but received 1.06 gigabecquerels for the first dose, and 2.374 for the second. During the first administration, the AU noted leakage from the microcatheter, and stopped the infusion to check this connection. Afterwards they continued the procedure and performed surveys all around the room here it was found that there was contamination of pans, and so they performed the decontamination procedures, and continued with the

second dose afterwards, which was delivered without incident. Next slide please.

They contacted the RSO to ensure containment of the radioactive material, and the personnel were surveyed, and access to the room was restricted in order to decontaminate it. Afterwards, decontamination of the room proceeded without incident. Next slide please.

This event is a Y-90 TheraSphere underdose where the patient was prescribed 1.067 gigabecquerels but received only .799 gigabecquerels. It was noted that a pinched clamp remained online during the infusion and was discovered after the AU noticed that there was more pressure than normal when pushing the syringe.

When this was noted, the clamp was removed, and the treatment resumed, flushing five times to ensure no microspheres remained in the tubing. However, images of the waste container indicated that there were microspheres in the inlet, and outlet lines, but the AU believed the patient was delivered a clinically effective dose. Next slide please.

The root cause was determined to be a failure to follow procedures, where the checklist was not followed through with the clamp prior to treatment,

and the corrective actions included procedure modification. Next slide please.

This event is a Y-90 TheraSphere underdose, where the patient was prescribed 2.46 gigabecquerels, and received only 0.47 gigabecquerels. The microspheres became visually clumped in the tubing distal to the blocks prior to the microcatheter connection, and multiple saline functions were not effective in clearing this clump. The infusion was stopped after half an hour, and the measurement of the tubing, and microcatheter indicated that only 20 percent of the dose was delivered to the patient. Next slide please.

This event is a Y-90 TheraSphere underdose, where the patient was prescribed 2.59 gigabecquerels, but received only 1.15 gigabecquerels. During the treatment, the dosimeter that was used to measure the spheres remaining in the container indicated that there was a lower than expected rate of decrease in the microspheres remaining in the container.

The activity going to the patient was lower than expected. And so the device, and the tubing was flushed more times than normal to remove any residual activity. Post-treatment surveys indicated that the

remaining activity remained in the tubing, and it was suspected that there was a blockage in the tubing due to a small portion of the septum lodged when it was pierced prior to the treatment. Next slide please.

This was a Y-90 TheraSphere underdose where a patient was prescribed two doses of 0.79 gigabecquerels to the left lobe segments 4A and 4B of the liver, but received 0.465, and 0.594 gigabecquerels to those lobes, or those segments respectively. Radiation surveys of the vials post treatment revealed that some microspheres adhered to the tubing.

Standard protocol was followed, yet no root cause was identified during discussions with the manufacturer. They noted that they had flushed the lines with saline three times, and they also noted that it is a known risk that microspheres can be stuck in the device in rare occasions, and it was determined that this was one of these occasions. Next slide please.

This event was a Y-90 TheraSphere underdose, where the patient was prescribed 640.1 megabecquerels, but received only 401.82 megabecquerels. The root cause was determined to be a leakage of the microspheres at the connection between the tubing, and the microcatheter. This leakage did

result in personnel and area contamination, which was addressed by the radiation safety staff. And no skin effects were reported or expected for any of the personnel involved. No adverse effects were also reported, or expected to patient, and the corrective actions included procedure modifications. Next slide please.

This event is a Y-90 TheraSphere underdose, where the patient was prescribed 1.33 gigabecquerels, but received only 0.75 gigabecquerels.

For this event, two doses were prepared for two separate sites of the liver. The doses were correctly labeled and prepared, but the smaller dose was administered to the site that needed the higher dose. And so, the second dose was not administered after this was discovered, and the root cause was discovered to be a miscommunication between the NMT and the AU. Next slide please.

No adverse effects occurred, and the dose was determined to be clinically effective, and corrective actions included updates to the administration checklist. The discussion of the use of the closed loop communication between the administer of the dose, and physician requesting the dose, and increased training for all applicable personnel. Next

slide please.

This event is a Y-90 TheraSphere underdose where the patient was prescribed 888 megabecquerels, but received less than 710.4 megabecquerels. During the event, a significant amount of microspheres leaked out of the tubing or catheter connection during the procedure. A sterile non-radioactive solution was able to be pushed through the tubing without incident prior to the administration.

However, several drops were noted at the connection during the administration and were cleaned off. Afterwards, contamination was detected on the gloves of the tech, the patient drape, and the towels after the treatment. However, no contamination was detected on the floor, the patient, or the staff themselves. Next slide please.

Post treatment imaging indicated radioactivity in the patient's liver. However, no adverse effects were expected. The physician stated that connecting the catheters took a little bit more force than normal, which indicated a possible defect. So, corrective actions included updating procedures, so two people check the connection between catheters, and the procedure itself was repeated at a later date to accomplish the prescribed dose. Next slide please.

This event is a Y-90 TheraSphere underdose, where the patient was prescribed 882 megabecquerels, but received only 624 megabecquerels. No contamination was detected in the room or in the staff members. No issues were found with the delivery system setup. The AU didn't mention any unusual resistance felt on the syringe during the treatment.

However, on the day of the treatment, an angiogram demonstrated brisk arterial supply to the tumor and verified the catheter position. So, no cause was able to be identified, and no adverse effects were expected. Next slide please.

For this event, the patient was prescribed 688.2 megabecquerels but only received 144.5 megabecquerels for a Y-90 TheraSphere event treatment which is 21 percent less dose than was prescribed. Treatment imaging afterwards determined that there was residual activity remaining in the delivery system. Next slide please.

This event is a Y-90 TheraSphere underdose where the patient was prescribed 2.36 gigabecquerels but received only 0.074 gigabecquerels. The connection between the delivery apparatus, and the catheter failed when the injection started.

However, all contamination was contained

in the paths below the connection, and no adverse effects were expected on the patient. Next slide please.

Inspection afterwards revealed a manufacturing defect in the administration kit, specifically a leakage at the lower outlet. A product advisory was issued, and all kits associated with the involved lot numbers were disposed of at this facility and corrective actions included sack training. Next slide please.

This is a Y-90 TheraSphere underdose where the patient was prescribed 2.76 gigabecquerels but received 1.32. The microcatheter disconnected from the lower lock during the injection. When this was noted, the lock was tightened, and the treatment was completed, and the leak microspheres were contained in absorbent towels. The actual underdose was estimated from measurement of the two main towels, and the microcatheter after treatment. The patient was scheduled for imaging to determine if follow up treatment was necessary and corrective actions included checklist training with a specific focus on the lower lock connection. Next slide please.

This event is a Y-90 TheraSphere underdose where the prescribed 860 megabecquerels but received

359.738 megabecquerels. For this treatment, the patient was prescribed the same dose of 860 megabecquerels to four separate lobes of the liver, three of which received the correct dose, but one was underdosed. Analysis of the delivery kit found that residual microspheres were in the last few inches of the tubing, in the microcatheter hub, and the initial length of the microcatheter which indicated an obstruction downstream of the administration site. The catheter itself was in good condition, but only a limited flow rate could be achieved afterwards. Next slide please.

It turned out the microcatheter did not meet size requirements for TheraSphere administration. No adverse effects were expected and follow up imaging determined that the treatment was clinically effective. Corrective actions included the use of correct microcatheters in the following treatments and the notification of physicians of the correct microcatheter to use. Next slide please.

This next event is a Y-90 TheraSphere underdose where the patient was prescribed 1.79 gigabecquerels but received only 0.716 gigabecquerels. Initially the root cause was not clear, but it was likely due to a selection of a distal arterial branch

for the administration.

This involved three hairpin turns, which could have resulted in ovalization of the microcatheter lumen. The location was checked multiple times during treatment, and flow was established using both saline, and contrast. The ovalization may have resulted in greater pressure on the administration site, and corrective actions included a cessation of treatment on patients with a significant number of tight turns to decrease the chance of this ovalization of the lumen. Next slide please.

This event is a Y-90 TheraSphere underdose where the patient was prescribed 592 megabecquerels but received only 368. A leak was identified during the event, between the administration kit, and the microcatheter. However, the spill was confined to the patient drape, which was confirmed by follow up surveys of the room, and the staff.

The root cause was determined to be a mismatch between the administration set received from the manufacturer and previous kits used in this facility which resulted in a leaky junction. Next slide please.

This event is a Y-90 TheraSphere underdose where a patient was prescribed 594.94 megabecquerels

but received 270.1 megabecquerels. Initially the treatment appeared to be correct, and the survey of items used afterwards determined that the patient had been underdosed.

Experiments were carried out to find the root cause, to determine the connection between the delivery set, and the microcatheter, it was not vertically oriented, and so the microspheres had become stuck during this treatment. These findings were communicated to all of the AUs, and corrective actions included amending checklists to specify that the connection must be oriented vertically.

And the patient, however, will need to be followed to determine if further treatment is needed. Next slide please.

Similarly, to the last event, this is a Y-90 TheraSphere underdose, where the patient was prescribed 1.56 gigabecquerels, but received only 1.04 gigabecquerels. Again, similarly to the previous event, the treatment appeared to be correct, surveys indicated a higher than normal residual activity in the catheter after the treatment.

And experiments found that the connection between the delivery set, and the microcatheter had to be vertically oriented, or else the microspheres

would become stuck. So, the findings were communicated to all AUs, they amended the checklist to specify that the connection must be oriented vertically, and the patient needed to be followed to determine if further treatment was needed. I'll note that these previous two events were from the same facility. Next slide please.

For this event, a Y-90 TheraSphere underdose, the patient was prescribed 13.65 gigabecquerels, but received only 10.51. 77 percent of the expected dose, which was determined to be medically appropriate. Surveys determined that there were no spills, or contamination.

And the root cause was determined to be decay of the dose due to multiple treatment reschedules. And so corrective actions included a program to review accuracy prior to patient scheduling, and dose ordered. Next slide please.

And so, we come to our SIR-Spheres events. This is a Y-90 SIR-Spheres wrong site event, where a patient was prescribed a range between 0.29 to 0.83 gigabecquerels to the left lobe of the liver.

They noted that the activity was arranged because the treatments were stopped, the left lobe had become saturated. Post treatment survey indicated

that instead the right lobe had received between 33 and 67 percent of the dose intended for the left lobe. The patient had been treated for the right lobe previously, and so this treatment was not intended for the right lobe.

Periodic flushing and fluoroscopy was performed, and indicated the catheter had moved during the treatment. It was suspected to be respiratory motion and vascular pulsations, which moved this to the right branch, however no adverse effects were anticipated. Next slide please.

For this event, a Y-90 SIR-Spheres overdoes, the patient was prescribed 489.14 megabecquerels, but received 1168.09 megabecquerels.

In this event, there were two different treatments that were prepared for different lobes of the liver. The higher dose was administered to the wrong lobe, and the error was discovered after the treatment of this first lobe. Afterwards, the other lobe was correctly treated with SIR-Spheres, and the root cause was determined to be an incorrect labeling of the doses, and failure to compare dosage to written directives. Next slide please.

Corrective actions included revised procedures that specifies labeling to only include

patient initials, radionuclide, activity, and date. And a time-out was also incorporated to compare each dose to the written directives signed by the AU. Next slide please.

This event is a Y-90 SIR-Spheres underdose, where they were prescribed 13,000 centigray to lobes two and three and another 13,000 centigray to lobes four and five. However, a complex vascular flow pattern complicated the treatment delivery. And so, the microspheres intended for lobes two and three, instead went to segment four. And the dose intended for lobes four and five only went to lobe five. And so, the segment four received a dose of 2,500 centigray, and segment five received a dose of 13,500 centigray.

The root cause was determined to be an incorrect placement of the delivery catheter, and the corrective actions included a review by a quality control committee. Next slide please.

This is a Y-90 SIR-Spheres underdose, where the patient was prescribed 599.4 megabecquerels, but received 140.6 megabecquerels. During treatment, a microcatheter had almost immediately clogged, and so this was determined to be the root cause for the underdose.

No adverse effects were expected, and

imaging of the delivery system after the event determined that the potential clumping was either in the delivery box or the microcatheter. Next slide please.

This event is a Y-90 SIR-Spheres underdose, where the patient was prescribed 2.697 gigabecquerels, but received 0.93 gigabecquerels. No contamination was reported, and the delivered dose was clinically effective.

There were no changes to the catheter or procedures during this administration that was different from prior administrations. And so, that was ruled out as one of the root causes. And so, one of the root causes was determined to be a clog in the catheter used and corrective actions included procedure modifications. Next slide please.

This event is a Y-90 SIR-Spheres underdose where the patient was prescribed 3.5 gigabecquerels but received 2.66 gigabecquerels.

The catheter clogged because of a high volume of microspheres, this catheter was replaced, and no stasis was observed, so treatment continued. No adverse effects were anticipated on the patient, and no additional treatment was required. Next slide please.

This event involves a Y-90 SIR-Spheres underdose where a patient was prescribed 1.6 gigabecquerels, but received 0.17 gigabecquerels.

The procedure was stopped after encountering resistance, and they intended to complete the administration at a later time, however the AU disconnected the line before releasing the pressure, and so microspheres were expelled onto the administration table, floor covering, all of these coverings were disposed of, and the room was properly decontaminated.

And the root cause was suspected to be a clogged microcatheter. No adverse effects to the patient were determined, and a follow up treatment was successfully administered. Next slide please.

For this event, it's a Y-90 SIR-Spheres underdose where a patient was prescribed 299.7 megabecquerels but received only 229.4 megabecquerels. The root cause was determined to be a retention of the microspheres in the delivery device.

There was a relatively large percentage of activity that retained in the delivery apparatus, which may be related to the small activity, and volume prescribed to the patient. No adverse effects were expected, and the procedure was expected to be

clinically effective, and the corrective actions included drawing low activity doses of 555 megabecquerels, or less using a delivery fraction of 0.90 instead of 0.095. This could better accommodate the larger residual percentages observed for low activity treatments. Next slide please.

This event is a Y-90 SIR-Spheres underdose, where the patient was prescribed 3.6 gigabecquerels, but instead received 2.46 gigabecquerels. This full dose was separated into two administrations through two separate arteries.

The first was administered successfully, however the second encountered catheter occlusion, and the root cause was determined to be a deformed catheter with a significant kink point on the inner catheter body. This reduced the flow rate and allowed for a full occlusion of the proximal segment of the catheter. Next slide please.

Follow up determined that no adverse effects were expected, and the patient returned for the remainder of the dose at a later time. Next slide please.

This event is a Y-90 SIR-Spheres underdose where a patient was prescribed 1.1174 gigabecquerels, but received 0.8854 gigabecquerels. The tech

encountered increasing resistance during treatment, which led them to believe that stasis had been achieved, however the root cause was a clogged microcatheter discovered post treatment. A subsequent treatment was given to make up the underdose, and corrective actions included obtaining new equipment. Next slide please.

And that is all of the medical events for fiscal year 2021. Here are some of the acronyms that I used. Next slide. Next slide. And are there any questions?

MS. LOPAS: Hey Daniel, this is Sarah, I'm going to -- I have to do one administrative thing before we get started with the ACMUI discussion. So, just for everybody at home, I am going to enable everybody's microphones right now, so hold your ears, because it's probably going to be a cacophony of noises. I'm going to enable everybody's microphones and then immediately mute everybody.

And I'm doing this because we're having a hard time getting Dr. Jadvar connected. So, Dr. Jadvar, after I've done this, remember to press star six on your phone, and that should unmute you, and then you can just use your phone mute to mute, and unmute. So, just a head's up to everybody, all members of the public that are on this call, external participants.

You will be able to control your own microphone, so please just make sure you keep it muted. I'm going to mute you all as soon as I enable all mics, I'll mute all, so don't do anything, I'll mute you all. But be aware of that if you touch it later on today, we'll be able to hear you. But that will be helpful for comments, which will be coming up throughout the day.

All right, so everybody get set, hold your ears, because it's probably going to be a little bit loud. All right, allow mics to all attendees. Okay, and then everybody is muted still, so this is good. So, Dr. Jadvar, this is your chance to press star six, and let's just test your phone real quick. And speak out when you are ready.

Okay, great, then you can hang up your phone Dr. Jadvar, because you're now, we've got you.

MEMBER JADVAR: Okay, thank you.

MS. LOPAS: All right, okay, back to you Daniel and Dr. Metter.

CHAIR METTER: Thanks (audio interference) medical landscape fiscal year 2021. I believe that's Mr. Dimarco from ACMUI, and the staff.

MEMBER OUHIB: Hi, this is Zoubir, can you hear me.

CHAIR METTER: Yes, we can hear you.

MEMBER OUHIB: Very well. Daniel, great job, thank you so much. I don't have a real question, but I just have a comment that seems to come back every time we go to the medical event. We're seeing some repeated errors, the same day, like the two capsules of iodine-131, we've seen these cases in the past.

It's amazing that we're seeing it again, and my suggestion perhaps, the manufacturers should have something that the user ought to sign when sending the shipping container saying indeed, they use two, instead of one capsule, that would force them into looking into that. The other thing is the skin case, I'm amazed that the device can actually treat a patient without having some sort of an interlock with the applicator in the unit.

That's sort of a little bit odd. And then of course we're seeing very, quite a few wrong microcatheter, or issue with the clogged catheter. I think that maybe, at some point this issue ought to be sort of resolved once for good. So, those are my general comments.

MR. DIMARCO: Thank you for those comments. To that, I guess I would say we did see that there was an increase in the number of medical events

this year. Prior, the previous years however, as all of you know, it's been quite an eventful year, specifically for medical treatments, and all of that. People coming back in from the pandemic, being able to have these treatments again after they were all halted.

That could be a cause for some of these repeated events. I guess only time will tell, we'll see in the following years if these things continue to be repeated.

DR. ANGLE: Daniel, this is John Fritz Angle, I'm a consultant to the Y-90 subcommittee. In a lot of cases of the underdosing, very detailed information about the root cause, which is terrific to hear. Is that information obtained just at sort of the willpower of the local RSO, or is the manufacturer helping in that? How do we see that information becoming available?

MR. DIMARCO: So, for a lot of these events, it was either an immediately obvious cause due to visible clumping in catheters, or things like that. But a lot of these events, they were able to take the treatment device, the complete kit and caboodle, and send them back to the manufacturer to do more extensive testing to see where it could have possibly, either

the actual kit itself malfunctioned, or they used the wrong catheter, something like that.

So, that was in multiple cases noted that they had worked with the manufacturer to, like I said, sometimes there were advisories that were brought out for things that seemed to be manufacturer defects, or something like that. Or reminders to use the correct size catheter. So, yes, we did get some good information about the root causes for that.

MEMBER GREEN: Hello, this is Richard Green, I'd like to respond back, a little more to Zoubir's comments regarding oral iodine-131 capsules. There are no commercial manufacturers of iodine-131 capsules in the United States. There are two manufacturers of kits for the preparation of iodine-131 sodium iodide capsules. And so, these prescriptions are prepared by the radiopharmacy.

And the prescription labels must indicate the number of capsules, the total activity, and the activity per capsule. It's very common with intravenous drugs to assay prior to administration, and assay post administration to get the net injected activity. I think that same thing with the recommended on oral dosing as well, thank you.

MR. DIMARCO: Thank you.

MR. MISHRA: Hi, my name is Vivek Mishra, I'm a member of public, and I'd like to make some comments about yttrium-90, Y-90, TheraSpheres, and SIR-Spheres --

MS. LOPAS: Hi Vivek, if we could just wait, we're going to finish up with the ACMUI comments, and then Dr. Metter will then open it up to the public. If you don't mind, just hold off, and mute yourself until we get to the public comment portion.

MR. MISHRA: Thank you.

MS. LOPAS: I promise we'll get to you though; you'll be the first one in line.

MEMBER MAILMAN: Okay, this is Josh Mailman. You noted part of this may be from everyone coming back to health therapy. Do we have a concept of either were there more therapies done, or more events? Is the denominator that much higher? And how does this compare to other years when we've done this review?

MR. DIMARCO: Unfortunately, we don't have any numbers on that yet. That was just, I guess a musing as to what could have been, hopefully in the next few years we'll be able to get better numbers on that and have a more complete picture of how the COVID-19 pandemic affected specifically radiation

treatments.

MEMBER MAILMAN: Whether it's just the COVID-19, or whether we're also just performing more treatments as well. I'm trying to get an understanding of was this a larger than expected, or about the same percentage wise, as what we were doing? Are we getting better, and just we're doing more treatments? It would be good to know those things.

MR. EINBERG: Yeah, Mr. Mailman, this is Chris Einberg, in response to your question, later on today we're going to have presentations from TheraSpheres, and SIR-Spheres, and anecdotally, the number of treatments is going up, and maybe they can speak to that in their presentations.

MEMBER MAILMAN: Thank you.

MEMBER OUHIB: This is Zoubir again, it would be great if every manufacturer, whether we're talking about iodine, TheraSpheres, SIR-Spheres, whatever, for them to actually share, or send to their users some corrective actions that they have thought about or received information about to all the users they have in their checklist perhaps. I think that would be valuable.

Because they're the one who probably will hear about what has to happen regarding their device,

or their radioactive material, or whatever. And I think that would be very valuable, if they were to provide it. Like here are some items you might want to consider adding to your checklist. So, that way it's not repeated again, and again.

CHAIR METTER: Thank you. Are there any other comments, or questions from the ACMUI?

MEMBER ENNIS: Only to follow up on Zoubir, this is Dr. Ennis. It's a really interesting idea to get more specific perspectives. We had in our prior discussion sent out, if I remember correctly, advisory notice, information notice based on a review of medical events to people to pay attention to the use of checklists as a method to prevent medical events. But we didn't get more specific than that, about what might be on your checklist.

That might be something for further work of ACMUI, to come up with proposed generic checklists, that might be a really useful tool for all the users across the country to use.

CHAIR METTER: Thank you, Dr. Ennis. So we've had some comments, and we now have to look at that in the future. Any other comments from the ACMUI?

MEMBER GREEN: Yes Dr. Metter, this is Richard Green, following up on those previous comments

from Dr. Ennis, and Mr. Ouhib. I think it might be appropriate to look to the professional licensing boards, since they have the expertise in these different procedures. To have them take lead on developing, and communicating, and standardizing checklists that were described in those comments.

CHAIR METTER: Thank you Mr. Green, that's a really nice thought. Any other comments from ACMUI?

MEMBER JADVAR: This is Dr. Hossein Jadvar, just one quick comment again, catching up on what was said already. First of all, I'm glad I can speak, my mic was not on. Regarding -- I was wondering if there was any heterogeneity with these events across the country with regards to the size of the practice, is it pretty homogenous across the country? Is there any functionality with regard to the private practice situations, versus academic situations?

The size of the hospital, and the number of the patients they see? I'm just wondering if there is such functionality.

MR. DIMARCO: So, as it might be expected, typically most of our medical events come from larger facilities, just the volume of patients, and again, the volume of treatments that they -- I'm losing the word right now. The volume of treatments that they

provide just numbers wise, makes it so that most of our events come from those larger medical facilities. However, we do get other events from those smaller ones, it's just not as many.

MS. VALENTIN-RODRIGUEZ: Thank you Dr. Jadvar, this is Celimar. One thing is we don't keep track of that information as part of our licensing records, but that is a good point, and maybe that's something that we can look into trending in the future, is to see if we can see any trends in terms of where in the country, and what types of institutions, so that's a good point to take in, thank you.

MR. EINBERG: Yeah, and Dr. Metter, and Dr. Jadvar, just saying once again, great presentation Daniel, a lot of time, and effort went into this presentation. Along those lines, we wanted to see if this format works for the ACMUI, and whether you have any suggestions on changing the format of this presentation. So, just putting it out there, if there's any thoughts about how we can represent the information better, or differently.

MEMBER JADVAR: This is Hossein Jadvar again. Maybe -- there was a lot of cases, and a lot of details, which is good, but maybe in a form of a summary of major -- categorizing them in a sense, in

a summary table. Let's say for all the Y-90 TheraSpheres, these are the issues that happen in major categories. And then perhaps -- I'm not sure if it's required to go over every case in detail.

That information can be available of course, as reference, but just to get a feeling of what is going -- for example, I saw a lot of under treatments, so I don't know, let's say of ten different cases you mentioned, maybe eight of them were under treatment. And then there maybe a few over treatment, a few kinking in the tube, and all that. So, that makes it easier to kind of reflect in our mind of what is going on out there.

As opposed to doing every case, after one case, and going very into detail of what happened, which should be there, but as a reference, not really going over every one case.

DR. ANGLE: This is Fritz Angle again. I agree with Dr. Jadvar's comments, but I will add there's incredible information, and thank you again for putting all the work you put into this, in not only their management of the situation, but also their sort of quality of process. And I really think we need to spend time as a committee looking at how they dealt with this.

It's amazing how their handling was of the exact same situation over, and over again, and I think there's a lot for us to learn from that and analyze. So, I don't want to lose sight of that incredibly valuable information you had in all the cases you presented.

CHAIR METTER: Thank you, Doctor, for your comments. I think the presentation today was excellent, and perhaps to help the (audio interference) that shows that a number of events related to medical practice (audio interference) at the end to (audio interference).

MEMBER O'HARA: Hi, this is Michael O'Hara, and I just want to thank Daniel for a very nice presentation, and it's very helpful. I think a summary table probably will be a good addition to what you've already put together. And thank you again.

CHAIR METTER: Are there any other comments from the ACMUI, or NRC staff on this topic?

DR. ANGLE: This is Fritz Angle again, and I am relatively new to these committees, but I think this information, particularly in a tabulated form would be incredibly useful to every Y-90 user in the country. Where, and how was this information disseminated, because I think it would be helpful

feedback to everybody who does this procedure.

CHAIR METTER: Yes, thank you Dr. Angle, and as you can see from the agenda this afternoon, we are addressing several sections of the line items. To some extent it's impossible to address these line item programs, and I think this is really good data, and I guess we need to really explore the topic. Anything else?

MEMBER OUHIB: Yeah, this is Zoubir. While the presentation might be long, and depressing at times, I still support having all the details that were presented, just like the previous comment, this is valuable information to members of the public to hear that kind of stuff. And learn from it certainly. But I think it does provide good information.

MR. EINBERG: So, no other comments from the NRC staff Dr. Metter.

CHAIR METTER: Okay, thank you. Any other comments from the ACMUI? All right, at this time there are none, so let's go ahead, and open the discussion to the public. Ms. Lopas?

MS. LOPAS: All right. So, Vivek Mishra, if you want to go ahead, and get us started for comments? But I will ask that everybody raise your hand. If you can find the raise hand icon on your Teams, that will

help me kind of control the comments. So, do not unmute yourself yet, hang on a second, we're going to have to mute everybody, I'm going to mute you all. Okay.

So, we're going to start with Vivek Mishra, but I want to just ask everybody to not unmute yourself until I tell you that you can, all right? Because I have enabled all your microphones, and I will ask that we use the raise hand function so I can kind of keep some order in the comments. So, Vivek, if you want to unmute yourself, and start your comments, we'll go ahead, and start with you.

MR. MISHRA: Sure. So, this comment is regarding yttrium-90, Y-90 TheraSpheres, and SIR-Spheres. There were a number of issues raised why it was a medical event. I'm not going to go into the kinking of the catheter, et cetera. However, I will point out one issue. When it is recorded that the intended dose was not reached, or was underdosed, that the dosimetry method used is very crude to establish how much dose was actually administered.

The way it is done is you take the wire inside the casing that is provided by the vendor, and put in a plastic cylindrical jar, and about eight and a half inches to 11 inches from the center of the cylinder, an ion chamber survey meter is used to get

full relevant readings 90 degrees apart. This method is used before the administration, and then everything that comes out, that can be squeezed into that jar, into that cylinder, is put back in, and you take more readings again.

And you average out, and you set the bag back down from the ion chamber. So, this is not a precise geometry which can be used to establish accurately whether you're getting 90 percent, 95 percent, 70 percent, or 80 percent. One vendor actually describes that the initial reading be taken while the dose is still in the sealed container. Obviously after the administration is done, the containment of the vial, the vial is not contained anymore with a lead shielded container.

So, the readings are going to be very erroneous. So, both the fact that the geometry, and the detector are very crude, as well as the fact that in one instance, lead could be actually reducing the initial ion chamber survey meter readings are big problems. They are used, but how can we establish the amount of dose that is administered to the patient? One can get all kinds of crazy answers.

That could be one reason why so many patients actually were reported to have under dosing.

But I'm just putting this out there, that this is not a good way of doing dosimetry for Y-90. I'm done, and I'm going to mute myself now.

MR. DIMARCO: Thank you very much for that information. Sarah, you are on mute.

MS. LOPAS: Thanks Daniel. So, let's see. Go ahead and raise your hand. So, it should be up top, you should potentially have a hand raise icon, and you can just click on that hand, and that will show me that you would like to unmute yourself and make a comment. And if you are on the phone, the way you raise your hand on the phone is by pressing star five.

And Don, let me know if you can see any hands raised. Although, I guess you can't see the chat, can you? I am not seeing any hands raised at the moment. I'm not seeing any hands raised. There we go, all right, Matthew Barrett, you can go ahead, and unmute yourself Matthew.

MR. BARRETT: Okay, I think I unmuted myself.

MS. LOPAS: Yeah, we can hear you.

MR. BARRETT: I am talking about an earlier portion within the -- not about the Y-90, and I didn't know if this was quite the right time for the public comment about what is the area of some portions

of this meeting. But I wanted to at least make a comment. I'm a license writer for the State of North Carolina, and I can say adding physicians with the AU (audio interference) other active users to allow -- to do the training on the other methods under 313A.

And I can say the vast majority of my experience with the 313A things is people get ahead all of the time. And one of the most common, and fastest ways to get the job done is when you actually have a board certified, and an AU eligible, because they close it up, and lock it. And so we in the business, more just begging for efficiency.

If you could please make sure that there is some sort of method to be able to add something like the ABR, now that the ABR is going to be getting rid of it. Because adding physicians will take a lot longer, a lot more physicians that are going to have to be trained, and this committee has good influence over the infrastructure and the civil license record. So, what I am just saying is that some method be established to continue something of that vein. I'll mute myself.

MS. LOPAS: All right, thank you for that comment. All right, Ashley, I see you have your hand raised, I'm also going to -- I know you're presenting

in the afternoon, so I'm going to go ahead, and make you a presenter, but go ahead, and unmute yourself.

MS. COCKERHAM: This is Ashley Cockerham. I was just going to follow up with what Mr. Barrett said as the individual on the manufacturer side who supports these physicians who submit those 313A forms. I can tell you in the dozens of amendments that I support on a yearly basis, we never use the 313A form. It is extremely difficult, it results in a response from the agreement state nearly 100 percent of the time that there is a deficiency.

And we overwhelmingly use the ABR certification pathway with AU eligibility for any possibility that we can. And in most situations, if we have a physician who does not have ABR certification with AU eligibility that's specific for Y-90 microspheres, especially for the radiologists, we would usually opt to not have them apply to be an authorized user because it is too difficult.

MS. LOPAS: Okay, thank you for that input Ashley. All right, any other public comments, just raise your hand, and I'll instruct you to unmute yourself. If you're on the phone, you can press star five on your phone, and then you'll simply press star six to unmute yourself. Okay, I am not seeing any other

hands. I'll have a last call for public comments on Daniel's presentation, or anything that you've heard this morning.

Just raise your hand. And then Chris, am going to I handing it over to you, or back to Dr. Metter?

MR. EINBERG: Back to Dr. Metter.

MS. LOPAS: All right, Dr. Metter --

MR. DIMARCO: I'd actually like to make a comment.

MS. LOPAS: Yes.

MR. DIMARCO: I think I saw her in the people in here, but I'd like to thank Dr. Donna-Beth Howe for her help. She did this for years, and years, and years before me, and so she's got a lot of experience, and so she helped me very much in my first year of doing this, so thank you very much.

MS. LOPAS: I hope you have some popcorn Donna-Beth, and you're sitting back on your couch relaxing, as Dr. Donna-Beth Howe recently retired.

CHAIR METTER: Dr. Donna-Beth Howe, thank you so much for your long years of experience, and just advice, and helping us have a very successful committee. So, if I look, are there other comments? I do see someone with their hand up, Ashley? Yes.

MS. COCKERHAM: Hi Dr. Metter, it's Ashley

Cockerham again. I wanted to get confirmation before I responded, but this, I wanted the committee to have this information sort of in the same session, even though I'm presenting later, in response to Mr. Mishra about the comments for the crude dosimetry, and the poor quadrant measurements, I agree, it is very basic.

However, in the case of TheraSphere, those measurements are always taken outside of the lead, both before, and after the procedure, and that's part of the standard manufacturer procedures. So, we shouldn't be seeing medical event discrepancies specifically related to measuring with, or without lead. The geometry is obviously different post administration, when everything is sort of microcatheters, and things, towels in one container.

But the lead, which would obviously provide significant shielding, should not be providing that attenuation either before, or after administration.

CHAIR METTER: Thank you Ashley for that. I just want to make sure it's done. I see another hand up? Sarah?

MS. LOPAS: That might be Ashley's hand still.

MS. THOMPSON: No, this is Diana Thompson

from Sirtex.

MS. LOPAS: There you go.

MS. THOMPSON: I just wanted to add again to Ashley's comment, that we also do not recommend measuring in the lead prior to administration. So, I'm not sure which manufacturer might be recommending that, but it was not Sirtex, I just want to clarify that as well.

CHAIR METTER: Thank you Ms. Thompson for that additional information. Okay, I do not see any other comments. Does anybody else see any? Mr. Zoubir Ouhib, you have a question, or a comment?

MEMBER OUHIB: Yes, I just want to comment regarding Vivek Mishra's statement. I sort of agree with him to a certain point, however for the present time, at least to the best of my knowledge, we have no better method to actually evaluate that. But I also would like to hear from the manufacturers, probably sometime this afternoon, the data incoming to recommending those methods.

How reliable are they? What are we talking about in terms of the errors, and so on, and so forth. I think that would be valuable.

CHAIR METTER: Well, thank you for the comment, Mr. Ouhib, and it looks like this afternoon

will be a very informative, and exciting discussion. And thank you, Mr. Lowman, for a succinct and good presentation, and a very, very informative session for the afternoon. Any last comments? Okay, seeing none, let's go ahead, and recess for lunch, and we'll be back at 12:45 for the next presentation. Thank you.

(Whereupon, the above-entitled matter went off the record at 12:09 p.m. and resumed at 12:45 p.m.)

CHAIR METTER: Well good afternoon. It is 12:45, so I believe we can start our afternoon session. Our first --

MR. EINBERG: I'm sorry, go ahead, thank you.

CHAIR METTER: Our first presenter will be Mr. Lowman, who will be reporting on ACMUI's reporting structure and just basically the ACMUI's committee and how the committee can provide feedback around this reporting structure. Mr. Lowman?

MS. LOPAS: Hi Don, are you there?

MR. LOWMAN: Hello, technical difficulties, sorry about that.

MS. LOPAS: There's been a lot of them today, haven't there?

MR. LOWMAN: Yes, there has. Yeah, good

afternoon, and as Dr. Metter mentioned, I'll be providing a review of the reporting structure. Sarah, are you going to share the slides, or?

MS. LOPAS: Yes, Don, I am sharing the slides already. You should be able to see them if you have Teams pulled up, but they're shared.

MR. LOWMAN: Okay, I'll be providing a review of the reporting structure. This presentation will go over the current reporting structure, our discussion of our annual review, the frequency of our meetings, and we'll have a discussion by the ACMUI after my topic. This slide provides a graphic of the current reporting structure.

Working from the bottom, the ACMUI reports directly to Mr. Kevin Williams, who is the Director of the Division of Material Safety Security State and Tribal Programs, otherwise known as MSST, or “Mist”. Reporting to Kevin is Chris Einberg, who is the Branch Chief of the Medical Safety and Events Assessment Branch known as MSEB. And our division, MSST, reports to Mr. John Lubinski in the Office of Nuclear Material Safety and Safeguards.

And it goes up the chain to our Executive Director of Operations, Daniel Dorman, who reports to the Commission. The ACMUI does not report directly

to Chris's branch, MSEB, however, within this branch resides the Medical Radiation Safety Team, which helps to support the day-to-day activities of the committee. During the presentation of the bylaws in September of 2012, the ACMUI recommended to have an annual review of its reporting structure.

At that time, ACMUI was presented with the option to continue to report to NMSS, or to report directly to the Commission. The subcommittee report provided in 2012 stated that the working relationship between the NRC, and the ACMUI remained excellent, and the report structure through the NRC staff continued to function effectively.

The subcommittee, and ACMUI agreed at the time that the associated logistics, with direct reporting to the Commission, such as more frequent meetings did not, and does not justify any change in the ACMUI's reporting structure. The ACMUI currently holds two meetings each year, one in the spring, typically March, and April, and one in the fall, September, or October.

ACMUI also meets via teleconference approximately two to three times between these meetings on an as needed basis. At this time I'll turn it over to Dr. Metter, and the ACMUI for discussion on whether

the committee is satisfied with the current reporting structure, what's not working, and recommendations on how to improve.

CHAIR METTER: Thank you Mr. Lowman. Do I have any comments from the ACMUI members regarding this proposed structure that Mr. Lowman has demonstrated?

MEMBER SHOBER: Hi, this is Megan Shober, I don't have any concerns with the structure.

CHAIR METTER: Thank you Megan.

MEMBER GREEN: Dr. Metter, this is Richard Green, I think it's helpful to see the structure laid out, and the org chart as presented by Mr. Lowman today, I'm grateful to see that organization chart. But I also think that we're getting very good support from the NRC, and from staff, and don't recommend any changes to the current reporting structure.

CHAIR METTER: Thank you Mr. Green. Any other members want to make a comment regarding the reporting system?

MEMBER MARTIN: Excuse me Dr. Metter, this is Melissa Martin, I was just going to say I have no recommendations for changes. I think we've had very good support.

CHAIR METTER: Thank you Melissa.

MEMBER JADVAR: This is Hossein Jadvar, I also agree with the current structure, thank you.

CHAIR METTER: Thank you. Dr. Jadvar.

MEMBER ALLEN: This is Becky Allen, I also agree with it, thank you.

CHAIR METTER: Thank you.

MEMBER OUHIB: This is Zoubir, I also agree with that.

CHAIR METTER: Thank you.

MEMBER ENNIS: It seems like everyone wants to say they agree, so I will also agree. I do also agree.

CHAIR METTER: Thank you Dr. Ennis. I also think the NRC has been extremely helpful with the Committee on the duties that we have to do, and I appreciate the help, and the expertise. Any suggestions? All right at this time I'd like to thank the committee. Thank you very, very much to the NRC staff for the stellar support of our Committee, and the work we do. Also is there anything that the NRC staff would like us to do to help them?

MR. EINBERG: Yes, thank you Dr. Metter, and the rest of the Committee for the kind words, and particular reporting structure. I think this is, right now, the most optimal reporting structure. And

I do think that the work that we do with the Committee, we do have a good relationship, and so we're always open to feedback. I'd like to also thank Don Lowman for stepping in and acting as the ACMUI coordinator as we try to back fill for that position.

Kellee Jameson provided excellent support in the past, and Don's stepped up, and we appreciate his help. But we're going through some transition within the branch, so we lost Dr. Howe, and Celimar came on board, and Lisa Dimmick came on board. So, we're growing, I think we're getting stronger as well. So, I appreciate the feedback.

CHAIR METTER: Thank you, your staff has really been very, very helpful, and it's great to see what you've been doing, and I really appreciate your expertise, and the way you're able to communicate with us. Thank you.

MR. EINBERG: Excellent, thank you. Dr. Celimar Valentin, did you have anything?

MS. VALENTIN-RODRIGUEZ: Sorry, I'm slow at the mic. No, I just wanted to echo your words, and thank Dr. Metter, and the other ACMUI members for their patience as we deal with some staff turnover, and I appreciate your support. And so, I'm here to work with you. So, if any issues come up, please feel free to

reach out.

CHAIR METTER: Thank you Celimar. So, the next item on our agenda is a special presentation by Dr. Vasken Dilsizian, and I believe the NRC will be doing the special presentation.

MS. VALENTIN-RODRIGUEZ: Dr. Metter, this is Celimar, I think that John Lubinski, our office director, was due at 1:00. So, I'll try to get him on, and maybe we can give him a few minutes.

CHAIR METTER: Okay, thank you.

MR. LUBINSKI: Hey, good afternoon everyone.

MS. VALENTIN-RODRIGUEZ: Hi John, how are you?

MR. LUBINSKI: Good, how are you Celimar?

MS. VALENTIN-RODRIGUEZ: Good. Yeah, I just pulled you in, we're a few minutes ahead of schedule.

MR. LUBINSKI: Great, I was just in the process of logging in when your message came through. So, I just hit the accept on that instead. So, are you turning it to me now?

CHAIR METTER: Yes, this is Darlene Metter, I'd like to thank you for coming to present this special presentation for Dr. Dilsizian, a very

important member of our committee.

MR. LUBINSKI: Well, thank you very much. Thank you, Dr. Metter, I really appreciate that, I appreciate you making time in the agenda. For those who don't know me, good afternoon, I'm John Lubinski, I'm the Director of NMSS. It's been a while since I've seen y'all in person, it's been a while since we've seen a lot of us in person. But yeah, I want to thank you for allowing me to be here today.

Before I get into the purpose of this presentation, I also want to just generally thank everyone at ACMUI, we are so fortunate as an agency to have this kind of committee that is able to help us in understanding the industry that we regulate, and has such focus on safety, and such a great expertise. And we have an honor this afternoon to honor Dr. Dilsizian, and he is stepping down, as currently the Vice Chair of our ACMUI committee.

And we really appreciate all of your service, appreciate all of the great work you've done while you've been here with us at ACMUI. For those who don't know, and to recap for all who do, you were appointed to the Committee back in May of 2014. So, we're going on eight years, a pretty long run there, and really appreciate all you've done since you've been

there.

On the Committee, we just really appreciated the different items that you've either led or contributed to. For myself, the importance of two of the committees, which you led as Chair, one was the original Patient Intervention Subcommittee, and then the reestablished Patient Intervention Subcommittee. Can't think of two more important committees than when we're talking about direct interaction in patient interventions.

The numerous subcommittees, I think the one that's most recent in people's mind is your contributions to our ACMUI COVID-19 Subcommittee. As we were going through the pandemic and being able to understand the impact from our own workers, what they were dealing with, it was really great to have your expertise. One of the items that gets a lot of visibility, as we all know, is the events that occur.

And that comes from our event reporting, and what we need to have reported, and what don't we have reported. And the number of subcommittees just in that area, medical event reporting, the appropriateness of the medical event reporting, infiltrations, extravasations, the work on that subcommittee to help us in our paper right now that

we have going forward, has just been outstanding.

Medical event reporting, and its impact on safety culture in the organization, that's something that we can never lose sight of, the safety culture of the organization. And then more recently, I think it was right around the time I was coming to NMSS, we were working on the yttrium medical events, which also resulted in some licensing guidance for yttrium microspheres.

Again, great responses there when we're looking at medical event reporting and helping us as an agency in how do we respond to that. Subcommittees along licensing guidance, whether it was the germanium-gallium generators, generator knowledge in general, the emerging radiopharmaceutical technology, that's another area that just is great to have such a medical expertise and helping us in that area.

Training, and experience for alpha, and beta emitters, and then release of patients, the patient release guide. Again, that's one that has the most direct impact with our patients, where we're able to give them information about what's needed and going forward. So, again, it's only really a few of the committees, and really appreciate that. We're just so fortunate to have someone with your total background

on the committee.

For those who don't know, in addition to serving the NRC on our committees, your leadership in the organization such as the American Society for Nuclear Cardiology, Society for Nuclear Medicine, and Molecular Imaging, the American College of Cardiology, as well as the American Heart Association. Just again, incredible. And we're not the only agency who's benefitted from you, and we really appreciate knowing that as well.

As you served on the FDA's Federal Advisory Committee, so again, great. And then finally, if you don't mind if I do a couple more platitudes here, from the standpoint you've got 208 original peer reviewed manuscripts, as well as some articles, ten books, and 43 book chapters. So, how you find the time to do your day job, and everything I just talked about with the other committees that you're working on is impressive.

I mean any one of the things I've brought up is a whole career, and then you've got your full career in your day job if you will. We can never, as an organization, thank you enough for what you've done for us. But we are -- we do want you to have some small tokens. It would be great if we could present these to you in person, we would like to invite you back to

a future meeting so we can give you a real handshake, and a goodbye.

But a couple things we did want to make sure that you had from us as a small token of our appreciation, and hopefully when you look at those, you'll remember us. One is we're going to present a flag to you, the flag has been flown over the U.S. Capitol, Senator Van Hollen was gracious enough to help us have that flag flown over the Capitol for you, so we will be presenting it to you.

We do have a Certificate of Appreciation from our Chair, Chair Hanson. I think as you know, Chair Hanson had an interest in ACMUI activities when he was down on the Hill, and so definitely an understanding, and knowledge of you, and the committee before coming here, and definitely have a great appreciation for you. I'm sure I can speak on his behalf today, but he'll speak for himself in the letter that will be coming to you, and the certificate.

And then a lapel pin from the NRC. We're all very proud of our organization, and very proud of our mission. And in the time you were with us, you definitely not only exhibited the safety focus we have as an organization, but we definitely felt that you were an individual that exhibited our mission. And

we're all here because of our mission, and the people we work with, and I can't say thank you enough.

I am going to ask for the folks on the line, we've done this in other groups as well, and I hope you'll bear with me, I'm going to ask all the folks on the line if you could turn off your mutes, turn on your mic, and give truly a real hand as we send off Dr. Dilsizian. Thank you very much, appreciate you.

VICE CHAIR DILSIZIAN: If I could say a couple words, thank you Mr. Lubinski. I really think -- I'm just hearing an echo, is that okay?

MR. LUBINSKI: I'm going to ask everyone to turn off their mics now so we can --

VICE CHAIR DILSIZIAN: Thank you so much. It is really an honor to serve for the NRC. I am grateful for the opportunity, and your kind comments, and words. I just am thrilled, that eight years went by so fast, it has been an extraordinary, and educational journey for me. I wanted to also thank Mr. Williams for recognizing me in his earlier comments, in the introductory comments.

And I'm grateful to Mr. Einberg, he is the one who interviewed me more than eight years ago, and I'm really pleased that he selected me, and he thought I would be qualified to serve such a great committee,

and organization, we're all leaders in the field, and I've learned so much from them. Of course, you've heard already praises about your phenomenal NRC staff.

I am particularly grateful to have served with Dr. Darlene Metter, thank you for your leadership, Darlene, and for being the Chair. I'm going to miss you all, I wish this was done in person as well, but I will make sure to come back, as was suggested by Mr. Lubinski, to really be giving my thanks to you all for allowing me to serve on such an honorable committee.

One of the most rewarding aspects, if I think back, of our profession, is this kinship that we develop along the way, with our academic, and government service activities. Which I will cherish forever, and I would like to express my heartfelt appreciation for having served with you all. Thank you again.

MR. LUBINSKI: Thank you so much. And Dr. Metter, thank you for allowing me to have time on the committee today to be able to recognize such a great accomplishment.

CHAIR METTER: Thank you Mr. Lubinski. Do we have any other comments from the ACMUI members?

MEMBER JADVAR: Yeah, may I start? This is Hossein Jadvar.

CHAIR METTER: Yes Dr. Jadvar, please.

MEMBER JADVAR: So, Vasken, I wish I could be there to shake your hands. It's been a privilege for me to work within the ACMUI, and of course other organizations such as SNMMI. Vasken is a wonderful friend of mine, and a great colleague, and I'm going to miss you Vasken, on the ACMUI. But I'm sure that we'll continue working with each other within SNMMI, and other organizations, or other avenues.

Again, thank you for all your contributions, as was already mentioned, many, many contributions in many different facets. And also, personally thank you for your friendship.

MEMBER ENNIS: Hi, this is Ron Ennis, I just want to echo the comments. Vasken's been my left-hand man since I joined ACMUI right after him, and he sits to my left, I sit to his right. Now I'm at the edge of the table, almost pushed off the edge too. But it's been great, he's obviously a wonderful person, and a major intellect, and major accomplishments, and I've learned a lot from our interactions.

Being on these committees, the great thing is you get to interact with people you otherwise would never meet. Other specialties, other backgrounds,

other perspectives, and I feel like we all grow from that. And I think we've done very good work together at ACMUI, we've done a lot of subcommittees together. And it's only sad that it has to end now, and that we can't do it in person.

But also that we won't get to continue that collaboration, at least not in this context. But maybe we can find some other way for SNMMI, and ask you to work together, so we get to work together some more.

VICE CHAIR DILSIZIAN: We'll do that.

MEMBER MAILMAN: This is Josh, Vasken, you and I were together for at least my last in person meeting, I think in January 2020 before we all locked down, and it was a pleasure working with you at the SNMMI when you were President, and continued as we worked together on the NRC, and I look forward to continuing collaborations, and just wanted to echo what Ron, and Hossein added there as well.

VICE CHAIR DILSIZIAN: Thank you Josh, you're a great asset to the Committee, and thanks for joining.

MEMBER O'HARA: Vasken, this is Michael O'Hara, I also want to add my voice to the voices that already talked. You have taught me a great deal since you've been on the ACMUI, and your leadership has been

outstanding. I want to -- I want to say I hope that you, and I at some point in time can get together for coffee, because I would really like that since we're so close. Take care and keep up the great work.

VICE CHAIR DILSIZIAN: Thank you Michael, come up to the FDA someday, since I live in Bethesda, it should be easy.

MEMBER O'HARA: Yeah, hopefully it's easy, if the beltway is cooperating.

CHAIR METTER: Vasken, this is Darlene Metter. I would really like to personally, in person thank you, not at this time, we'll do it in the future. But meaningful, and very valuable, exceptional leadership to the ACMUI, and its subcommittees. And particularly, very practical contributions during our discussions around the different issues that are brought to the committee.

Your work is truly fabulous, I wish you the very best, and thank you again for your dedication, and time. You've taught a lot to the medical community, the NRC staff, and the ACMUI, and I'm sure I'll see you at other meetings like the SNMI in the future, and hopefully I'll see you again soon.

VICE CHAIR DILSIZIAN: Darlene, thank you again for your leadership.

CHAIR METTER: Okay, but I'm going to celebrate that.

VICE CHAIR DILSIZIAN: Yes.

CHAIR METTER: Thank you very much.

VICE CHAIR DILSIZIAN: Take care, thank you again.

MR. EINBERG: So, Dr. Dilsizian, on behalf of myself, and the NRC staff, we want to thank you for all the great contributions that you've made over the past eight years. It does seem like just yesterday when you were sitting in the corner office there, face to face, and we had that interview there. But you clearly did demonstrate what we were looking for, and you always bring such a positive attitude to your work.

And you're very willing to work on all the subcommittees, and you've been a great contributor. So, thank you, thank you so much for all your work, and that you brought such expertise to the committee. The entire committee as you know, we're very humbled to have such an esteemed committee supporting the NRC staff. Without all of you, we couldn't do our jobs. So, thanks again Dr. Dilsizian.

VICE CHAIR DILSIZIAN: I'm grateful Mr. Einberg, thanks for selecting me, appreciate it.

MR. EINBERG: Our pleasure.

MEMBER OUHIB: Hi, this is Zoubir. One last thing, you will be missed. And I'll tell you one of the things that will be missed, and you're going to do it right this second, is your smile in that room. You're always there with a smile, and providing some constructive, and positive feedback at all times. I truly admire that, and I wish I could learn from you. So, you'll be missed.

But I really hope that in some fashion your contribution will not end at this point. Thank you.

VICE CHAIR DILSIZIAN: Thank you so much Zoubir, it's been always fantastic working with you as well, and I have no doubt that we're going to see each other in subsequent meetings.

CHAIR METTER: Any other comments from the ACMUI? Dr. Vasken Dilsizian will truly be missed. He's just been a very solid person to relate your expertise, and experience with us. And we will really miss you.

VICE CHAIR DILSIZIAN: Thank you very much everyone. Goodbye, I'll see you -- I guess in a couple more weeks I guess, what I was told. So, I will serve until then, and thank you again.

CHAIR METTER: Thank you. So now, the next item on our agenda is a TheraSphere presentation. Somebody at our morning session asked that I emphasize

the importance of these next few presentations. And our first presenter will be Ashley Cockerham from Boston Scientific presenting on TheraSpheres, and glass microspheres. Thank you. Ashley?

MS. COCKERHAM: Thank you Dr. Metter, following Dr. Dilsizian's recognition is a really tough act to follow, and Dr. Dilsizian, I apologize, you are falling off the left end of the table. I was there when you started on the right end of the table, and I think I was responsible for that organization. But you have officially graduated, and I also appreciate your time, and input on the committee, it is valuable having sat in a couple of chairs now.

VICE CHAIR DILSIZIAN: Thank you so much Ashley, appreciate it.

MS. COCKERHAM: You're welcome. So again, I am Ashley Cockerham, and if you'll go to the next slide please, I am here speaking as a consultant on behalf of Boston Scientific. Next slide please.

I'm going to give a short presentation on the TheraSphere product, and we'll talk about how to order the box setup TheraSphere administration, the kit disassembly, and post administration rates measurement, which we touched on a little bit earlier.

And lastly, I want to talk about written

directives. And I will try throughout my presentation to tie all of these topics to the training that is provided by Boston Scientific, as well as how that ties into the NRC regulations, and eventually the clinical medical events. Next slide please.

So, what is TheraSphere? TheraSphere consists of small glass microspheres. They have a mean diameter of 15 to 35 micrometers, and the yttrium-90 is not bound on the outside of the glass microspheres, it's actually an integral part of the glass. And here you can see the comparison of TheraSpheres to a strand of human hair. Each vial contains between 1 and 8 million microspheres depending on the activity ordered. Next slide please.

So, TheraSphere is delivered through the hepatic artery. The Y-90 is a pure beta emitter with a half-life of 64 hours, or approximately 2.7 days. And Y-90 has an average tissue penetration of 2.5 millimeters, which provides for a targeted therapy within the liver. Next slide please.

So, a lot goes into planning for a TheraSphere treatment. There is imaging with CT, or Cone-beam CT, or MRI, and this is performed to select suitable patients.

Angiography is also performed to determine

if embolization is needed. A tc-99M MAA scan is performed to assess the extra hepatic flow to the GI tract and the lungs. And the perfused volume and dosimetry calculations are performed to determine the appropriate activity and number of vials to be ordered. The last step is to perform the actual treatment.

But before we get into treatment details, I want to review the tools that Boston Scientific provides to customers to prepare for the treatment. Next slide please.

I believe this was referenced in an earlier presentation for one of the, maybe a corrective action to make sure that the treatment window illustrator matched the written directive. So, this is what the treatment window illustrator looks like.

It assists with ordering the appropriate TheraSphere activity based upon the desired dose for the patient. It takes into consideration the timing of the administration, the lung shunt fraction, the dose to the lungs, and the anticipated residual waste. The user completes the cells that are highlighted in yellow, and activity values that correlate with a targeted dose are bolded for the physician to choose the appropriate vial size based on the planned treatment date.

So, this is an Excel based tool that is shared with each customer during training and is recommended for use in ordering. Next slide please.

There is also an online ordering tool, this is similar to the treatment window illustrator. Boston Scientific offers an online tool that assists customers with determining the appropriate TheraSphere activity to order.

And then this order can be placed directly online once that has been determined using the same inputs that went into the treatment window illustrator, and the same sort of outputs where it highlights the appropriate vials to select for the treatments. Next slide please.

Shifting to the box setup, here are the items that are necessary for product administration. The TheraSphere sales representative provides hands on training and provides three mock infusions for each new TheraSphere site prior to the radioactive materials license amendment. So, the administration tube being set is shown here on the left as item one. The administration accessory kit, or delivery box is shown as item two. And the led pot containing the dose vial is shown in item seven.

There's also a RADOS electronic dosimeter,

which is shown as item six, right next to the lead pot. And this is clipped to -- it's difficult to see, but it's on the front edge, the front center of the delivery box. The electronic dosimeter is put there for each procedure to show when the procedure has been completed, and there is no longer activity remaining in the vial.

When the administration is complete, all of the single items are placed in the Nalgene waste container, in the beta shield, which is shown as item three. The dosimetry meter, as shown in item four, is used to confirm that there is no contamination present on the reusable box, or on individuals in the IR suite, or within the treatment room. Next slide please.

So, the TheraSphere administration checklist is one of the most important tools for TheraSphere administrations. The form provides a list of all materials and equipment needed, as well as step by step instructions for the following items. It helps with patient, and room preparation, administration set timing, the dose vial preparation, assembly of the kit, and dose vial. The TheraSphere administration itself, and disassembly, clean up, and patient follow up. So, this is a two-page form, there's only an excerpt of

it shown here, but all of that is contained within a two-page form. Next slide please.

So, section two from the administration checklist shown on the previous slide addresses IR suite setup. All new TheraSphere sites receive vendor training on appropriate contamination precautions.

So, drapes, absorbent pads are placed on the floor underneath the cart with the TheraSphere administration kit, and along the delivery path from the kit to the patient. Additional drapes are placed in areas where contamination might occur. Double gloves, and shoe covers are recommended for staff in the IR suite, and staff are monitored for contamination prior to exiting the treatment room.

After TheraSphere has been administered, and the catheter is being removed from the patient, a piece of gauze or a small towel is used to catch any drips or potential contamination. The catheter, gauze, and single use items are rolled up and placed into the Nalgene waste container. Next slide please.

Prior to administration, the tubing set is primed by flushing the saline to remove any air.

There is an overflow vial, which is sort of the darker colored vial in the very front, center picture. It's a translucent vial, but it looks a

little bit darker, that is the overflow vial. And that, and the tubing set area labeled A is put into place on the administration box after the tubing set is primed. Next, the middle injector assembly, which is shown with the green cap in the center photo, is connected to the dose vial.

And the remaining tubing set items labeled B, C, and D are placed in their labeled slots on the box. So, I mentioned that mock infusions are performed as a part of each new site's training, and this is the beginning of what that setup would look like. Next slide please.

So, the steps on this slide are also covered in the administration checklist, but I wanted to point them out here as they are important to optimize delivery and to help reduce the likelihood of a medical event. So, if the dose vial was inverted during shipment, the spheres can become lodged around the septum. Boston Scientific advises to lock the lead pot and then tap the bottom of the lead pot on a hard surface to dislodge any spheres. The vial should then be maintained upright until it's time for the administration.

There's also a pinch clamp in the system that's placed on the tubing set we have labeled C during

setup. And this clamp must be removed prior to administration. Instructions are provided on how to relieve the dent that's left by the clamp in the tubing to minimize the potential for air in the delivery line. And for the final item, the manufacturer recommends constant pressure, a constant flow rate of greater than, or equal to, 20 CCs per minute to ensure the microspheres do not remain in the system after delivery. Next slide please.

So a little more on that pressure. On the previous slide, I mentioned that a flow rate of 20 CCs per minute, or greater is recommended, however the pressure should not exceed 30 PSI. If the pressure exceeds 30 PSI, a visual indicator of a steady stream of saline will appear in that darker overflow vial, and it's just saline that's streaming through.

So, if a stream of saline is seen, the pressure should be reduced slightly if this occurs. You should only see a drip, or two, if anything. And that confirms that the appropriate pressure is being used to deliver TheraSphere. Once TheraSphere is administered, three additional flushes of 20 CCs of saline are recommended to clear the delivery system of any remaining spheres.

You saw in some of the recorded medical

events they directly addressed this saying that they followed the procedure to clear the system with those 60 CCs of saline. Next slide please.

So, once the saline flushes are complete the electronic dosimeter should be read to verify that no microspheres remain in the system, and this is also recorded in the administration checklist.

On the photo on the right, you can see where it's clipped sort of just on the outside of the plexiglass box, and near the A line that's going out, and between the vial, and it should be zero once the microspheres have cleared the system. Next slide please.

So, after the electronic dosimeter is confirmed to read zero, the microcatheter and tubing kit can be rolled with a towel and placed in the Nalgene waste container. The box can then be surveyed to confirm that there is no contamination within the system. Next slide please.

Here's the Nalgene container that was mentioned earlier, the waste container inside the beta shield. So, the Nalgene waste container is placed on a template and measurements are taken in four rotational positions. These measurements are averaged and background radiation is subtracted.

So, the same measurements are taken with the full dose inside the same setup prior to the procedure, so pre and post treatment measurements can be compared to determine the percentage of activity measured. And as I mentioned in the comments earlier, the vial would be removed from the lead pot for all of these measurements. Next slide please.

So, Boston Scientific provides a template written directive for sites to use. They pooled the required information about the patient, the treatment site, the radionuclide, the type of microsphere, and the prescribed activity. The measurements taken in the last slide are used to confirm that the percent of activity delivered is within 20 percent of the prescribed activity. If you look at the yellow highlighted cell on the bottom left-hand side of this slide, I don't know if it's legible, but it says dose vial A.

You can see the pre-treatment measurements are recorded. And then the post treatment measurements are recorded under waste jar vial A on the right side of the slide near the middle in the yellow highlighted areas. The activity administered is calculated and compared against the prescribed activity from the pre-treatment planning section of

the written directive.

This template also provides an area for the RSO and the authorized user to verify the calculation inside. And as part of Boston Scientific's quality management system, they have a robust process to track and trend customer reports. And those reports include those that meet the definition of a reportable medical event. And although the raw number of medical events recorded has changed from year to year, the incidence rate has averaged about 0.2 percent for the last two decades.

And there has been no significant change or increase from that average in the last several years. Boston Scientific is always looking for ways to support customers, and reduce the number of medical events, and we're open to feedback, and look forward to collaborating with the ACMUI to achieve this. I'm happy to take any questions if we have time. If not, I'll turn it back over to you, Dr. Metter.

CHAIR METTER: Thank you for your presentation. And I believe Mr. Einberg, did you guys have the next presentation, would that be more efficient?

MR. EINBERG: Yeah, I think that would be better, thank you. If Ashley's going to stick around.

MS. COCKERHAM: Yes, I'll be here.

CHAIR METTER: Thank you Ashley. Our next presenter will be on SIR-Spheres, Y-90 resin microspheres, Diana Thompson from Sirtex Medical. Ms. Thompson?

MS. THOMPSON: Hi, can you guys hear me okay?

CHAIR METTER: Yes, we can.

MS. THOMPSON: Excellent, thank you for having me. So, thank you for having me, as well as Sirtex as part of this conversation. We are thrilled to support the NRC, and the ACMUI, and our end users to ensure safe use of our product. So, with that, we were asked to present an overview similar to what Boston Scientific just presented, and we'll get started. Next slide please.

Over the presentation, we'll go through the preparation, and the delivery box setup, the delivery principle and infusions that we can look at from places where we can troubleshoot in regards to medical events. Potential abort points where procedure should be terminated, as well as post procedure information. Next slide please.

One of the things that I did want to highlight during this presentation was that our litany

of training resources, and our brand new account resource kit that we have just created. One of the things that we have that was in response to the new Y-90 guidance from the NRC, was an RSO training that includes radiation safety, regulatory issues, and emergency procedures.

We also in partnership with MIM, have developed post infra-imaging protocols that we provide to our sites, and checklists for dose preparation, dose delivery, and dose verification. As you can see on the table of contents, which also is very difficult to read, we have over 100 pages of resources, and references for our sites to use to ensure that all the steps of our approved instructions for use through the FDA have been complied with. Next slide please.

All my headings are gone. So, the second piece is that we also have a training, education, and certification program whereby we use our field staff, as well as certified physician proctors to support our physicians in patient selection, and in ensuring appropriate adherence to our procedures, and checklists as well, and awareness of those procedures, and checklists. No site is left unsupported until appropriate evaluation by those physician proctors, as well as our field staff has been signed off. Next

slide please.

So, going through the preparation of the dose, which is a little bit different than the other product, is that we do handle our doses in nuclear medicine. Next slide.

The first step is to unpack our shipping vial. Which is a vial that's about 10 mL, a glass vial that is used in the dose calibrator, as well as the vial that will go into the IR suite, which is the V-Vial. The V-Vial is shielded by an acrylic shield. That acrylic shield is exactly thick enough to stop all the beta radiation and convert it into bremsstrahlung prior to that administration.

This is the vial that we are now measuring prior to the administration to get that exposure rate. So that's why we like to talk about that exposure rate prior to administration, because it's shielded, and we're looking for X-ray radiation. With that lead pot, once you've unpacked the lead pot, and you're prepared for your dose draw inside of your nuclear medicine hot lab, you're going to shake up that vial inside of the lead pot. Please leave it in the lead pot at all times. And we'll go to the next slide.

And then it is removed with long handling tools to put it into the dose calibrator. We set our

dose calibrators against the glass 10 mL vial in terms of the calibration. This vial is indented and we will take the dose draw from this vial. Next slide please.

This syringe shield is provided by Sirtex. It is made of acrylic, so it should not be sterilized using alcohol, but instead should be sterilized using bleach, and we do provide a lubricated 21-gauge needle that's at least 50 millimeters in length. This length is important in order to get to the bottom of the vial. Once the shielded syringe is inserted into the shipping vial, you'll also draw back, and forth on the plunger of that syringe about four times to ensure a homogenous distribution, or suspension of those microspheres.

That homogenous distribution is well seen by the eye of a trained dose drawing nuclear medicine tech, or radiopharmacist, and you can see that it's homogenous. Once you see that it's homogenous, and you think that you've gotten the right volume, as calculated per our checklist, you will withdraw that syringe and the needle, ensuring that there is no contamination during that removal of that needle.

You will cap the needle, and then you're going to measure that shipping vial again to do a subtraction. This is critical for the calibration of the dose calibrator, because we've calibrated the

geometry of a ten mL glass vial. But also, we would see if there were any issues in terms of the homogeneity of the suspension at this time.

So, our calculations assume a homogeneous distribution, and if you do not have a homogeneous distribution, you'll see that you've left activity in the sipping vial, and then you'll have to redo that dose draw. Once the correct activity has been obtained -- please go to the next step. We are injecting that activity directly into the V-Vial. And this is only done once.

The activity being injected into the V-Vial, it's very important at this point that the nuclear medicine technologist does have these marks on the crimp, where you'll see at noon, and at 6:00 o'clock, you'll see these marks, as well as around the three mL on the side, and this just shows the nuclear medicine technologist where they are inserting their needles and ensures communication up to the IR physician so that he does not puncture in the same location.

The liquid is then infused up to the 3 mL, so we're going to add some D5W if we need to, in order to bring it up to full volume, because that remaining volume of air is kind of like an air spring, that you'll

see is important throughout the delivery in terms of ensuring the appropriate pressures. Again, we talked about pressures in TheraSpheres, we also want to ensure that we have appropriate pressure during our delivery. Next slide please.

So, once the dose is ready to go, we put the black plug on, and we'll do those pre-measurements. So, those pre-measurements will be done at the same distance using that same lucite shield prior to administration. The lucite shield, in terms of the physics, I don't think is that important in the pre-measurement, but it is incredibly critical, as Dr. Mishra noted, for the post-measurement.

Because it is converting all of the betas that are in the catheter, and in the delivery set into bremsstrahlung that we can have as close to a one-to-one ratio as possible for that post administration measurement. So, now that the nuclear medicine is ready to go, please go to the next slide, and we'll start with the delivery box setup. Thank you.

So, now looking at the delivery box, this is the original delivery box, and we'll call it a box for obvious reasons. And it comes with the delivery set on the bottom, it has the two needles. The C is for center, and the D for deep, and we'll also talk

about a B for bypass, and a D for dose. So, they're labeled A, B, C, D, but I do like to say the full word, just because B, and D sound very similar when we're not side by side watching each other's faces.

So, this is the system, you'll notice it has a lot of acrylic. Most all of our acrylic is measured to be at least a centimeter thick for the reason of stopping the maximum energy beta, and ensuring that we're only looking at bremsstrahlung outside of our device. And low energy, low exposure rate bremsstrahlung at that. Next slide please.

So, as I was alluding to with the delivery set having the two needles, the C, and the D line needle, these are the needles that the IR physician is going to be inserting into that V-Vial septum in order to deliver the dose. There are one-way valves fitted on the D for dose, as well as you see here, going into the three-way stopcock where the hot fluid is flowing into the patient, or towards the patient. So, that no radioactive fluid can flow backwards towards the user, this is for safety of course. Next slide please.

So, once the delivery set has been primed with D5W in our case, you will affix the three-way stopcock that now controls whether you're going through the bypass syringe, or the dose syringe into the

bracket, and you put them through the labeled holes. They are both color coordinated, as well as labeled, so that it's obvious which hole each one goes into. Next slide please.

The one thing that is different, and critical for our product is that bypass line. So, that bypass line, or the B line is what has contrast fluid on it. And contrast fluid is used by the interventional radiologist to ensure a forward flow.

So, the way that people talk about it is like a sandwich method, right? So you put in a little bit of radiation, and you put in a little bit of contrast, and you kind of alternate between the two. And our administration is done at a much slower rate, of about five mL per minute, and this is as well as an outlet of about two to five mL depending on how much forward flow you have, and that's based on what the physician is feeling for his particular patient, as well as the pathology of their disease.

So, when you're applying the contrast on the B line, you can verify the catheter placement to ensure that it's going to the correct lobe, and we talked about that earlier. You can also ensure you're still having forward flow, you're not having retrograde flow, so it's not flowing outside of the liver, or to

other organs. And also that if there is stasis or there is vascular spasm.

We call that stasis, and we stop the treatment and reevaluate whether we need to have a second treatment, or if a different treatment is more appropriate for this patient. So, that, or if therapeutic intent has been met. So, that bypass syringe is really important for evaluation of the case before, during, and after, and the end of the administration. Next slide please.

I actually really like this slide, because here you can see where those punctures are and how those needles work out. So, you see the mark at the noon, and the 6:00 o'clock, I guess these are 3:00, and 9:00 o'clock, just depends on how you turn it, reference frame, right? And then you can see the physician is puncturing near the center of the septum.

Whereas the nuclear medicine physician is puncturing near the outside. And you want to make sure that they're at least two millimeters apart and this is just to ensure that that pressure is maintained. And the next slide kind of illustrates that.

So, in this slide, you can see that as you're pushing in the D5W through the dose line, or the D line, the one that's deep, right?

I have a four-year-old, I like to do these beginning sounds. So, we're going into the water for deep -- the D5W for deep, and we're going down in, and it's going to store up these microspheres. The microspheres get into a homogenous-ish distribution, and here's where we're looking at the C for center. C for sampling if I may stretch it a little bit too far there, needle in the top.

Where it's kind of taking a little bit of those microspheres off the top. And so, one of the things that you'll see is that if that needle is too deep, you're going to get a thicker slurry, and you're going to get those clogs, right? And I don't think that we saw any of those happen in any of the reported medical events, but there was one that had a significant amount of spheres, the three point something GBq administration.

And they said that they struggled to get in all the microspheres, and I could see that happening in this situation here, so they would have to be very careful, to ensure that it doesn't clog that needle, the C line needle. So, you can see that in the whole time, we're maintaining that air pocket at the top, right? So, you kind of press on that D syringe, you see it pulse in, and it'll come back down as the fluid

is going towards the patient.

Once we don't see that fluid moving forward, or that spring bounce back, that's when we know that we're building up pressure somewhere in the system, and we need to look at those abort points. Next slide please.

So, here's where we're talking about again, so repeat the procedure until the full delivery is achieved, slowly integrate flow, or there's stasis. You're not seeing forward flow anymore on that bypass, or B syringe, that's the end of your treatment, right? You hit stasis, you administered however many GBq that you're going to get in, and we're going to evaluate if we have a therapeutic intent met there. Next slide please.

And these are the abort points that I noted, so you can see that meniscus. Once it starts rising, that means that either you're losing that pressure through the septum, which could be a leak, or it could be a buildup of pressure somewhere down the line, right? You're not getting fluid forward, you have a clog, you have a loss in the septum, so there's something wrong with the system once you start seeing that septum going wrong.

Another potential important point, which

I want to state, but should be obvious, is the large contamination in the hot lab. If you spill the dose, don't just stop, and we'll try again. Get a new dose, clean up, let's do this right. Next slide please.

In this one we're seeing also leaks. So, if you're seeing leaks as you see on the top of the septum, at any of the connections, at the three-way connection, or even on the outside of the box from the A line to the catheter.

So, that's another thing that's really beneficial, is once we attach our delivery set to the catheter, always administer through the B line syringe, or the bypass syringe first to, with cold material, not radioactive material, to ensure that that connection is good and that you're getting good flow forward. Once we know that our catheter is in the right place, you're getting a good flow, you're not leaking anywhere, that's when we're going to start administering that radioactive material to avoid any contamination of that. Next slide please.

And then after the procedure has been completed, one of the things that the NRC has highlighted in the new Y-90 guidance was the importance of the post procedure survey. So, in the NUREG 1556, Volume 13, in Appendix R, I think, if you do get

radioactive material on the floor, you can survey, if it's below a certain amount, like when we're doing a bone scan, or like the MAA scans.

But in Y-90, we are using the radioactive material in an unrestricted area, and so we want to document those surveys immediately after and ensure that nobody leaving the IR suite is contaminated. We don't dedicate these IR suites to radioactive materials used, we use the one that's there. And so, it's very important that we do these surveys, and we document them.

So, we're checking all the personnel as they leave, we're checking the tables, we're checking the waste to ensure that every atom is accounted for, right? Cradle to grave. And then the next slide please.

This is actually a really nice graphic that we included, also in a new account resource kit that I really liked, because I do like to reinforce the safety of the radiation outside the patient once they're administered this radioactive material.

These patients can go home immediately, and as you can see, being one meter from the patient will get you less radiation than flying in an airplane for an hour. I think that it's really important that

we as a community work towards debunking the radiation fear myth to ensure that patients get the treatment that they need. Because you can get good results with less side effects, hopefully.

And especially as our technology gets better, and better. So, with that I'll close, and open for questions at the end of the session, thank you.

CHAIR METTER: Thank you very much, Diana, for your very nice presentation. Our third presentation will be by ACMUI's Dr. John Angle, and he's from the University of Virginia, to talk about checklists, other events, and radiation. Dr. Angle, thank you again, and welcome to the committee.

DR. ANGLE: Thank you very much for having me. So, just a bit of background, I'm an interventional radiologist at University of Virginia, authorized user for our Y-90 program. Next slide please.

I want to highlight the collaborators really helped us develop our checklist program over 15 years ago. Our radiation physicists Dr. Mulder, and Dr. Polemi. And our radiation oncologists, Dr. Read, and Dr. Janowski really were instrumental in solidifying our checklist process. Next slide.

As we've really talked about a fair amount

today, this used to be a stubborn floor to a number of reportable events around Y-90 administration. And although the number is not large, as the number of procedures goes up, like a lot of things in medicine, we have to decide is a percentage we're trying to fix, or is it the absolute number?

And I think we all, hopefully we're after this absolute number. We made these things seem like we can address them now, certainly it's been our approach as we built these checklists, to try to stamp out any of these adverse, or preventable events. Next slide please.

I keep a common unexpected event list. I think about this all the time when I'm doing procedures, and when we have our meetings to update our checklists. We think about new ones we've learned along the way. We'll talk about many of these today, an excellent presentation we had about incomplete delivery of the prescribed dose, which may be device, or technique related. Delivering a larger dose than planned, or desired, administration to the wrong lobe, or segment, treatment does not adequately treat all the feeding arteries, which can be an error in planning, or in delivery.

The administration of Y-90 into the

gastrointestinal tract other extra-padded dose, which can be again related to planning, or delivery errors. Arterial-venous shunting without injury, arterial-portal shunting with liver, GI, or lung injury, wrong patient, exposed splashes, or improper disposal, and unexpected exposure to fetus, family, caregivers, Y-90 care givers.

And even we fretted on occasion about pathologists, because they're doing autopsy. Many of these overlap, one type can of course cause other ones to occur as well. Next slide please.

As you're probably all aware, medicine suffers from a hierarchy where physician decisions are often not questioned, and this opens us up to occasional preventable medical errors. We try very hard in the administration of the spheres to use a team approach and encourage everyone to speak up about anything they're concerned about. And obviously we want to make sure they don't fear any repercussions ever, for doing that. We want to inspire a chain of command that responds to that reporting, even in real time, in the middle of a procedure.

Or, after a procedure, about something we can change in our process to increase safety. We want to make sure those events lead to durable change, and

we've been doing this again, for over 15 years, so we're really starting to see how some things you think of fit into your process with new hires and changing of the guard start to fade away. So, you have to be very diligent about maintaining your process.

And as we've found along the way, institutions are relatively isolated in implementing their safety measures. And so, making that a process that is going to predict those errors that you've not encountered yet is difficult, and it's a very incomplete pathway of information. Next slide please.

So, our process follows what's in the literature about common methods for reducing medical errors. Of course, team approach is number one, and that team must take opportunities to identify steps in the process that are high risk, or prone to error. They must review all events, and that can be internal, or external, and have some analysis to process, and improve the process based on those events. We have to develop actions, and outcome measures.

This includes things such as time outs, checklists, and data collection with minimal analysis, communication, and process dates. Next slide please.

Our institution, like I think at most major academic centers, we identify potential patients for

the number two above. This is a noted specialty of peer review process to determine that Y-90 makes the most sense for a patient.

When that patient comes for their Y-90 planning, their MAA study, and any embolization of branches that may lead to the gastrointestinal tract. Then after that planning, the radiation oncologist, and interventional radiologist discuss the anatomy, and plan the treatment, dose, lobes, and how the administration is going to happen. Again, using a team approach to keep as many eyes on the subject as possible. Next slide please.

One of our interventional radiologists initiates the actual dose planning with this form here. We define the tumor vascularity, the measurements which are stored on our picture archiving system, so a radiation oncologist can review. The area that's going to be treated is actually highlighted on the transaxial, we define which segments are going to be treated, in what order they're going to be done.

We suggest a target dose, which is then critiqued by the radiation oncologist, and then of course we make a choice about vendor based on a lot of factors, including the number of particles. And then our radiation physicists, along with the radiation

oncologists will finalize the plan, and submit a purchase order. Next slide please.

We felt very fortunate to start this process early in Y-90. Again, to the foresight of Dr. Mulder, as much as anybody. And of course, since that time, it's truly become a medical necessity. Dr. Atul Gawande's work of course was pretty earth shaking, and importance of checklists. It's important to have pause points at which the checklist is supposed to be used, and what does that mean? They are DO-CONFIRM checklist analysis, or usage, and then there's the READ-DO checklist.

And I'd say we started out with the READ-DO format, where every step is confirmed, and read back, and checked off on a list. As time went on, we went to more of a DO-CONFIRM, where the operators could quickly go through tasks that have no risk, and then would control most of those with the radiation physicist, and the RSO in the room. So, we start with READ-DO, and involved into sort of a hybrid DO-CONFIRM steps that are relatively low risk in between. Next slide please.

Different members of team have different checklists that they are going to work with. And before a procedure, the radiation safety office sends

personnel to the area where we're going to be working, and which of our radiologic technologists -- because there's so many things beyond the administration system that impact the success of the procedure.

And so, our technologists are making sure that our fluoroscopic equipment is going to deliver the images that you need, that we have the reference images in the room, we're using microcatheters that are going to be appropriate for the administration, et cetera. And so, all these checklists occur at various stages in the planning process in the time we sign the planning form. Next slide please.

Before we leave the room, a radiation physicist is going down a checklist of all the things we have to have in that room before we start. I think this has become very routine now, but we still go through this every time so there are no shortcuts due to something missing in the room, and this has been updated over the years as supplies change, and as our insight from internal, or external events suspects potential pitfalls. Next slide please.

Many of these now, in preparing the injection for administration, and I'm just showing you the one for TheraSphere one, but we have one for SIR-Spheres as well. We have come to match the ones

I think that the vendors now supply. There's an overlap, where we learned from theirs, and incorporating it into our existing, to make sure no steps are shortcutted, and of course the hope is preventing any adverse events. Next slide please.

Inter-procedurally, this is most challenging for our radiation physicists, and our RSO, because physicians are removed, there are various slots, and times, a lot of confidence in the room, but everyone's a good sport, and we do this, and it makes a big difference, I think. It's the best we can do to prevent adverse events. So, we go down this checklist one step at a time, read through this checklist so that all boxes have been followed.

They can check their own files if they do need to go back and review a case. Next slide please.

And it is quite detailed, highlighted ones are recent editions where adverse events, these again, are internal, or external, highlighted areas. So, as the list changes, people can keep abreast of what's new, or changed in prior administrations. Thank you. After the procedure of course, we have to close out the procedure seriously.

And make sure that the materials are safely removed from the room, and there's no contamination,

which has again, become very standard process. Over the years we've found a system that works very well for us. Next.

An area that I'd say we need to grow into is trouble shooting. It's invariable that something is not going to go right, and it's really still mostly up to operator experience, and collective thought in the moment how to manage this.

I think there's a lot of opportunity for us to make more extensive troubleshooting pages, and checklists so that if you do have something unexpected, that you have basically a template, an algorithm to go through, and help you deal with that. So, this is a work in progress for us, and a few, as I show an example here, where you've got excessive resistance injecting the microspheres, and I guess a few points you can check on the system.

Which again, industry has been incredibly collaborative, and helpful in helping us build these out, their experience has been excellent in this. Next slide.

So, our current list of problems that led to our checklist is rough. Our personal experience, the NRC notifications, which come out in real world time, and communications we get at medical meetings.

I think it would be good if we had a process of commonly encountered problems that we could share. Everyone I know has some checklists at their institution, but I have to say, I certainly don't have much awareness of what's going on at other medical centers, and I doubt they do at ours. I think these checklists are made available to the standardized care at a national level as we manage some of these known problems. Next, the last I think.

So, summary, most important tool to preventing adverse effects is having a defined team with established communication channels, and no hierarchy. Checklists seem ideally suited to Y-90 planning, and administration. And I think there's a great opportunity for standardization of these checklists across institutions. Maintaining compliance of these checklists presents a challenge.

I will admit this, keeping them updated, and current is also going to be an ongoing work in progress. Thanks very much.

CHAIR METTER: Thank you Dr. Angle, for a very nice presentation, and I appreciate your many years of experience in this therapy. Now, for the last two presentations, and I believe they are supposed to be helping us with the public?

MS. LOPAS: Yeah, that's right Dr. Metter, so is the plan to take some questions, and comments right now, and then go to public.

CHAIR METTER: I want to go ahead and open it to ACMUI first. Any questions from the ACMUI on any of these three presentations?

MEMBER JADVAR: This is Dr. Jadvar. So, thank you all three of you for these wonderful presentations. I certainly learned a lot. Dr. Angle, you mentioned about standardization across institutions, I thought that is the case. You're saying it's not the case that what is provided by the companies is not similar across institutions? And if it is not, how do you suppose, or maybe all three speakers can pitch in, how are we supposed to do that in standardization?

DR. ANGLE: Yeah, no, I think that industry has provided incredible standardization of the process. I think that most of the gross potential is going to be in physician directed parts of this that I think industry really has not had much of a say in up to now. And that really is information that's shared mostly through medical meetings. So, I think that a lot of the actual steps in the process, industry provides a very complete set now.

I can't tell you how our workflow compares to what other institutions are doing, but I do know that everyone starts with a wonderful similar foundation provided by these two companies.

MS. THOMPSON: Hi, it's Diana from Sirtex. I would say that I appreciate your comments Dr. Angle, and we do provide the standardized templates, and we do have the approved instructions for use, but each facility is different, where they do the handoff, how they do the handoff, and what teams are involved. So, I will say that there is some -- I guess personalization to those procedures.

And we do always defer to the site RSO for their expertise of their procedure and what equipment they have available to customize those procedures as needed.

MEMBER OUHIB: Hi, this is Zoubir. I have some questions, and comments for all three speakers. Thank you first of all for great presentations. My first question is for the first two presenters. When you do the training, obviously you go through the process from A to Z to actually perform the procedures. I'm just curious whether you have incorporated or thought about sort of include situations where there might be some trouble.

In other words, cause troubles, and see if the user can identify where the problem is, and how do you actually correct it? The unfortunate thing is they're learning by doing on the patient sometimes. So, if you actually say okay, here's what we're going to do, we're going to undo this, or we're going to loosen up this, watch what's going to happen basically.

And people learn from visual, seeing things happening in front of their eyes basically, and they remember that. The other question that I have is for Dr. Angle. More effort in troubleshooting, and that goes back to the same thing, is that troubleshooting by witnessing trouble, perhaps, or creating trouble, and then we learn from it. And then maybe compliance with checklists.

I think that can be improved by incorporating or including accountability. And what I mean about that, I was looking at your checklist, there's a checkmark, but there is no sort of initials, who actually performed that? Who did that? And I think most people have to put their initials, or their name next to a task, they become more focused, because what am I signing here? What am I checking here? Versus check, check, check. So, those are my comments, and thank you.

MS. LOPAS: Dr. Metter, we have Melissa Martin, and Dr. Ennis, who are waiting to speak, so we'll go to maybe Melissa Martin first.

MEMBER MARTIN: Thank you. My question concerns the dosimetry that seems rather simplified in the approach that's being done. I'm one of the people, the physicists that's involved in planning an entire AAPM summer school on doing dosimetry for these diagnostic isotopes. And I'm trying to just correlate what I see on these papers as basically check a box, and this is going to -- if you check a volume, this tells you how much to inject.

And this tells you what dose you're going to get. Versus planning a summer school, where we're going to have hopefully very intelligent physicists sitting there for four to five days learning how to do dosimetry. I'm wondering how this happens, because somewhere there's no correlation here. Who decides the dosimetry factors? In other words, how did you simplify it?

What kind of assumptions are you making to perform these quote dose estimates that are involved in these sorted checklists?

DR. ANGLE: Ashley, want to talk about your approach -- I could certainly talk about it from

a physician standpoint.

MS. COCKERHAM: Sure. I was going to say dosimetry is something that has been discussed with the ACMUI for as long as I can remember, and I think for Y-90 it has been the standard based on the technology that's available, and there have been lots of discussions about how post implant dosimetry can come into play to really make this more robust. I can say from a practical standpoint, not all facilities are setup to do that type of post implant dosimetry.

And so, it's never become a regulatory requirement. I can also say, and I know NRC is not involved in this, but it does absolutely affect medical practice. Post implant dosimetry is not reimbursed by Medicare. And so it's very difficult to urge physicians to move in a direction towards personalized post implant dosimetry when there's -- it's difficult to move in that direction.

But I will say that dosimetry software has been developed, and studies are being done to move in that direction. But I would not say that is the standard of care, or something that is available, or realistic for all Y-90 facilities at this time. That's sort of been the conversation of ACMUI for as long as I've been involved in this.

MEMBER MARTIN: Well, my follow up question would be maybe to Dr. Angle then. Is the physician community comfortable with the approach that's currently being taken for dose estimations?

DR. ANGLE: I think there's a lot of opportunity here, and a lot of clinical lead here, no question. But I think the technology frankly has been lacking a little bit. We have a couple different modeling mechanisms, and everyone is very aware of their shortcomings, and has their ways of sort of adapting. If we see a vascular tumor, you're going to change your dose.

If you see a hyper vascular tumor, you might change to a different dose. And so, what you don't have is a way to really accurately model how much dose is going to tumor, how much is going to background liver, and that's -- I know a key interest to a lot of researchers right now. But for right now, it is very dependent on operator experience I would say.

MEMBER MARTIN: I think those are very valid comments, I agree with you.

CHAIR METTER: Thank you Dr. Angle, and Ashley. I still see a question from Dr. Ennis. Dr. Ennis?

MEMBER ENNIS: Hi, good afternoon

everyone, or good morning if you're on the west coast I guess. And thanks for those presentations. For the vendors, a question, comment, great presentations, and clearly both vendors have done a great job of developing a system that works well in supporting users. But I guess I would say now, I would challenge them, and maybe Dr. Metter, we want to invite them to come back in a few months.

To come up with solutions to improve and be able to drive down the number of medical events. Because as we've talked about, it's definitely low, but present, and the themes are recurrent. It's the same issues as Mr. Ouhib mentioned before, it's the same ones every single time. So, let's put brains together, and figure out how we can maybe redesign things.

Maybe it's just an implementation science issue, maybe it's educational issues, but the systems are very, very good, but we have a problem that I think if we put some thought into maybe there could be some redesigns, or other tools to improve them. For Dr. Angle, excuse me, great to meet you, and hopefully in person soon, that was great.

And I loved a lot of your comments, and dovetailing with what Mr. Ouhib had said before, what

you kind of alluded to, and it's my experience as well, a lot of times, even in medical meetings, we might talk about doing the same procedure. But what we're really doing isn't quite the same, and we don't really know that.

And might there be a way that we, as ACMUI can move towards a more national kind of shared quality procedures, checklists, or other standardizations. That we say this is what ACMUI recommends, or this is what Dr. Angle recommends, use it as you want, tweak it as you want, but at least a more national approach based on what's going on across the entire country, might be a good step forward. Just curious what your thoughts.

DR. ANGLE: Well, I agree, I think there's potential for that, and I wouldn't hazard to try, and guess what format that should be in, but I do think operators everywhere would be very receptive to the concept and that's of course the first step to implementing something like this.

MS. LOPAS: I think Dr. Tapp wanted to speak up for a minute.

DR. TAPP: Yeah, this is Dr. Tapp with the NRC. Dr. Ennis, I just wanted to let you know that both manufacturers have agreed to meet with the

subcommittee, and help us, the subcommittee, on yttrium-90 microsphere medical events and hopefully we are working that to look at recommendations to potentially lower medical events. So, there is still ongoing work happening and hopefully we'll be able to present -- that subcommittee is ready to present in the fall. So, just wanted to let everyone know that that work is ongoing.

CHAIR METTER: Thank you Dr. Tapp and thank you to the NRC staff for the comments, they help, it's huge to help with that. I do see a question from Megan Shober.

MEMBER SHOBER: Yes. I don't know if this is a question, so much as some anecdotal observations. But my experience as an inspector, and as a license reviewer over the past several years, we've seen a lot of increase in the number of sites that are authorized for Y-90 microsphere administrations. And they're really pushing down into the some of the smaller hospitals.

And so, to Dr. Angle's point about a dedicated team, and clear communication, and all this, the medical events that we're having in my state are not happening at the major academic medical centers. They're happening at the slightly smaller, the next

tier of hospitals that are -- some of them are just getting launched with the microsphere program, some of them have been around for a while.

But in terms of their caseloads, they're not doing as many as those major medical centers, and so they don't have the luxury of having -- or they don't all have the luxury of having a dedicated team, and that practice that comes with doing things over, and over, and over again. One question that I do have, I guess for Ashley, we've seen a pretty surprising number of TheraSphere overdoses.

And so, I guess my question is just in terms of both the ordering, we've had a lot of ordering issues, is that something that TheraSphere is looking at? We saw it in the medical event summary this morning as well, with treatments were not administered on the day that the doses were -- when they were supposed to be. And for Y-90, with its half-life, that's a huge deal.

So, I guess I'm just wondering if there are any ideas that are coming out from Boston Scientific specific to the TheraSphere ordering process.

MS. COCKERHAM: Yes, so I actually, this addresses that, and sort of a discussion that happened earlier about grouping these, and analyzing, if we just

take a quick look during the break, I crunched some numbers on the medical events from 2021 to sort of put them into five categories. And only two of the medical events were actually attributable to sort of ordering, or using the wrong dose, at the wrong time.

So, I would say it's actually a very small percentage of what we're seeing nationally. Within those groups, I sort of have five categories that was, the majority of them were clumps, clogs, kinks, blockages, and activity left in the tubing. A couple of those were specifically due to a catheter that was too small. So, that was just over 60 percent that I could calculate.

And then the next large group was failure to follow manufacturer procedures, which was not administering during the originally scheduled time based on the order, incorrect dose calibration, not removing the pinch clamp, and then not using the vertical connection, not ensuring that it's a vertical connection with the catheter. And so, that was about 20 percent, there was another about 20 percent that were related to leaks.

And then a smaller percentage, closer to ten percent, were attributed to patient vasculature, and then we sort of had three of the random ones that

were about the wrong location due to catheter movement, one was unknown, and then the vials were interchanged. So, I don't know if that helps give the committee sort of an overview of the groupings of what we're seeing just from last year's data.

But we do continue to evaluate that on a regular basis. It's not just an annual review for Boston Scientific, it's a continuous review. And when they do something, they don't hesitate to issue a product advisory, or get information out to the customers. So, I don't know if that helps, I had one more thing. I think Dr. Ennis had mentioned, if we could make a quick change to the kit.

Or tweak some little thing here, and there, and I wanted to give a little bit of perspective on that for more of the NRC, and FDA side, that for a manufacturer, for them to make that change is going to require clearance again, by the FDA, and actually this is a pre-market approval, so it's going to be a full PMA approval. And then on the NRC side, the sealed source and device registration would have to be updated.

So, that would be no small feat to make changes to the administration kits. So, I just wanted to put that out there for some context.

CHAIR METTER: Thank you Ashley. You had another comment Dr. Angle?

DR. ANGLE: Yeah, it's a great question, a comment, I guess I would remind everybody that this checklist sort of approach to things is a constant work in progress. I mean just sitting here today I've learned that could happen at UVA. That you would somehow change the date, somehow, and you would end up having an overdose. Which has never happened, but I'm going to get a team together, and we look at our process, and see how we can make sure it never does happen.

So, it's going to take a lot of people over a distributed network to identify these things. And I think the information shared today is very helpful for doing that.

CHAIR METTER: Thank you. I see a question from Mr. Zoubir.

MEMBER OUHIB: Yes, this is for the two vendors, Ashley and Diana. Do you feel like some sort of an annual review, sort of like an overall review with your accounts at all, and going over the procedure itself as just a fresh, and observe how they actually do it, and all that? I'm just curious.

MS. COCKERHAM: So, for the TheraSphere

side, typically the TheraSphere representatives, the sales representatives who are responsible for the kit setup, and sort of overall management for the account, they would be present for the procedures. Now, they aren't always, but I do know that Boston Scientific has placed an emphasis on this and has hired basically a second set of representatives to ensure that clinical cases can be covered.

So, that is the expectation, is that someone's there, and that there is that ongoing support. But I think to your point, you kind of do all of the initial training up front, and then the question is what is the follow up, what is the follow through where you come back with the lessons learned? And so maybe that's something I can take back with our training team.

And discuss rolling that out with the TheraSphere consultants who are in the field to say hey, maybe this is a good touch point, or a good reminder as we analyze, and see these types of events.

MEMBER OUHIB: And Diana same question.

MS. THOMPSON: Absolutely. So, on the Sirtex side, we also have, as Ashley mentioned, we have the field support that includes the clinical support through the medical science liaison as well as the field

support through the sales staff, and representative who kind of manage the accounts. And we do have them present at as many of the clinical procedures as possible.

And we have hired that second set as well, to ensure that coverage. I will say also, that we do monitor how many doses each account is ordering through our TEC process to ensure a little bit of that proficiency through that program as well. So, we do have some eyes on it, but there's nothing per se, like today on January 5th, we're going to do an annual review of that account.

Though, we do have our annual reviews, per our licensing, and approvals that we have to do on our side to ensure that we have appropriate communication when it's necessary.

MEMBER OUHIB: Right, what I was referring to is more of like a session where you go over the procedure. Not necessarily having a patient but going over the procedures. And let me just add, have a copy of the outstanding presentation that was done earlier on medical events and share that with them at that time on an annual basis, and say here's what's going on.

And a discussion can take place, and somebody might say my gosh, we almost had that problem,

I'm so glad you brought up this, and so on, and so forth. Just a thought.

MS. COCKERHAM: Yeah, and I can say from the TheraSphere side we've actually already taken that on. I've had two meetings in the last couple of weeks just since these handouts were released to sort of start analyzing them and sharing it with the executive teams so that it can be rolled out to the field sales team with the idea of them being able to share lessons learned, and best practices in the field on not just the initial basis.

But more of an ongoing basis. So, I think that's a really great suggestion that we'll take into consideration.

CHAIR METTER: Thank you for your comments and particularly questions. Any other questions from the ACMUI members? Any questions from the NRC staff? Okay, hearing none, Ms. Lopas, do we have any questions from the public?

MS. LOPAS: Yeah, so I do see one person who has their hand raised. That's Dr. Donna-Beth Howe. Dr. Donna-Beth, you want to unmute yourself?

DR. HOWE: Okay. My question is to Dr. Angle, and that is that every year, when we do the medical event reporting, we publish the slides on the

NRC medical toolkit. And so, we haven't been doing this from the very beginning, but we have been doing it for a number of years. Are you aware that those slides are up there, and do you provide the kind of information that Daniel DiMarco provided today?

So, that you can look at that at any time, and help you develop however you want to apply it to your practice?

DR. ANGLE: Well, I'm embarrassed to say, even though I'm a member of this committee now, that I just heard about this today. But I'm very, very glad to know about it. We do get our radiation safety officers -- get the reports, since they come out sort of piecemeal throughout the year. So, we have had access to the information, but I think getting a once a year overview like that is a fantastic tool.

DR. HOWE: Yeah, and that means you don't have to wait for NRC to put out a specific publication.

DR. ANGLE: Yeah.

DR. HOWE: Thank you.

MS. LOPAS: Okay, and the next commenter we have is Vivek Mishra, Vivek go ahead, and unmute yourself.

MR. MISHRA: Hi, thank you again for letting me speak. So, earlier we discussed my views

on the geometry, and the ion chamber detector, and the limitations those impose. And thank you all for commenting on my views. Again, I'm bringing in a perspective from a physicist point of view, who has done these procedures in the last ten plus years.

So, the other point I would bring to this committee is that if we plot the number of medical events as a function of the dose prescribed, I have a feeling you're going to be seeing a lot of events that occur at the lower end, where the prescribed dose is very low. So, in those cases, if prescribed dose is 7, 10, 15 millicuries, that the residual number that you measure is going to be very large compared to the percentage of the initial readings.

Perhaps we can spend some time in understanding this issue and coming up with a consensus if there ought to be a lower threshold, below which those should not be prescribed, because it leads to large relative errors. Again, this is from my perspective, and the idea is that we need to all work together, so we can have events a lot lower in number. Thank you very much.

MS. LOPAS: Sorry, go ahead Dr. Angle.

DR. ANGLE: No, I guess I could just comment on, I think it's a very good question, and I

think it's certainly worthy of discussion. The higher the dose procedures, the more particles you put in, we seem to see that's where more underdosing happens because of plugging. So, there's a lot of factors at play here I guess, but it's certainly worth talking about all of the thresholds for underdose reporting.

MS. THOMPSON: So, hi, this is Diana Thompson from Sirtex. And I think, Vivek, I appreciate your comment, but coming at it also from a physicist perspective, I would say that we need to work to do better on our precision measurement rather than control the medicine that needs to be delivered to patients. If a 7, or 10, or 15 millicurie dose is clinically appropriate, and indicated, then we need to look at the risk that is being mitigated by the medical event reporting.

Maybe we need to look at a different threshold, like look at a dose threshold in terms of that, or maybe we need to look at doing measurements on the gamma camera, instead of using the exposure rate measurements. It was published in the journal of I think Cardiovascular and Interventional Radiology in 2020 by an author, Evers, that he used again, the camera to meet residual rather than using exposure rate.

While we want to save this for patient use,

I would rather measure residual on off hours, rather than prevent the patient from getting a ten millicurie dose because it's going to give me a medical event. Because those patients should be treated if it's clinically indicated.

MS. LOPAS: All right, Dr. Metter, I'm not seeing -- Zoubir has his hand raised, Zoubir do you want to make the last comment? And then I think we need to move on to the core presentation.

MEMBER OUHIB: Thank you, real quick. I think Vivek brings up a very good point, and I sort of agree with him, that I think that's infringing on the practice of medicine, not a regulatory item here. And maybe, just maybe on the regulatory side, should we have two different tables? Like if you're dealing at a certain dose, here's what is considered medical event.

And if you're dealing with a lower dose, then maybe it's more forgiving, or whatever. But I think that would be very difficult to accomplish. Good point though.

CHAIR METTER: Thank you Zoubir, for your comments. One further comment from Diana Thompson, and then we need to move on.

MS. THOMPSON: Sure. I just wanted to

echo the last comment. I think you do accomplish that with the medical event criteria for other products, where there is a dose threshold, whereas for TheraSpheres and SIR-Spheres there is no dose threshold, it's a 20 percent limit. So, as we look for getting better dosimetry, as indicated by the AAPM representative, that may be possible that we have a dose threshold for that medical event criteria and can do lower doses.

CHAIR METTER: Thank you for that comment. Okay, the next item on our agenda, are the two on the CORAR comments on the NIST Radioisotope Measurement Assurance Program for Mr. Guastella.

MR. GUASTELLA: Very good, well said, thank you Dr. Metter.

CHAIR METTER: You're welcome, thank you for coming.

MR. GUASTELLA: It's a pleasure to be here, thanks everybody, and maybe keeping with this theme, or one of the themes today of the accurate measurement of radioactivity, certainly in the healthcare setting. I just have a few slides here; I should be able to get us back on track from a schedule perspective. So, yes, I'm Michael Guastella. Next slide please. Can you hear me?

MS. LOPAS: I can, did it move forward for you, or no?

MR. GUASTELLA: It did not, no.

MS. LOPAS: Okay, hang on a second here.

MR. GUASTELLA: All right, thank you.

MR. EINBERG: This is Chris here, it did move forward for me, I think there's a lag a little bit in Teams here.

MS. LOPAS: Okay, hang on a second here. Of course now I just moved it back, and forth, so now it's going to --

MR. EINBERG: It shows slide two right now.

MS. LOPAS: Okay.

MR. GUASTELLA: I've still got slide one, but I'm happy to -- I've got a hard copy here, so I'm happy to --

MS. LOPAS: Okay, yeah just give me your slide cues, so we're on slide two, we're showing slide two, at least I think that's what the majority of folks are seeing.

MR. GUASTELLA: Are they? Okay.

MS. LOPAS: I believe so.

MR. GUASTELLA: I've had problems with Teams --

MEMBER MAILMAN: We are seeing slide two, we're all good.

MS. LOPAS: Okay, thank you.

MR. GUASTELLA: Okay, great, thank you. And just for those that may not know, like I said, I'm Michael Guastella, I'm the executive director of the Counsel on Radionuclides and Radiopharmaceuticals, or CORAR. We're a Washington D.C. based trade association of companies that manufacture radiopharmaceuticals, radionuclides, and other radioactive products used in medicine, research, and industry. Next slide please.

So, on January 13th of this year, CORAR submitted comments to Dr. James Olthoff, he is the acting director of the National Institute of Standards in Technology, and our comments kind of provided a request that NIST consider restarting the Radioisotope Measurement Assurance Program, or NRMAP. And provide sufficient resources for the NRMAP, and the NIST radioactivity group.

Just some background, the NRMAP has provided standard reference materials, or SRMs, and reference materials, or RMs to medical, and industrial stakeholders for the past 47 years. Participants in the NRMAP receive SRMs and RMs to ensure their radiation

measurements are NIST traceable. Next slide please.

So, on slide four, an extended interruption in the NRMAP service began in late 2019. The NRMAP was unable to provide the required calibration standards for more than 24 months, a significant period of time. And as of the end of 2021, there was no clear resolution to the ongoing shutdown of the NRMAP. Now, as we all know, and as we've discussed earlier today, nuclear medicine radiopharmaceuticals are used in the diagnosis, and treatment of disease.

Devices that measure the radioactivity of a dose must use calibration sources that can be traced to NIST SRMs and RMs that have been provided by the NRMAP. And also consider that accurate dose measurement could have Medicare reimbursement implications for radiopharmaceutical dose payment based on activity. Next slide please.

Of particular concern at the time for CORAR members was the NRMAP shutdown -- we're on slide five.

The NRMAP shutdown was occurring at a time when exciting new radiotherapies are being developed, exploiting alpha emitting, and beta emitting characteristics such as lutecium-177, and copper-67. For the alphas, actinium-225, a lot of excitement

around that radioisotope right now, and lead-212. With that in mind, clinical research metrology should be traceable to NIST SRMs, and RMs.

And the medical, and industrial licensees require NIST traceability, making the restart of the NRMAP a high priority for radiopharmaceutical and industrial radioisotope stakeholders in industry. Next slide please.

So, slide six, CORAR expressed concerns that further delays in restarting the NRMAP could result in several challenges such as complying with FDA and NRC requirements.

Providing radiation detection measuring standards that ensure patient, and worker safety. Supplying short lived diagnostic, and therapeutic standards traceable to NIST, SRMs, and RMs, and having NIST traceable SRMs, and RMs, available in the development of new radiopharmaceuticals. Next slide please.

So, in our comment letter, CORAR closed with an urgent request. And that is that NIST facilitate the restart of the NRMAP as soon as safely possible, and reinvigorate with sufficient resources, both the radioactivity measurement group, and the NRMAP to ensure that required NIST traceability needed by U.S.

healthcare, and industry is consistently available this year, and in the future. Next slide please.

So, NIST actually responded, Dr. Olthoff responded to CORAR, and our comments on February 2nd, and thanked us for our comments. With regard to the NRMAP services, Dr. Olthoff mentioned that NIST remains fully committed to providing high quality radioactive metrology services. That NIST has embarked on a restructuring of the existing NRMAP, and NIST is working expeditiously to restore the essential functions of the NRMAP.

CORAR appreciated the follow up from Dr. Olthoff, and yes, we look forward to learning more about the return of services provided by the NRMAP. And happy to say that Dr. Zimmerman is following my short presentation and will provide an update on where NIST is at relative to the restart of NRMAP, and additional activities that are occurring at NIST. So, I want to thank you for the opportunity for presenting today.

CHAIR METTER: Thank you so much for the presentation. And introduction, as you said, to our next presenter, Dr. Zimmerman from NIST, will be giving an update on the NIST Radioisotope Measurement Assurance Program, and changes. Dr. Zimmerman?

DR. ZIMMERMAN: Well, thank you very much,

and thank you for the opportunity to speak to you today. We at NIST appreciate the concern that's been expressed by all of the stakeholders in terms of the availability of our calibration services and our standard reference materials and our reference materials programs.

I should mention that the last couple years have been a particularly challenging time for the federal government as a whole, but also for our division and our group at NIST. The previous speaker mentioned the last 24 months.

So the -- there was some ongoing effects of the previous government shutdown that sort of slowed down the activities of the NRMAP program for a while. And we were dealing with that backlog when we had -- the COVID pandemic hit us.

And along with that, we were undergoing a massive construction at NIST, remodeling and modernizing the facilities that we have in the Radiation Physics Division.

So we appreciate that there was a slowdown in the availability of our -- of our services. But I want stress that we didn't actually stop the program at any particular time. That having been said, there are some major changes that are being made to the program, and I'd like to just address those a little

bit.

So just to give you a little bit of background, as the previous speaker mentioned, this program's been in existence for a long time. And it was originally founded in 1974 as a way for the manufacturers, in particular the isotope producers, to have some assurance of the measurements of their own production facilities, as well as those on the receiving end to make sure that they were getting what they were paying for.

And so, this arrangement enabled measurement assurance on both ends, both the provider and the user of the -- of the various products, primarily first in the medical community and then on to the source buyer community after that.

And the way that it was set up was that there was a cooperative research and development agreement that was set up, first with an organization called the Atomic Industrial Forum.

And then this was followed by the Nuclear Energy Institute and then most recently a company called USRMA, that essentially produced standard reference materials and reference materials on behalf of NIST and operated the proficiency testing part of that program.

And this was all done with a large amount of government oversight. But because the program had been in existence so long and it was a long history, and that they were more or less operating very autonomously. And if you could go back to the -- to the second slide, please. Yeah.

So the program was running fairly autonomously until -- until recently, when we had personnel changes within the research associates that were acting in the cooperative research and development agreement.

And ultimately there was an event this past fall, there was a safety-related event that sort of prompted a complete review of the entire program in terms of the appropriateness of what the program was doing in terms of the NIST mission and policies of the federal government.

And so, a decision was made by NIST senior management that the CRADA, the Cooperative Research And Development Agreement, with USRMA would be terminated. And that the program would now become a completely federal program that would be done within the Radioactivity Group completely by federal employees.

And the reason for this is, as I'll show

in a second, is that the establishing and maintaining of standards is an inherently government function that needs to be done by federal employees. And the program over the last almost 50 years really grew in complexity. Not only the regulatory background of the activities, but also the burdens that have been put on NIST and other national metrology institutes because of changes in the international metrology framework have increased the administrative burden. And additional requirements on us for maintaining quality systems.

It also -- the review of the program also showed a greater need for government oversight to ensure not only the safety of the program, but also the integrity of the traceability chain starting from the primary standards that NIST develops to the measurements that are ultimately made at the end user levels.

So, we're hoping that the changes that we're going to be describing are going to provide an increase in safety integrity and a greater amount of accountability on the part of NIST towards its customers. Next slide, please.

So, there were a number of planning considerations that went into developing the plan forward once the -- once the CRADA was terminated.

And one of these was going back to the history of the program at its height in the last 90s.

This program supported two full-time professionals, a full-time technician, a half a secretary that also served as a shipping clerk. And then the other 50% of that person's time was shared with the Radioactivity Group.

In addition, there were gas standards such as xenon-133 that were regularly distributed through the program. But these were conducted by NIST staff without any additional compensation back to NIST.

And in addition, any sources that get prepared and measured by the Radioactivity Group always undergo some degree of gamma ray spectrometry studies. And this was also done by staff dedicated 100% to those type of measurements.

There was a small metrology research program in that area as well. But for the most part, all of those measurements were being made by one person full-time uncompensated by the program.

I should mention in terms of the way that the Radioactivity Group develops and maintains its standards, the calibration and measurement services are separate from the research component that goes into the developing of new standards.

So, any of the things that are happening to the NRMAP program, there is an influence on our capabilities to work on the development of new standards, but it's because of some of the personnel issues that I'll mention in a minute.

But, and with regards to the list of radionuclides that are of particular interest, we have started working on the four particular radionuclides. And in fact I can -- I'm happy to report that we're actually finished with the lead-212 standardization, and that's now available.

But some of the changes at least for the next year or so will impact to some degree our ability to finish these other projects that we've started, for reasons that I'll explain in a second. So next -- next slide please.

We had a number of other legal factors that we had to take into account that weren't necessarily in place at the time that the program was started.

Of course, you know, the U.S. Constitution that clearly lays out our function in terms of maintaining standards was in place at the time, as well as the Organic Act and the NIST Technology Act that basically outlined our functions were in existence at the time.

These basically call out the government as being responsible for developing and maintaining standards. Promoting the transfer of those standards is called out in those two items, but the mechanism for doing this is never defined. And so, the way that these standards are transferred depends on what the most efficient way for both the government and the customers is at the time.

But to other important policy end, our public laws that also came into effect after the initial formation of the -- of the previous generations of the NRMAP program. OMB Circular A-76, which prohibits NIST or the federal government from competing directly with private industry for the same services.

So if there are standard reference materials or reference materials in general that are NIST-traceable, that are available from private industry, then NIST is forbidden from competing with those companies.

It also makes available the opportunity for privatization of standardization services and the dissemination of standards as long as the traceability chain is maintained. So that provides additional opportunities for growth in the economy.

And then a subsequent public law that has

become even more important in the operation of the federal government is the Antideficiency Act, which means that all government services must be at cost recovery.

And this goes back to some of the factors that I had mentioned before where were actually doing a lot of uncompensated for these -- these programs, which has been determined to be in conflict with this -- with this particular law. So, the next slide, please.

So, the proposal that we've put forward and that we've started implementing is that this is going to be an all-fed program. It's going to be all federal employees and they're all going to be permanent employees of NIST. And I can mention that we do have support for this, for the changes for this program.

Dr. Olthoff, that Mr. Guastella referred to earlier, is also our Associate Director for laboratory programs. So, he's essentially second in command when he's not acting for -- for NIST Director. And he has expressed his support for these changes.

The idea is that we will have direct government supervision, and hopefully this will also result in direct funding of the program, as well as cost recovery. And because this was all prompted

initially by a safety incident, the safety and nuclear security are paramount in the reformation of this program.

The idea is to reduce the risk to NIST and to the government in terms of radiation hazards and as well as outsource accountability as well. Also, to make sure that the staff are sufficient to perform these duties safely and that they have the resources available.

These steps are going to be taken slowly and deliberately to make sure that we're both doing this safely and that we're doing it in compliance with federal law. And to whatever degree possible, we're trying to meet current customer needs moving forward and making sure that the stakeholders that need traceability are able to achieve that. Next slide, please.

So, the immediate significant changes that most of the participants are going to see is that the blind distributions, so these resources that were prepared by -- by the program, sent in the blind, that would get analyzed by the participants and then they would report those values back. And that those results would be compared to the NIST certified values.

That distribution scheme for now is

suspended. Instead, traceability is now going to be achieved, at least for the foreseeable future, through the Radioactivity Group's calibrations program. And these programs have been well established.

An important component of this, and this goes back to some of the changes that came about because of obligations that we have under international metrology framework, but the program is now going to be covered under our quality management system.

When the program was first put together, there was no such thing as a quality system for NIST. But changes in the early 2000s culminating in the mid-2000s sort of forced our hands into making sure that all of our services are covered under the measurement -- or the quality management system. And that we're in compliance with the International Committee on Weights and Measures mutual recognition arrangement. So, traceability is still very important to us. It's a critical -- being able to provide traceability to our stakeholders is a critical part of our mission, and we're still going to enable that.

The reports of traceability, again, this is a remnant of a time prior to times that we were covered under measurement -- or our quality management system. That these reports of traceability are

actually not recognized under our -- under our measurement, our quality management system.

So, what we will do is provide the calibration reports that we are -- that we have been providing under our calibrations program. And these will include a statement about what the -- the participant's value was and it compares to the NIST value. So that a claim of traceability can be made by the stakeholder.

So going back to this, an important set of policy decisions that were made subsequent to the formation of the program back in the 70s is that NIST policy is that the entity making a traceability claim is the one that's responsible for documenting and providing the proof of that, that traceability. And the interpretation of whether or not traceability actually exists is the responsible of the customer.

So, the person who's asking for traceability is the who one -- is the one that ultimately makes that interpretation. NIST is only able to provide data to support those claims but is unable to make a judgment as to whether or not a measurement is traceable or not.

Now, there are existing standards currently that exist, namely ANSI N4222. But that

standard has expired. It is in the process of being rewritten under the IEEE. But as of right now, the only existing standard that defines traceability in this way is an expired one. So next slide, please.

So, we're doing this measure, we're doing this change intently with, you know, being -- being very purposeful in what we're doing. So, we're currently in phase one of what we're thinking is going to be a three-phase approach. And a big part of this is communicating our plan to the stakeholders, and that's a big part of what -- of what I'm doing here today.

We're trying to address the critical calibration needs of our -- of our stakeholders to whatever degree that we're able to. And we started with clearing a backlog of outstanding certificates and reports that has existed over the last 24 months, actually. And so, we've actually done a good job in recent weeks of clearing a lot of those certificates out and getting those back to -- to the participants.

We've asked our participants to get in touch with the Calibrations Program Coordinator to give us an indication of what they're expecting to submit this year in terms of calibration submissions. And to help us prioritize those so that we can best meet

those needs.

Right now, because we are short-staffed, we've shifted existing personnel over to our calibrations to whatever degree is possible. And so, part of the -- part of that switch was the people from the part of the program that goes to developing new standards are now working more on doing calibrations of existing radionuclides for part of this program.

And because we are governed by our quality management system, there are necessary changes in terms of administrative work that need to be made, and those are also being done.

We've also begun the hiring process for new personnel. We do have two advertisements currently out on the street for permanent positions, one technician and one full-time research chemist. And we are anticipating being able to hire and get those people on board by early summer.

Our goal is to keep these essential services going as much as we can with existing mechanisms. And right now our realistic through-put is about two calibrations a month. Next slide, please.

So, one of the things that we're -- that we're focused on is increasing the level of measurement rigor of the measurements.

A review has found that some of the processes that have been adopted in order to sort of streamline and to be able to do more of a production mode of putting out reference materials and the standard reference materials they way that they have been over the last couple years may have been done at sacrificing a little bit of the rigor in the measurements results.

And so, we've taken that back into the group. And these are -- and now all of the measurements and all of the data analysis are being done by federal staff in the Radioactivity Group. That, you know, that their job is essentially to do the metrology of these types of measurements.

The submissions are going to be done through -- these are service numbers that are in our measurement services catalog. Basically, for the different -- the different types of measurements that would be covered by the different radionuclides that would be appropriate for either the radiopharmaceutical industry or the source buyer industries.

And again, right now we're looking at two sources a month maximum until we get the people on board and trained up. And our standard reports of test are

being modified to include this statement of the difference from the NIST value so that the stakeholders are better able to make a traceability claim. The next slide, please.

So, the next phase will be to train the new personnel as they become more proficient to gradually increase the through-put. And hopefully start returning some of the people who have been reassigned back to more of the research component of the group so that our pipeline of new measurement standards doesn't suffer as a result.

So, the realistic through-put for this is maybe four calibrations per month. We're also going to be hiring additional people during this time beyond the two initial people that we -- that we have right now.

We're looking into the possible use of a new measurement geometry, specifically for this program, that would enable the stakeholders to submit sources in a more clinically relevant geometry that's easier for them to seal and to prepare than the NIST 5 ml flame-sealed ampule.

This will make it easier for them to prepare and it'll make it easier for us to measure as well. So, the through-put ultimately will increase

as well.

And we're also in -- in association with some of the professional societies. We're looking into the possibility of secondary calibrations labs. And these would be laboratories that would be able to extend this traceability to the clinical level as part of clinical trials by getting direct traceability through us and then being able to do more of the distribution side on their end directly. Next slide, please.

And then a third phase, we do have additional personnel that we're going to hire as part of this program. So, this is going to overlap with what we're calling phase two as well.

And during this time, we're going to develop the new measurement assurance program that will be part of our quality management system and that people will be able to sign onto the same way that they were able to sign up for the NRMAP program in the past. But this will be a cost recovery program that is covered under our measurement assurance program, our quality management system, and run completely by NIST personnel.

At that time, we may start picking up some of the samples being sent as blinds, some of the ones

that can't be easily done by calibrations or the standard -- the standard way of preparing standard reference materials, known as SRMs. So, it's actually a specific term that we use.

At that time, I think our realistic through-put is going to be six calibrations a month. And that is actually more than the -- than the NRMAP program was at the sort of, the 2018/2019 timeframe. And hopefully by that time we'll actually be able to implement this, the inclusion of the second measure of geometry. So, the next slide.

So again, the major changes to the program that the -- that the stakeholders are going to see is that there's going to be a greater reliance on the company's internal QA and QC capabilities.

So where in the past we've calibrated and provided calibration certificates for the multiple sites of the same -- same company, there would be an expectation that one laboratory within the company would be able to provide calibration services, sort of act as a hub for other sites within -- within the company, to whatever degree possible.

And that was actually done very early in the development of this program and for various reasons expanded to allow individual sites to participate in

the program.

Most of the work will still be done as calibrations, not necessarily distributions. And what we're going to try to do eventually is coordinate the calibrations so that, you know, for example all of the companies that need iodine-123 calibrations can do them all at the same time each year.

As part of this review, we're also looking at all of the standard reference materials, all the SRMs that have been offered across all of our programs, not just in medical applications, but also nuclear security and environmental measurements. And those will eventually be limited to only those that -- that are specifically critical that NIST do and that aren't available through private industry.

At that time, probably a limited number of nuclides may be sent as blinds. And unfortunately, because of the requirement that we recover all of our costs, the participants may initially see an increase in the costs of the program.

But I can mention that there won't be any sort of membership fees like there were previously. And so, the participants are only paying for the calibrations that they need or really want.

Good news for some of the companies, some

of the entities, we will be reintroducing radioactive gasses as part of the standards and calibrations programs within the group. And again, we're going to create a special test that's specifically for this program and other PT programs that are run within the radioactivity group.

So that they're all covered under our quality management system. And so, by doing so, they'll all be compliant with ISO-17025, 17034 and 17043 once this whole process is completed. So next slide.

Just to summarize, NIST realizes, and the Radioactivity Group in particular recognizes that this a critical component of our mission. This is a program that's been going on for a very long time. I have spent almost my entire time at NIST working on standards for medical applications. So, for me personally, this is also an important component of our work.

I've been assured by other management that they are committed to this transition. I want to assure everybody that we are not getting out the calibrations or the standard reference materials business. But that being said, we can't compete with private industry. But we're hoping that this provides new opportunities for businesses to provide

traceability going forward as well.

The success in us being able to make this transition is going to rely on the stakeholders communicating to us the priorities of their needs and to be honest about those assessments.

And ultimately the program is going to be better off because we are going to expand our capabilities being able to provide more types of calibrations and standards, a more convenient geometry for the participants, and as well as more flexibility for the types of measures that can be offered to the participants in the program.

So, I thank everybody for their attention and the opportunity to talk to you today, and I'll be happy to take any questions.

CHAIR METTER: Well, thank you, Dr. Zimmerman, for that update on your really important work with the NIST Radioisotope Measurement Assurance Program and for your work reorganizing it. And thank you to the center for your closed comments on this.

And I'd also like to thank one of the members of the ACMUI, Mr. Richard Green, for bringing up this important topic for you to present during our meeting.

Now, do I have any questions from the ACMUI

for these last two presentations?

MEMBER ENNIS: This is Dr. Ennis, I have a couple questions.

CHAIR METTER: Yes, Dr. Ennis.

MEMBER ENNIS: Now, Dr. Zimmerman, do you have enough funding to carry out and ramp up to the needs of the community?

DR. ZIMMERMAN: At the current time, I have been promised resources for the two new hires going forward. So, the availability of the future funding of course will depend on the budget next year, as it always is.

Like I said, I've gotten commitments from upper management. Their ability to carry through with that will depend on the funding that we get from Congress of course, as well as any other -- other agency funding that may come in as well. But at the current time, we have commitments for the two new hires that are being brought on.

MEMBER ENNIS: Second question, and maybe the industry representative could also comment, like in the current state, how well are you able to meet the needs, let's say for 2022, how well are you going to meet the needs of industry and academia?

DR. ZIMMERMAN: So again, looking --

looking at least for the next probably six to eight months, we're talking about two calibrations a month. That is, you know, depending on the radionuclides, of course. So, the way that the program was structured is that some radionuclides were much more popular than others.

So, if we average out the number of calibrations, it is a little bit lower than what had been done in the past. What would be critical, of course, is, is the availability of the reference materials for the short-lived radionuclides.

Those, some of those can be done by calibrations. Obviously, technetium-99 may be an issue. But a lot of the other short-lived radionuclides, as long as they are arranged logistically properly with the coordination -- with the calibrations program, even copper-64, which, you know, we've done before, can be calibrated as well.

So, there will be a transition period where people will have to wait for calibrations. But that's why it's important for us to know at any given time what the criticality of a particular calibration is.

Whether it's, you know, something that, you know, if they have an audit coming up and they need to be able to demonstrate traceability for a particular

radionuclide for that, that's something that we need to know so that we can move that up the queue if necessary.

MEMBER ENNIS: And then my last question just was it seems like it's taken two years to get to a restarting point. Just if you could comment on what the difficulties were and why it took that long. It seems like a long time.

DR. ZIMMERMAN: Well, as I mentioned before, we've had a confluence of several events. The first one was the government shutdown back in -- I can't even remember what year it was. But basically, we were shut down for six weeks, and then the restart for that.

We're also about two-thirds of the way through a $300 million construction project that is modernizing all of the laboratories within our division, including the Radioactivity Group. So essentially our laboratories were shut down for a year, and part of that time has overlapped with being shut down for the COVID pandemic.

I could mention that the Department of Commerce, under which we are right now, recently sent out its 30-day notice to recall employees only on April -- or sorry, on March 25. So, supervisors are going to start going back 60% time on campus starting on April

25. And the full staff won't be returning to their normal work schedules till June 25.

So we've been under -- under restrictions in terms of number of personnel we can have on campus. As well as the number of projects that we're able to do because of support from plant administrative support, health physics support, etc.

But at no -- but at no time except for a very short time that the campus was actually locked down, and I think that was only a two or three month period, was the -- were the activities completely suspended. At no time have the activities been completely suspended for the program.

And I want to -- I do want to stress that. So, when people are saying, you know, restart, it's not a restart. It's actually a reformulation of the program. And the fact that there had been some issues with being able to, you know, have some through-put during that time is an indication of why a change like this was necessary.

CHAIR METTER: Thank you. You've done a lot of work reorganizing the program, but it's been a very, very fruitful event for all of us.

I see Dr. Harvey Wolcov has a question.

MEMBER WOLKOV: Yes, I was wondering if

the speakers would provide an estimate of the backlog for calibration.

DR. ZIMMERMAN: Say again.

MEMBER WOLKOV: Yes, could the speakers provide an estimate of the backlog for calibration.

DR. ZIMMERMAN: I don't have that --

MR. GUASTELLA: Mr. Zimmerman, I don't have -- I don't have an estimate from CORAR's perspective, so I'd have to defer to you.

DR. ZIMMERMAN: We have started getting some information from the -- from the participants of what their needs are. So far, since we made the announcement back in February, we have not had any of the former participants or the stakeholders actually schedule any calibrations yet, even though the services are available.

So we have been notified of a couple of needs that are coming up. I don't have the data at my fingertips, but there are some calibrations that people are going to want to do very soon that are in the process of getting scheduled.

In terms of backlog, that depends on the individual companies and that has not been communicated to us beyond what they intend to be able to submit this year.

CHAIR METTER: Thank you. Are there any other questions from ACMUI or the NRC staff? Okay, seeing none, I'd like to --- all right, is there a person yet?

MS. LOPAS: Yeah, it looks like there's one person, Dr. Metter, I'm trying to pull them up. Let's see, we have the hand raised. Okay, we'll take one quick question, then we do have to break.

Dan, you can unmute yourself, Dan J. Devries.

MR. DEVRIES: Devries, yes.

MS. LOPAS: Devries, sorry.

MR. DEVRIES: Thanks, Dr. Zimmerman. I know North Star; we're looking forward to the increased capabilities that everything in house under NIST is going to bring. I know that the measurement program itself may not have been operated, but not receiving, you know, SRMs in the way that we had been is just causing us to have to react and grow with your development as well.

So, it might be some time before, you know, companies start scheduling measurements, but it might also come fast and furious.

DR. ZIMMERMAN: Right, and we recognize that, which is why we had specifically asked everybody

to sort of prioritize those for us.

You know, recognizing that, you know, each company has their specific needs, and we also have to accommodate the other people that were in the program as well. But we are trying to get those critical needs done so that everybody is able to get the traceability that they need.

And by the same token, we're trying to streamline our processes so that things are a little bit more efficient on our side so that things can be done more quickly.

MR. DEVRIES: Yeah, we're specifically looking forward to what the overall solution is for tech-99m.

DR. ZIMMERMAN: Yup.

MR. DEVRIES: So we'll keep an eye out. Thank you.

DR. ZIMMERMAN: Yup.

CHAIR METTER: Thank you very much. Mr. Guastella with CORAR and Dr. Zimmerman for this very important update, and we're absolutely up for this. This is very, very important, not only to our community, but to our patients. Thank you. Thank you.

So, we're at a break time, and it looks like we just take a short break. Would it be possible

to go until till -- return at 3:35?

MR. EINBERG: Sounds good, Dr. Metter.

CHAIR METTER: Okay, thank you. We'll see you then.

(Whereupon the above-entitled matter went off the record at 3:23 p.m. and resumed at 3:35 p.m.)

CHAIR METTER: Good afternoon. I'd like to start our next session, which is the last session for the spring ACMUI 2022 meeting. The next presenter is a presenter from the ACMUI, Mr. Michael Sheetz. He will be presenting on non-medical events.

Mr. Sheetz will provide an analysis of the fiscal year 2020 and 2021 non-medical events reported by medical facilities and community pharmacies. Mr. Sheetz.

MR. SHEETZ: Thank you, Dr. Metter. Can you hear me okay?

CHAIR METTER: Yes, we can.

MR. SHEETZ: Okay, so this presentation will cover the non-medical related events reported by medical licensees for fiscal years 2020 and 2021. I presented a similar report two years ago for fiscal years 2018 and 2019.

This format for presenting non-medical events occurring in medical facilities was started many

years ago by Mr. Ralph Lieto, former ACMUI member, and Dr. Donna-Beth Howe, former NRC medical staff team. It has become a recurring presentation to complement the medical-related events. Now the next slide, please.

MS. LOPAS: Did it change for you?

MR. SHEETZ: It did not.

MS. LOPAS: Maybe turn off your video, see if that helps. Can I get a confirmation from anybody else that it moved forward, okay? Okay.

MR. SHEETZ: Okay, I see it now.

MS. LOPAS: Okay, great.

MR. SHEETZ: So, this data comes from the Nuclear Material Events Database, or NMED, for non-medical events reported by medical licensees and both NRC and Agreement States.

It does not include the medical events reported under Section 35.3045 involving patient administration errors, or Section 35.3047 involving unintended exposures to embryo, fetus, or nursing infant, or any other events involving patient safety or harm.

What is included are the events reported under various sections of 10 CFR Parts 20, 30, 35, and 49 involving leaking sealed sources; lost, abandoned,

or stolen radioactive material; personnel overexposures; contamination incidents; equipment failure; and transportation incidents involving radioactive material. Can I have the next slide, please. Thank you.

This slide shows the number of non-medical events occurring in the different event categories for Fiscal Years '20 and '21, ranking them from the most frequently occurring events, there were a total 40 lost, abandoned, or stolen sources; seven leaking sealed sources; seven equipment malfunctions; five incidents involving transportation of radioactive material; four personnel radiation overexposures; and four radioactive contamination incidents.

So, on average, there are approximately 30-some non-medical events reported each year, which has been consistent with prior years. And if you compare this to the 50 or 60 medical events reported by medical licensees each year, as indicated by Mr. DiMarco's presentation, it's about half as many. Can I have the next slide, please.

MS. LOPAS: It's showing, Mr. Sheetz, so.

MR. SHEETZ: Okay, I don't --

(Simultaneous speaking.)

MR. SHEETZ: This chart shows the relative

number of non-medical events reported by medical licensees compared to the total number of NMED events. But while categories -- so you can see that they represent a small portion, approximately seven percent, for combined Fiscal Years '20 and '21. And can I have the next slide, please.

MS. LOPAS: It's there.

MR. SHEETZ: Okay, so if we take a closer look at the circumstances of the events in the different categories, there are some general recurring themes. In the consideration of everyone's time, I'm not going to cover the specific details of each event. However, I will cover a summary of the type of events, starting from the most to least frequent in occurrence.

So, for lost, abandoned, or stolen sources, there were 19 cases involving lost iodine-125 seeds. Approximately activity of 100-200 microcuries each, which were used for radioactive seed localization of non-comparable breast lesions.

Most were lost in the process stage of removing the seed from the tissue specimen. Therefore, it had been expanded from the patient, or the seed was left in the specimen and the specimen was then discarded. And two involved a seed that fell out of a patient sometime after being implanted.

Keep in mind that this number of lost RSL seeds is about double that from that reported in Fiscal Year '18 and '19.

Six involved sources discovered to be missing by the licensee and then never found. These sources included 108 millicurie vial of technetium-99m, a 15 curie tritium exit sign, a ten microcurie radium-226 liquid scintillation counter with external standard, a one millicurie germanium-68, a 100 microcurie cobalt-57 dose calibrator vial source, and 180 microcurie cesium-137 dose calibrator vial source.

Three involved iodine-125 or palladium-103 seeds discovered missing following prostate implant brachytherapy procedures. Three involved a shipment of multicurie iridium-192 HDL sources that were reported as temporarily lost or unaccounted for by the common carrier, but which were ultimately delivered to the hospital.

Two involved several iodine-125 brachytherapy seeds missing from the shipment, as indicated in the documentation from the manufacturer.

Two involved a shipment of radioactive material that was lost by the common carrier and never received by the end recipient and upon investigation,

were never located. These sources include three one-and-a-half millicurie vials of indium-111 and a 700 microcurie cobalt-57 blood source being returned for disposal.

Two involved the common carrier or delivery vehicle being stolen and then recovered by police, one carrying a 200 millicurie vial of lutetium-177, which was recovered but had been removed from the shipping container so it could not be used.

The other, carrying three containers of technetium-99m with a total reactivity of 820 millicuries, which were recovered intact. There was no vehicle contamination in these incidents.

One involved recovery of abandoned, sealed cobalt-57 flood and cesium-137 sources from a medical facility that went bankrupt. One involved the delivery of eight iridium-192 industrial radiography sources, totaling over 800 curies to a hospital diagnostic imaging department in Hawaii, instead of its intended destination to a facility in Canada.

The hospital had properly secured the sources and promptly notified the carrier and source manufacturer. The carrier retrieved the package and delivered it to its intended destination.

And one case involved a medical facility

reporting that a sharps container was set off in the radiation monitoring lab.

It was discovered that the sharps container came from a medical facility and contained 20 used lutetium 177 vials with an estimated total activity of approximately 10 microcuries. It was determined that the medical facility did not perform proper surveys prior to releasing the vials to the waste stream. Can I have the next slide please.

The leaking sealed sources, six cases involved cesium-137 dose calibrator vial sources found to have removable contamination during a routine six-month leak test. This seems to be a recurring event for these types of sources and most likely due to the length of time these sources are kept in use due to the long half-life of cesium-137 or the plastic vial becomes brittle and cracks.

One case involved a I-125 RSL seed that was inadvertently cut during surgical removal of a tissue specimen by the surgeon, who was using scissors to perform the dissection. Thus, it resulted in internal exposure to the patient with an estimated activity of 30 microcuries. The patient was given a ten-day regimen of potassium iodide. Can I have the next slide, please.

For equipment malfunction, there were four cases reported by licensees using strontium-90 coronary intravascular brachytherapy devices where the source train failed to fully retract from the patient at the end of the designated treatment time. In one case the sources also failed to be deployed fully to the intended treatment site.

In all cases the device and source train were placed in the emergency plexiglass bail-out box and the device was evaluated by the manufacturer. The device failures were suspected to be due to either the pin gate not being located in the fully open position, or there was a temporal compression or kink of the catheter.

There was a case where the HDR source did not fully retract to the shielded position after channel four of a ten-channel treatment. Staff initiated emergency procedures and manually retracted the source. The patient treatment was not able to be completed.

There was a case during HDR source exchange where the source did not fully secure inside the transport pin. Additional service engineers were called in to troubleshoot and were then successful in securing the source.

There was a case with a gamma knife icon where the patient treatment was interrupted when the high-definition motion management system lost connection and prevented continuation of the treatment plan. A service engineer was called in to repair the device and the patient treatment was completed the following day.

It should be noted that except for the HDR source unloading problem, all of these events were also reported as medical events. Can I have the next slide, please.

Are you on the shipment of -- transportation of radioactive material?

MS. LOPAS: Correct.

MR. SHEETZ: Okay, great, thank you. So, for shipments of radio material, there were four incidents where a medical facility identified removable contamination exceeding report limits on the outer surface of the package coming from a commercial radiopharmacy, which contained diagnostic unit doses of TC-99m or F-18.

And in all cases the contamination was limited to the package surface and not the internal contents, which were subsequently able to be used.

Other reports identified where or how the

contamination occurred, and there was no noted contamination of the carrier vehicle or driver.

There was one incident where a radiopharmacy delivery vehicle was involved in an accident. Another radiopharmacy staff member arrived at the scene to complete the delivery. No one was seriously injured, and the radioactive package was not damaged. Can I have the next slide, please.

MS. LOPAS: Radiation overexposure.

MR. SHEETZ: Thank you. So, for personal overexposures, there were two overexposures reported for interventional radiologists who performed both fluoroscopically guided interventional procedures and Y-90 microsphere cases.

The one resulted in a lens dose greater than 150 millisieverts. The actual dose was not included in the report. And the other, an extremity dose of 1.2 sieverts. Obviously, most of the dose was attributed to the fluoroscopic X-ray.

There was an overexposure of a radiochemist performing research using high activities, hundreds of millicuries, of F-18, resulting in an extremity dose of 800 millisieverts. Exposures were primarily attributed to improper material handling technique and frequency.

And there was an individual who received an unnecessary study at a hospital involving the administration of 26 millicuries of TC-99m exametazime labeled white blood cells. The order for the study came in error from a physician's office in June 2021, but it was dated December 2015.

At the time the order was received, the individual was under the care of a different physician and had not seen the ordering physician since 2015. The RSO concluded that since the individual was not a patient, the radiation exposure should be classified as an exposure to a member of the public.

At that time, the NRC agreed with that conclusion. However, as I will note after my presentation, that ruling has since been retracted. Can I have the next slide, please.

MS. LOPAS: Yup, we're at radioactive contamination.

MR. SHEETZ: Thank you. Some delay in my computer, there it goes.

There was inpatient hospital room that became contaminated when the patient's catheter became dislodged 12 hours after administration of 300 millicuries of iodine-131 MIBG. The patient was decontaminated and released. Her room was held for

two months to allow for decay before being released.

A hot lab was contaminated when the AU intentionally broke open two iodine-131 capsules containing a total activity of 30 millicuries and poured the contents into a glass of water. The patient who was scheduled to receive the therapy had informed the AU that they could not swallow capsules.

The hallway and treatment room was also found to be contaminated. The RSO cordoned off the contaminated areas, which were not reopened for three months.

A nuclear medicine technologist was administering 27 millicuries of tech-99m to a patient when something created back pressure and sprayed a small quantity of the technetium into the technologist's face and eyes.

The technologist went to the emergency room and had her face and eyes washed out. The radiation dose was estimated to less than one centigray to the skin and lens of both eyes.

And a mobile PET/CT service reported finding rubidium-82 contamination on the top of a rubidium-82 generator infusion cart. All patient activity was cancelled for the day and the cart was decontaminated, and the system from the site.

A review of the equipment and discussions with the manufacturer concluded that the infusion system was not the source of the contamination. The infusion system worked properly for use the following day.

And it was determined that the contamination occurred due to cross-contamination by the technologist and not from an issue with the infusion system. Can I have the next slide, please.

MS. LOPAS: Other events, landfill alarms.

MR. SHEETZ: Thank you. There are always a number of miscellaneous events that get reported to NMED which do not fit into one their defined categories. One of these related to medical licensees, it's the detection of short-lived medical isotopes at municipal waste landfills or transfer stations.

The radioactivity gets into the waste from the body fluids patients were being administered radiopharmaceuticals for either diagnostic or therapeutic procedures. There's no standard reporting requirement for these events.

The NRC does not require them to be reported. And so, the requirement level of reporting to NMED varies from state to state and year to year.

In the past, there have been a relatively large number of events, primarily coming from just states. The number of events reported in this slide reflect those that were identified as detecting medical isotopes. There were many more events reported where the radionuclide was not identified, and I'm sure there are many events that are occurring across the country and not being reported.

The response to these events often results in either the waste being returned to the originator, if it is known, or the contents of the truck were unloaded and an attempt is made to locate the hot waste bag in an attempt to identify the originator, which can sometimes result in a fine or request to retrieve the waste.

I take the time to point this out as I feel these reported events were only the tip of the iceberg and that a significant response effort is being undertaken for something that does not present any public safety or hazard a risk.

With the increasing use of radiopharmaceutical therapy and recent FDA approval of TC 177 PSMA, I'm concerned that this may become an increasing problem with potential serious impact on our patients.

Pennsylvania has a model landfill monitoring program to address this problem that requires all municipal waste to be monitored for radioactive sources, which is important to identify abandoned sources. It allows waste identified to only contain short-lived medical isotopes to be immediately buried in the waste site. This eliminates the response effort for something that does not pose any risk to the public.

There is currently an open action item for the NRC and the national materials program to evaluate this issue and produce recommendations or guidelines that could be used to educate and advise the states on best practices for processing and disposal of municipal waste identified to contain short-lived medical isotopes.

This would be of great benefit to our patients, who would not need to deal with the threat of fines or penalties which may contain small quantities of medical isotopes, but also alleviate the need for licensees to instruct their patients to hold their garbage following radiopharmaceutical therapy for several months. Can I have the next slide, please.

MS. LOPAS: Conclusions.

MR. SHEETZ: Conclusion. And so, in

conclusion, there are a relatively small number of medical events occurring with medical licensees. Most of these events have minimal public safety and health impact.

And while there have been some efforts made to address short-lived medical isotopes setting off landfill alarms, I feel there needs to be continued effort to produce recommendations or guidelines that could be used to educate and advise the states on best practices for processing and disposal of municipal waste identified to contain short-lived medical isotopes, as it can create a significant and unnecessary burden on regulators, licensees, and patients.

And then the next three slides are the acronyms that I used in my presentation.

CHAIR METTER: Thank you, Mr. Sheetz for a very complete, and very interesting presentation on the non-medical events that have occurred in the last couple of years.

Do I have any questions from the ACMUI for, and I see them from, is that Dr. Ennis?

MEMBER ENNIS: Yes, it is. Mr. Sheetz, good to see you.

I wondered if you would just comment, the

one that stuck out to me was the RSL post ex-plant. Seems like 19 of them, seems like a lot.

And, you know, they aren't medical events I guess, because they are outside the patient. But are we having an in the pathology department with exposures, or just what your thoughts are about that happening, the magnitude of the issue. Is this something that needs attention?

MR. SHEETZ: I'm not sure it needs attention, or the numbers have approximately doubled. One, it may be due to the increased number of procedures being performed, because it is becoming more popular and more licensees are utilizing this procedure, for agent localization.

At the institution that I used to work at, as an RSO, we used to do at that time over 1,000 seed implants a year, just from our institution, at the five different places.

And, we lost two seeds. And, you know, it happens.

I think part of the problem is there's a lot of hand off, you know, of the seeds, you know, to implanting the patient, and ex-planting, and going to pathology, and then recovering the seed.

And, a lot of people, especially with

pathology and OR personnel, who are not necessarily trained to go up in handling radioactive material.

And, so turnover of people, you know, lent to not understanding the procedures.

It would be interesting to know the end number of, you know, procedures being performed, and just heard that so the rate has not increased. The percentage has not increased or we're getting more lax. Do not know the answer.

CHAIR METTER: Any other questions from the ACMUI for Mr. Sheetz?

MEMBER MAILMAN: Thank you, this is Josh Mailman.

Thank you for bringing up the recent approval of lutetium-177 PSMA and highlighting that this may become an issue. Is there something we can do in patient education, or in release material, to help make sure that this is less of an issue?

MR. SHEETZ: It's going to vary by state because obviously PSMA, you know, the majority of the materials are excreted through the urine, and a lot of these patients will be incontinent. There will be a lot of diapers, and so a lot of this can end up in landfills.

If it happens in Pennsylvania, it's not

going to be a problem because, particularly in the landfill.

If it happens in a state that can't identify it, or doesn't allow it to go in the landfill, then there's going to be these issues. And that's why I bring it up.

And, so I think it's important to address this problem, then somehow get the word out, or come up with guidelines and best practices for the states so everybody's on the same page.

MEMBER MAILMAN: Thank you for that.

MR. SHEETZ: If I may, I did want to bring up the one case in my presentation involving an overexposure to a non-patient from a nuclear medicine procedure.

CHAIR METTER: Yes, I was very interested in hearing, Mr. Sheetz. Go ahead.

MR. SHEETZ: In recap, the individual received an unnecessary study at a hospital involving the administration of Technetium-99 exametazime labeled by blood cells, resulting in an effective dose equivalent of 8.5 millisieverts, which the order for the study came in error from a physician's office.

And, at the time the order was received, the individual was under the care of a different

physician.

We also concluded that since the individual was not a patient to radiation exposure, it should be classified as an exposure to a member of the public.

And the NRC initially agreed with this, however I believe they have since retracted this and far too many dose limits for general members of the public, specifically exclude the dose contribution from medical administrations, even if they are unintended, and that all medical administration should be regulated under Part 35.

I bring this up for clarification as there have been recently several other similar cases. At NRC there has been a debate among the medical community, whether these need to be reported as an overexposure to a member of the public, since the individual is not scheduled for any nuclear medicine procedure.

And, so I would welcome someone from the NRC who would be able to comment on this, and thank you.

MS. VALENTIN-RODRIGUEZ: Hi, Dr. Metter, this is Celimar. I can comment and respond to Mike.

CHAIR METTER: Please do. Thank you very much.

MS. VALENTIN-RODRIGUEZ: Sure thing.

So, the Commission has weighed on this issue, which is why we retracted the initial assessment.

Back in 1995, and there was a Federal Register notice that was published, and I'll give the reference for those who want to look it up.

It's 60 FR 480-623, that was dated September 20, 1995, where the Commission clarified exactly what Mr. Sheetz said, that all medical administrations of radioactive material received by individuals, regardless of whether the individual was intended to receive the medical administration, fall under the requirements of Part 35.

And so there were conforming changes to Part 20 and Part 35, to ensure that wording was consistent between the two Rules, and to provide further clarification that medical administrations don't fall under the public dose limits in Part 20.

So, I believe this was also discussed by the ACMUI back in 1995 in a public meeting, and the ACMUI agreed with the Commission, that medical administration should fall under Part 35.

And so we requested that the unmet event entry be updated. And I believe that's either been

taken care of or is in the process of.

And I just wanted to add that regarding the discussion on lutetium-177 PSMA, one of the things that the medical team intends to do, is we want to review a licensing memo that we've issued for lutetium-177 radio pharmaceuticals back in 2018, to see if there's any changes that need to be made to the guidance, based on the FDA's approval of PSMA. Lutetium-177 PSMA.

So, that's something that we're undertaking. And we're also looking at that short-lived municipal waste recommendation from the ACMUI. That task was turned over to me, and I'll be doing some further engagement with the Agreement States to kind of get those, the ball rolling on those recommendations.

So, we are working on those things. I just wanted to give an update to the medical team on that.

CHAIR METTER: Thank you very much, Dr. Valentin-Rodriguez, on that update.

Are there any other questions for Mr. Sheetz, from the ACMUI or the NRC?

Are there any questions from the public?

MS. LOPAS: So, go ahead and use the raised hand function, if you would like to ask a question or make a comment on what was just presented by Mr. Sheetz.

All right, Dr. Metter, I am not seeing any raised hand.

CHAIR METTER: Thank you very much. And, Mr. Sheetz, excellent presentation again. You did end up your reports and very appreciate your input on this, the issue.

Now our next presenter is Dr. Valentin-Rodriguez, from the NRC. And she will be giving a Medical Team update.

MS. VALENTIN-RODRIGUEZ: Thank you, Dr. Metter.

Good afternoon to ACMUI members, and members of the public. Like Dr. Metter mentioned, I am Celimar Valentin-Rodriguez, Medical Radiation Safety Team Leader.

And today I'll be providing our overview of current activities and efforts by the Medical Safety Team.

Kevin Williams touched upon some of the items in my presentation this morning, so I'll try to go through those a bit quicker since I know it's been a long day for all of us. Next slide, please.

So, with respect to the Abnormal Occurrence Criteria, like Kevin mentioned, the staff issued to the Commission, a SECY paper requesting a

proposed limited revision to the Commission's policy statement on criteria for reporting abnormal occurrences, or AOs. And I'll be focusing specifically on the area of medical use.

The proposed revisions to the AO criteria for medical use include changes to the language in the text in Criteria 3CI, and the addition of a new medical consequence criterion.

And, just to note that the staff did not recommend any changes to the reporting requirements in 10 CFR Part 35, license conditions for technical specifications. Next slide, please.

Regarding criterion 3C1, the staff proposed to retain the quantitative dose-based threshold with certain revisions, as I previously stated.

As a screening tool to identify medical events and need to be further reviewed for public health or safety significance.

There's four big changes. One of them is to clarify that we review AO consideration, for AO consideration, events that are reported under specific license conditions for emerging medical technologies.

And this is based on a 35.1000 guidance that is issued by the staff and the NRC.

We also clarified that the dose to be unintended, instead of expected. We know there's a lot of new medical uses out there that intentionally deliver doses near bone marrow, lens of the eye, gonads, that exceed the dose limits in 3C1A.

So, the proposed revision would provide the unintended dose to be greater, or equal to the specified doses for these sites.

We're also removing the requirement for a written directive under 3C1B, since not all procedures where unsealed byproduct material is administered to an individual, require written directives.

And we want to cast a wide net in terms of dose events that we want to consider for AO consideration.

And lastly, including unintended doses resulting from delivery of prescribed doses, dosage, or activities because we recognize that radio pharmaceutical administrations are for prescribed dosages, activities, or ranges of activities, and not doses.

And, also, as you may recall in 2019, we revised our requirements for permanent brachytherapy, to define medical events in terms of activities and

not doses. Next slide, please.

The staff is also proposing to add a second step to the medical AO criteria. This would be step 3C2, that would further screen potential AOs based specifically on physiological harm, which promptly manifests following treatment.

This AO criteria would include a qualitative threshold for impairment of a body function, or damage to a body structure, similar to the Health and Human Services definition of a severe adverse event.

And, we feel that this would adequately capture the subset of medical events that staff recommends classifying as I said, for public health or safety significance.

So, in our review of those potential for that medical consequence criteria, we would consider the location, dose, time of onset, and description of the radiation injury, to determine if that injury would heal naturally, if it will require some type of medical intervention, including surgery, or if the injury is beyond medical intervention. Next slide, please.

With regards to externalizations, I think Kevin said it all this morning. We prepared a Commission package, which includes a rulemaking plan

in dispositions PRM 35-22. The staff has shared this draft package with the Agreement States in October, for a 60-day comment period.

We're in the final stages of concurrence, and we plan to issue this package to the Commission by the end of this month. Next slide, please.

Thank you. We continue to implement our new streamlined process for the evaluation and development of licensing guidance, for emerging medical technologies.

Since implementing this new process in 2020, we've evaluated three technologies. We continue to engage with the Agreement States, the ACMUI, our federal partners like the FDA, and the regulator community to identify new technologies.

As you've heard from Kevin, we recently issued our first licensing guidance under this new process, which was the Alpha Tau Alpha DaRT series device guidance. And that's publicly available in the NRC's medical toolkit.

We plan to issue the licensing memo for CivaDerm in the next few months, and we're also drafting licensing guidance for the Liberty Vision Y-90 Disc Source, and that will be issued to the Agreement States, and to you, the ACMUI for review and comment over the

next few months, too.

And we're also looking at two additional technologies, a phosphorous-32 brachytherapy for unresectable locally advanced pancreatic cancer, and Akesis Galaxy, which is a Gamma stereotactic radiosurgery unit. Next slide, please.

As part of our efforts to continue evolving our medical use regulations, you've heard that we recently received Commission approval to move forward with the rulemaking, to codify requirements for rubidium-82 generators, incorporate well-established emerging medical technologies into Part 35, and create additional flexibilities into Part 35, to address future emerging technologies. Next slide, please.

No, there we go. Oh, that one. Sorry, that was my bad. You were on the right slide.

So, in February 2022, we formed a joint NRC Agreement State working group, to proceed with the rulemaking.

We're currently in the pre-rulemaking phase where we're developing the regulatory basis. We plan to issue this to the Commission by March 2023, so 14 months after we receive Commission direction.

There will be a 90-day public comment period following publication of the Reg basis. And

we anticipate opportunities for engagement with external stakeholders, and the regulated community at this stage.

I believe we plan to issue the draft Reg basis to the ACMUI and Agreement States for comment, sometime in the late summer of this year. So, that's coming up.

And, then the rest of the schedule for the rulemaking includes the proposed rule with draft implementation guidance, which is due to the Commission by August 2024. And, then the final rule and guidance due to the Commission by August 2026. Next slide, please.

At the end of January of this year, we also received Commission direction on the training and experience requirements, for unsealed byproduct material rulemaking plan.

This was issued to the Commission back in January of 2020, pre-pandemic. The Commission maintained the NRC's current T&E requirements for use of unsealed byproduct material in 10 CFR, Part 35.

As you may all recall, the staff's recommended option would have removed the alternate pathway and would have required physicians to be certified by an NRC agreement state recognized medical

specialty board, to become authorized users. Next slide, please.

So, although the Commission did not approve any changes to the existing training and experience regulatory framework for unsealed byproduct material, we did receive three actions from the Commission.

The first is to reconsider the full complement of training and experience requirements and obtain stakeholder feedback on this as part of our ongoing rulemaking for emerging medical technologies.

And, we will have opportunities for public engagement on this particular topic, as well as others, during the rulemaking process as I mentioned before.

We were also directed to complete an assessment of each medical specialty board and determine if these boards still satisfy the board recognition criteria.

And, to provide the results of this assessment to the Commission in July 2022. I believe Chris alluded to this earlier in the day. And we're following an established process by the staff, to complete this assessment.

Right now, we currently issued letters a few weeks ago, to the medical specialty boards

requesting confirmation of satisfaction of board recognition criteria, and certificates within 30 days.

Our process provides for the staff to reach out to the ACMUI if we see any deficiencies that we need to seek advice on.

And we also plan to share the results of the staff's assessment with the ACMUI once it's ready for, to be issued to the Commission in the late summer.

And, regarding ABR's request for termination of NRC board recognition, in the letter dated March 29, they did tell us that they intend to terminate their board recognition by December 21 of next year, 2023.

And, the ABR's Board of Governors determined and let us know in this letter, that this function is outside of their mission, and diverts resources from enhancing their exam delivery, and customer service.

We are following our office procedure and we're working with ABR on this termination.

Finally, the Commission also directed the staff to develop implementation guidance to clarify roles and responsibilities, of those individuals who are subject to T&E requirements, and to clarify how individuals will fulfill these T&E requirements.

And, we plan to develop and issue this implementation guidance concurrently, with the proposed and final rules for emerging medical technologies rulemaking.

And, thanks for the correction, Maryann, because for some reason I wrote 21st, December 21, 2023, in my script, and it should be December 31, 2023. Next slide, please.

So finally, in October 2021, the staff established a joint NRC Agreement State working group, to develop a rulemaking plan to request Commissioner approval to develop a regulatory framework to authorize vet licensees, veterinary licensees, to release animals containing byproduct material following vet procedures, with appropriate instructions under certain circumstances.

The staff's draft rulemaking plan explores options to address release criteria for animals following these vet procedures with byproduct material, release instructions and waste disposal.

The staff expects to issue this draft rulemaking plan to the Agreement States in the next few weeks, I believe in the next few months.

And, will have further engagement with the Agreement States to discuss the draft rulemaking plan,

and options.

And, our current schedule is to provide this rulemaking plan to the Commission, by the end of the fiscal year.

And, I believe my last two slides are acronyms. So, this concludes my presentation and I'll turn it back to Dr. Metter.

CHAIR METTER: Thank you, Dr. Valentin-Rodriguez for your presentation, and for the work that the medical team has been doing for us.

Now, do I have any questions for Dr. Valentin-Rodriguez from the ACMUI?

MS. VALENTIN-RODRIGUEZ: It's late in the day.

CHAIR METTER: I think so. Well, you had a wonderful presentation.

MS. VALENTIN-RODRIGUEZ: It's been a long day.

Oh, we got a hand.

CHAIR METTER: There is a hand. Melissa Martin?

MEMBER MARTIN: Oh, I'm sorry, and I do know it's the end of the day.

Am I talking?

MS. VALENTIN-RODRIGUEZ: Yes, you are. I

can hear you.

MEMBER MARTIN: Okay. I was just wondering, we've recently seen or been told this about the ABR letter to request that they know, that the ABRs no longer be recognized as authorized user status.

Have they said anything, or has there been any thought or consideration, given to what that does for recognition as RSO qualified?

I believe that it's a deficiency that we are addressing. And, we reached out to ABR to confirm which qualifications, or what recognition criteria they're looking to terminate.

If it's all of them, or if it's some of them.

MS. VALENTIN-RODRIGUEZ: Okay, thank you.

MS. AYOADE: Hey, Celimar, this is Maryann --

MS. VALENTIN-RODRIGUEZ: Yes.

MS. AYOADE: --- Ayoade at NRC and yes, I did confirm with the ABR that it's all of the specialty areas, including the specialty areas that they have recognition for. The authorized medical physicist, and the radiation safety officer.

MS. VALENTIN-RODRIGUEZ: Thanks, Maryann. Oh, well, okay --

CHAIR METTER: I have a question. Is that asking for additional penalty?

MS. AYOADE: Yes, Dr. Metter, this is Maryann again. So, it is for the authorized user, the authorized medical physicist, and the radiation safety officer.

The radiation oncology and diagnostic radiology are specialty areas fall under the authorized user eligibility. So, yes.

CHAIR METTER: Thank you.

MS. AYOADE: You're welcome.

CHAIR METTER: Any other questions?

Can we open it up to the public?

MS. VALENTIN-RODRIGUEZ: Sure.

MS. LOPAS: Sure. Just so please press the hand, the raised hand icon, if you would like to unmute yourself and ask a question or make a comment.

That's for anybody in the public that's listening in right now.

MS. VALENTIN-RODRIGUEZ: I don't see any hands.

MS. LOPAS: No, I do not either.

MS. VALENTIN-RODRIGUEZ: Don't be shy.

MS. LOPAS: You overwhelmed them, Celimar.

MS. VALENTIN-RODRIGUEZ: Yes, it was a lot

of information, short amount of time.

CHAIR METTER: Thank you very much for your presentation and those --

MS. VALENTIN-RODRIGUEZ: Oh, I think I see a hand raised, Dr. Metter.

CHAIR METTER: It looks like there is a hand.

MS. LOPAS: And of course I'm having a hard time. Whoever, okay, yes. So, Sean Wilson, you can go ahead and unmute yourself.

MR. WILSON: Hi, thank you, can you hear me?

MS. VALENTIN-RODRIGUEZ: Yes.

MS. LOPAS: Yes.

MR. WILSON: Okay, great.

I know it was brought up earlier, thank you for the presentation, and Melissa kind of hit on it with her question as well.

As a RSO at a hospital, who often submits AU amendment requests, that's a potential nightmare for us.

Because we do rely quite heavily on the ABR-AU status indicator, for submitting our license amendments.

And, just recently, I had to work with a

university hospital system down in Florida, who could not provide a 313a that was even remotely accurate.

And, it caused us to essentially delay getting an authorized, a new authorized user onto our license until they could pass, or get the ABR letter.

Because the facility, even though it was a very highly skilled and qualified residency oncology program, the staff there just had no idea how to properly fill out the forms in order for this individual to pass through our state regulator.

So, that is a very significant impact on our medical programs, I believe.

Thank you, that's all I had.

MS. VALENTIN-RODRIGUEZ: Thank you.

Thank you, I was slow getting off the mic. Thank you for your input.

MS. LOPAS: And, then we have another comment. It might be Ralph. Ralph, you can go ahead and unmute yourself. And, just introduce yourself, give you full name before you, when you start.

MR. LIETO: Yes, so Ralph Lieto. I'm a retired medical physicist. I'm currently president of the Michigan Radiological Society of ACR.

My question relates again, following on the train that Melissa and Daniel just had on the ABR

designation.

I'm trying to understand, because I think a lot of us are in shock about this, and its ramifications. A couple of questions come up.

I know that ABR is expected, I think, by the end of summer, August thereabouts, to make this assessment on the board certifications. And so forth and report back.

And I'm just wondering in light of this, the fact that the AU designation is something relatively new in the life of board certifications.

And largely came about because of the changes that NRC made in recognizing boards in the early 2000s, and created, actually created this.

So, the fact that it doesn't have AU eligible on the board certificate, does not necessarily mean that the training is not adequate for these individuals to be AU designates, based on board certification alone.

So, I'm just kind of concerned that this clarification needs to be done before I think, NRC makes its assessment about the board certifications quote, being eligible for recognition.

So, that's, you know, one major concern that I have.

And, also in your, and I don't know if you or Maryann can make a response right now, maybe later.

How do you go about, I mean you, NRC, determine that a board certification adequately meets the NRC's criteria when, I mean do you go in and actually look at the board exams and what it includes?

Or do you do some kind of other assessment? Because this has always been a question of mine ever since this issue came out in the early 2000s when I was on ACMUI. It's how does the NRC go in and determine that the board certification process, is adequate?

And, I know I've asked a couple of questions here. So, I'll just turn it back over to NRC staff.

Thank you.

MS. LOPAS: Sure. Maryann, you want to take that question? I know you've been in the wake of a process.

MS. AYOADE: Yes, thank you for that question. This is Maryann Ayoade from the NRC.

So, when the board submits to us that they are seeking you know, recognition from NRC, they provide their certification process, to include all of the training they are, training and experiential requirements that they have on their end, for each

specialty area.

And, in addition to that, they have to meet all of the training and experience requirements, that are listed for each of the training requirements in Part 35.

And so we review that against their processes. They also submit the ACGME accreditation counsel for graduate medical education manual, which may or may not cover all of NRC's requirements.

But we review that, and we also make sure that they include all of NRC's requirements, including the work experience, supervised work experience, and that they are fully competent.

Part of our review also includes their board examinations, and what they have for topic areas, to make sure that its being covered, or that it reaches, it touches the NRC requirements as well.

And, so we do review their process, which includes things that meet, the requirements that meet the NRC's training requirements, and the board examination topics that are covered as well.

MS. LOPAS: Thank you, Maryann.

MR. LIETO: Follow up question, please?

MS. LOPAS: Yes, go ahead, Ralph.

MR. LIETO: A follow up question is that

as a part of the Commission's document that came out in January about the training and experience --

MS. AYOADE: Yes.

MR. LIETO: -- there was a directive to address the training and experience requirements that are specified, what I'll call the alternate pathway right now.

And, but several of those are severely shall we say outdated. And, not relevant to current training nowadays.

But if, would it be appropriate that as this assessment goes in, that these requirements as they're updated, goes into the boards, or I should say the training programs, which then are reflected in the boards?

That is going to be something that's going to, you know, obviously take some time over the course of probably, the next year or so.

And, it would seem that addressing the board certification requirements might be a little bit premature, that might need to have to take place before that time.

MS. AYOADE: So, yes, we are as part of the Commission's tasking, and Celimar addressed it in one of her slides, we were tasked to develop implementation

guidance, to clarify the expectations on how individuals do fulfill their training and experience requirements.

And we also, one of the areas that we wanted to make sure that we clarified, which is part of the tasking, was to make sure that people understand the roles and the responsibilities of each person's role as it relates to the training and experience requirements.

And, so yes, we are looking at that. Included in that tasking is us looking at our Form 313 and trying to provide information that will help clarify what it is that NRC wants to see on these forms when we ask for the information on these forms.

MR. LIETO: Okay. Thank you. And just one other just statement if I may.

MS. AYOADE: Yes.

MR. LIETO: I think if you try to force everybody to go the alternate pathway as a result of this, you are very much going to adversely affect medical care.

Because as the previous speaker pointed out, this is a very difficult process and, in some places, especially and I can tell you in NRC Regions having been an RSO there for about 35 years, you can

end up having an individual not being on the license on the order of about 6-9 months to get the process corrected. And that is not good. Thank you.

MS. AYOADE: Thank you.

MS. VALENTIN-RODRIGUEZ: Thank you. All right, Ashley, you have your hand raised? Sorry, Sarah.

MS. LOPAS: No, all good.

MS. COCKERHAM: Yes, hello, Hi Ralph, I didn't know you were still around. I thought when you graduated from ACMUI, you got to move on. But good to hear you.

MS. COCKERHAM: Wanted to echo some of what Ralph said.

As the person who is physically tracking down the documentation for an interventional radiologist to become an authorized user for Y-90 microspheres, I can tell you it is next to impossible, if not impossible, to gather, the ABR certification covers the diagnostic radiology experience and the interventional radiology experience, and I don't see that going away because they're still going to issue those certificates.

But the issue is that AU eligibility stamp. And, that accounts for 80 hours of specific nuclear

medicine training.

And, if a physician has been out of their residency or a fellowship program for any amount of time, there is no way to go back and get a hold of that documentation, and get those logs, and put that together.

And, then the probability of it being put together in a way I believe that it was Matt Barrett that said it, in a way that would be acceptable to the regulator, also doesn't happen.

And I don't think that I've ever actually gotten any amendments through using the alternate pathway, and that's literally my job right now.

And, as a former regulator, I would hope if someone could do it, that it would be me. But it's a behemoth task. And so this is a huge hit.

And I know that that's speaking just specifically to Y-90, but the issue that it could affect radiation oncologists, interventional radiologists, the RSOs, the authorized medical physicist, I think is going to be a big problem beyond 2023.

MS. VALENTIN-RODRIGUEZ: Thanks, Ashley, and we do recognize that.

Matthew Barrett, I believe your hand is up?

MR. BARRETT: Yes, I was just --

MS. VALENTIN-RODRIGUEZ: Okay.

MR. BARRETT: -- going to ask. I mean obviously we're all sort of on the similar opinion that this is. And I was just curious because people actually have been asking me. What was the plan?

I mean, I am thinking that since the NRC, and pretty much everybody recognizes that getting all of the alternate pathways, aside from like a board certificate could be very difficult, are you thinking and I'm just curious, is that maybe you get rid of the AU designation, but the board certificate without the stamp would be acceptable?

Or is there any sort of board certificate that you guys were thinking would be acceptable? Or are you thinking of only putting guidance down, and a board would be one part, and then you'd still need other documents?

I'm just sort of trying to understand what roughly, is the thought process. I mean, I know rules have been made, but is there a guidance where you would say a board would only satisfy like, one part of the training, but you, because you're getting rid of the AU issue. So, you would also need this, this, and this.

I'm trying to figure out what exactly the

thought is on the particular requirements that are needed, if an AU eligible stamp is no longer available. Would a non-AU eligible certificate work?

And, so as one person said, an old non-AU eligible, and then a maintenance sub-certification, would that work, and we're just getting rid of the AU eligible stamp?

Or there is, you have to go through and put out your entire 313A form, and all of the training, even if it was done 20 years ago? Or, what, I'm just trying to figure out.

Because I think we all agree without that board certification, there are a lot of people, it's going to put a lot of people in difficult straits.

So, what was the thought process and planning? Because maybe we're getting excited over something because you guys have already thought through it and you're thinking, oh no, we'll just modify and we'll accept the board certification without the stamp. Or something.

So, maybe all of us getting worried about a non-AU eligible or AMP eligible stamp wouldn't be that big of a deal.

Thank you.

MS. VALENTIN-RODRIGUEZ: Thanks for the

comments.

I mean, at this point, I think it's too early to tell. We got direction from the Commission about the no changes to the T&E requirements, and the need for implementation guidance, a few months ago.

And, we just learned about ABR's intention to terminate, and I'm sorry, my light went off in my office, I think a week ago, if Maryann can correct me.

So, I think that we weren't planning on this, and we can't force ABR to maintain their board recognition.

So, I think we're in a spot where we really have to brainstorm about where we are within our process, and what's the flexibility that are afforded by our current regulatory framework, since the Commission did not approve any changes to the current training experience requirements. So you'll --

MR. BARRETT: Got it.

MS. VALENTIN-RODRIGUEZ: -- yes. You'll have to wait and see.

And, you'll get more from us, but at this time, we're not ready to respond to that question because we're in, in the information gathering stages right now.

MS. AYOADE: Yes, Celimar, this is Maryann.

MR. BARRETT: Thank you.

MS. AYOADE: We did receive the formal letter of intent from ABR, as Celimar had mentioned, on March 29th, last week.

And, as she said, the tasking from the Commission on implementation guidance, was before we got news of this.

Currently, the only pathways that we have are the board certification pathway, and the alternate pathway. And, then there's the pathway that exists for physicians that are already listed on a license.

And so those are the pathways that we have for what you proposed. That's something that can be, that could be considered but it's not something that exists for a specialty board that's not recognized to come in with that, with their certificate and then have that in addition to the maintenance of certificate. I think that's what you proposed.

But currently, our pathways don't allow for, we don't have a pathway that speaks to that what you proposed.

MR. BARRETT: Thank you very much.

MS. VALENTIN-RODRIGUEZ: Melissa, and I think then Dr. Metter?

MEMBER MARTIN: This is Melissa Martin.

I would just like to request that when all of the considerations are being done by the evaluation of boards that will qualify people to practice as an authorized user, I would like to support the request that came from other people that have spoken up.

That recognition of the ABR, with or without the AU stamp on it, be one of the pathways considered by evaluating basically the ACGME curriculum that is used.

The other thing that I really just want to say at least from my experience, this will create a really shortage of radiation safety officers.

There's already a problem trying to get people authorized to be radiation safety officers. And, I think that's just one of the considerations the NRC staff is going to need to look at is, what is going to qualify someone? Which curriculum, which certifications will qualify someone to serve as an RSO?

MS. VALENTIN-RODRIGUEZ: Thanks, Melissa. Dr. Metter?

CHAIR METTER: Yes, thank you.

I just have a question. Is the ABNM the still going to be able to use, their diplomates of that board certification, be able to use that for authorized user?

MS. AYOADE: Hi, Dr. Metter, this is Maryann Ayoade, from NRC and yes, we still have the ABNM, we still recognize certificates from them for I believe it's diagnostic radiology, and radiation oncology.

CHAIR METTER: Thank you.

MS. AYOADE: Celimar, this is Maryann. The ABNM we recognize for the nuclear medicine specialty area. I want to correct that. Sorry.

CHAIR METTER: Yes, it's for nuclear medicine.

MS. AYOADE: I was thinking about ABR.

MS. VALENTIN-RODRIGUEZ: Thanks, Maryann.

I don't see any other hands raised, Dr. Metter, from the public or the ACMUI, or the NRC staff.

CHAIR METTER: Well, thank you very much. Oh, I think Dr. Jadvar?

MEMBER JADVAR: Yes, very quick question. So, do we know why ABR is doing this?

MS. VALENTIN-RODRIGUEZ: I think the --

(Simultaneous speaking.)

MEMBER JADVAR: Any ideas?

MS. VALENTIN-RODRIGUEZ: -- what they said in their letter is that this takes a lot of resources, and it takes away from their time and resources for, to focus on the examination and customer

service. But Maryann, I don't know if they provided additional details to you?

MS. AYOADE: No, that's pretty much it. They said that they looked at their mission, and their role.

And, also as Celimar mentioned, that they are putting a lot of time and resources into other things, including the way they do their examinations, remote examinations. And so it sounds like it's a resource thing on their end.

CHAIR METTER: I think there's another question.

MS. VALENTIN-RODRIGUEZ: Yes, there is.

Let's see if I can get to it. So, Bette Blankenship, or Betty Blankenship. You can go ahead and unmute.

MS. BLANKENSHIP: Hi, thank you. This is Bette Blankenship. I just wanted to add to the conversation that I think we're all shocked with the ABR's determination.

However, for radiation safety officers, the American Board of Medical Physics, will continue to be providing radiation safety officer certification, board certification. Just wanted to let the group know that.

MS. LOPAS: Thank you.

MS. VALENTIN-RODRIGUEZ: Thank you. And I think one thing that is very clear to the NRC staff, and we should probably provide the feedback that we got today from you all, to ABR. So, we plan to do that. So, I appreciate the thorough feedback.

CHAIR METTER: Thank you.

Thank you for your presentation and for others that participated. And this really last discussion, which is very important.

So, our next item on our agenda is the Open Forum. So, we have any comments or some topics of interest that the ACMUI would like to bring up for the next meetings.

Yes, Mr. Green?

MEMBER GREEN: Yes, Dr. Metter. I'm probably going to butcher this, so please bear with me. I believe it's the Appendix to Part 30, which was quite antiquated and didn't have all the modern nuclides we're using today in medical practice. And, even has some typos in it.

Is there a timeframe, and this may just be someone to refresh my memory. Is there a timeline for that to be updated with, you know, for example, we went through this whole process with Germanium

Financial Insurance warranty bonds, and decommissioning funding plans, and all that.

Because there was not on the list. Is that list pegged to be revised?

CHAIR METTER: Can someone at NRC help with this?

MS. VALENTIN-RODRIGUEZ: I believe we have a current effort for rulemaking plan to update Schedule B, in Part 30. Is that what you might be referring to? If not, Mr. Green, I can take it back and get back to you.

MEMBER GREEN: Yes, I believe it is Appendix B to Part 30.

MS. VALENTIN-RODRIGUEZ: So, yes, so Schedule B, which is 10 CFR 30.71, we do have an effort right now with the staff, and we're working on a rulemaking plan to provide the Commission with recommendations on that.

MEMBER GREEN: Great, thank you. Glad to hear that.

MS. VALENTIN-RODRIGUEZ: So, I can get back to you on the timing of that, when we expect to issue that to the Commission. The medical team is supporting, but it's the effort is being led by another group.

MEMBER GREEN: Will that be routed to ACMUI

for comments?

MS. VALENTIN-RODRIGUEZ: We can certainly take that back.

MEMBER GREEN: Thank you.

CHAIR METTER: Thank you.

Any other topics or other things to suggest for future discussion? Okay, seeing none, shall we proceed to the administrative closing with Mr. Lowman to present a meetings summary, and the proposed dates for the fall 2022 meeting?

MR. LOWMAN: Thank you, Dr. Metter.

So, yes, for the fall meeting, we always like to hold that in conjunction with the ACMUI Commission briefing. This year we're looking at three dates. One in September, one in November, and one in December.

We'll pick two dates for the fall meeting and after the meeting, will provide staff in the office of the secretary with dates and hopefully, they will be able to align with one of our proposed dates for the fall meeting.

So, for September in yellow we have the 19th and 20th. I sent that out via Doodle poll. So, that can definitely be one of our dates.

So we need to focus on these two dates in

November and December. And, in red are holidays or federal holidays, or religious holidays.

And, we all, you know, I know that the preference is to have the, since this will be in person, to have it on a Monday and a Tuesday.

And, the month of October was out just due to all the meetings and holidays.

MEMBER MAILMAN: I would say that November 28th, this is a problem for us on the West Coast because November 27th is one of the largest travel days on the planet.

MR. LOWMAN: Right.

MEMBER JADVAR: And, also it's --

CHAIR METTER: It's RSNA week, isn't it?

Go ahead.

MEMBER JADVAR: 28, 29 is also RSNA.

CHAIR METTER: That's exactly what I was going to say. 28th and 29th is RSNA week.

MEMBER JADVAR: Yes.

MR. LOWMAN: How about the 5th and 6th of December?

MEMBER JADVAR: That's right after RSNA. So, I guess we can come from Chicago, directly to Washington.

MEMBER MAILMAN: Clearly better than

November. But yes, I think September we all liked, and December is possible.

MEMBER JADVAR: Yes, I agree.

CHAIR METTER: Yes. But for December 5th and 6th, who will not be able to make it?

Melissa, is that you?

MEMBER MARTIN: No, I'm fine.

CHAIR METTER: Oh, okay, you had --

(Simultaneous speaking.)

MEMBER MARTIN: That's after RSNA. I just flagged it with RSNA week was the 28th and 29th. No, the 5th and 6th would work. There's going to be several of us literally going from Chicago to Washington.

CHAIR METTER: Dr. Jadvar, your hand is up?

MEMBER JADVAR: Sorry, I will bring it down.

CHAIR METTER: Okay.

So, it looks like we don't have anybody who cannot make December 5th and 6th. We might just have it, there are two dates there.

MR. LOWMAN: Okay, well, that's good and hopefully the Commission will be available on the September dates, so everything will work out for the best.

MEMBER OUHIB: September is the hurricane

season down in Florida. It's how they get away.

PARTICIPANT: Or maybe it's good to get away.

MEMBER OUHIB: That's true, too.

CHAIR METTER: Okay, just to summarize then. For September, it will be September 19th and 20th, and for December, December 5th and 6th.

PARTICIPANT: Correct.

MR. LOWMAN: Correct.

MR. EINBERG: And, September 19th and 20th is the preferred date?

PARTICIPANT: Correct.

CHAIR METTER: Yes.

MR. EINBERG: And, the reason I ask is because December, you know, we can start having winter weather here in early December.

MEMBER GREEN: December dates kind of makes the fall meeting a misnomer.

PARTICIPANT: Not until the 21st technically.

CHAIR METTER: Right. So, it looks like we have these dates, and any other administrative concern, Mr. Lowman?

MR. LOWMAN: Other than I'd like to mention as a reminder, that any comments we received in writing

will be appended to the transcript.

And, that's all I have, Dr. Metter.

CHAIR METTER: Okay, I see Melissa Martin has her hand up?

MEMBER MARTIN: Oh, that's a mistake.

CHAIR METTER: Okay. All right, so if there are we, have any other issues to bring up, Mr. Einberg?

MR. EINBERG: I don't believe so. And, I was just thinking are there any open items, or action items, that we took away?

I know that we talked about giving feedback to the ACMUI, on our board certification review. We'll be doing that as a part of our normal activities. So, I don't think we need to track that.

But Don, or anybody else on the NRC staff, did you catch any other open items, or actions items?

MS. VALENTIN-RODRIGUEZ: No, Chris. I think the ones we discussed, we're already tracking in some manner.

MR. EINBERG: Okay, so I don't believe there was anything else then, Dr. Metter.

CHAIR METTER: Well, thank you very much, Mr. Einberg.

So, it looks like this concludes the 2022 spring meeting of the ACMUI. I would like to thank

the NRC staff, the ACMUI members, and all meeting presenters, and the public for their participation.

An important discussion of regulatory issues that came up today, particularly our Y-90 therapies. And the information on minimizing medical events regarding Y-90 therapies.

Also, I'd also like to thank today the Council on Radionuclides and Radiopharmaceuticals, for their input on the NIST Radioisotope Measurement Assurance Program.

And the NRC staff on the ACMUI reporting structure. Medical and non-medical related events, the latter presented by Mr. Sheetz. And, then a medical team update.

And lastly, my sincere appreciation for the contributions and service for Dr. Vasken Dilsizian. He will dearly be missed.

So, until next time, hopefully we look like we'll be, hopefully we'll meet in the fall in person in D.C. Does that look pretty good, Mr. Einberg?

MR. EINBERG: It does. Let's keep our fingers crossed.

CHAIR METTER: We should have a little celebration there.

MR. EINBERG: Yes.

CHAIR METTER: Anyway, any final comments for anyone?

MR. EINBERG: So, yes, on behalf of the NRC again, I'd like to thank the ACMUI members, the presenters, excellent presentations, the NRC staff.

There was an excellent discussion today on a myriad of topics, and a lot for us to take back as well, as far as the NRC staff, a lot to consider.

Excellent feedback on the ABR certification discussions. And, so we have our work cut out for us as well.

But once again, thank you everybody.

CHAIR METTER: Okay, everybody and last thing, happy Easter.

(Whereupon, the above-entitled matter went off the record at 4:48 p.m.)