UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

March 16, 2021

MEMORANDUM TO: Christian Einberg, Chief
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Office of Nuclear Material Safety and Safeguards

FROM: Sarah L. Lopas, Project Manager
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SUBJECT: SUMMARY OF DECEMBER 8, 2020, U.S. NUCLEAR REGULATORY COMMISSION PUBLIC MEETING ON RADIOPHARMACEUTICAL EXTRAVASATIONS

Meeting Identifier: 20201329

Date of Meeting: Tuesday, December 8, 2020; 2:00 p.m. EST

Location: Webinar

Type of Meeting: Category 3

Purpose of the Meeting: To provide a brief background information on the U.S. Nuclear Regulatory Commission (NRC) staff's planned evaluation of whether radiopharmaceutical extravasations should be reported as medical events, and to obtain medical community and stakeholder feedback on the issue in order to help inform the staff's evaluation.

Background Information: In a 1980 rulemaking (45 FR 31701), the Commission made the policy decision not to require licensees to report extravasations to the NRC, stating: "Extravasation frequently occurs in otherwise normal intravenous or intraarterial injections. It is virtually impossible to avoid. Therefore, the Commission does not consider extravasation to be a misadministration." New radiopharmaceuticals and advances in therapies since the Commission decision have prompted the NRC to re-evaluate whether extravasations should be reported as medical events.

Additionally, on May 18, 2020, Lucerno Dynamics submitted a petition for rulemaking (PRM-35-22) requesting that the NRC revise its regulations to require medical event reporting of extravasations that result in a localized dose equivalent exceeding 50 rem. The petition asserts that this reporting will not only alert the NRC to instances of serious misuse of byproduct

material, but also will incentivize practitioners to improve injection and infusion quality, ensuring that nuclear medicine patients are protected from unavoidable irradiation and given access to information to understand when and how medical events impact their care. The NRC Medical Radiation Safety Team's evaluation of extravasations is separate from Rulemaking staff's evaluation of the merits of the petition for rulemaking, but it will help inform the Rulemaking staff's recommendation to the Commission on whether to accept or deny the petition for rulemaking.

General Details: The NRC published the official public meeting notice on November 16, 2020, providing the agenda and webinar registration instructions for attendees (Accession No. ML20321A247). The meeting was conducted remotely via webinar and began at 2:00 p.m. EDT with a 20-minute presentation by NRC staff on some background information about radiopharmaceutical extravasations, the staff's ongoing evaluation of whether extravasations should be reported as medical events, and the petition for rulemaking and congressional interest on the matter. The staff then walked through a series of discussion questions related to injection quality monitoring, classification of extravasations as medical events, reporting extravasations as medical events, and other considerations. The staff's slide presentation is available in ADAMS at Accession No. ML20338A283. Following the staff's presentation, the meeting was then opened to receive public comments. Approximately 275 people participated in the meeting. A list of NRC and external meeting participants is enclosed. The meeting concluded at 4:06 p.m. EST. The staff has summarized the comments received and a transcript of the meeting is available in ADAMS at Accession No. ML21012A446.

Summary of Comments Received:

Opposition to Regulating Radiopharmaceutical Extravasation

The majority of commenters were medical community members (physicians, nuclear medicine technicians, medical physicists, radiation safety officers, etc.) who strongly opposed regulating radiopharmaceutical extravasations. Broadly, commenters stated that significant injury from extravasation was extremely rare, requiring monitoring for extravasation would not prevent extravasation from occurring, and requiring extravasations to be reported as medical events would create undue regulatory burden for licensees without any improved safety benefit for patients.

Several commenters stated that there was no technology that would prevent extravasation from occurring, and that monitoring would allow clinicians to start corrective actions earlier, but it would not prevent extravasation. Another commenter stated that the only technology that could prevent extravasation is the use of a central line into a major vessel, and that most physicians who manage patients reserve central lines only for nutrient or lifesaving techniques, and so "there effectively is no technology other than care." One commenter reiterated that nursing best practices are being implemented in nuclear medicine departments. They stated that there has been a reduction in the "straight stick" injection technique and the use of butterflies and IVs reduce the likelihood of extravasation. Another commenter elaborated that while no technology exists to prevent extravasations, "we rarely have extravasations because we utilize catheters, such as angiocaths, to establish IV access rather than performing direct sticks."

Commenters stated that monitoring would not improve intravenous (IV) administration technique, which is a practice of medicine issue and is within the scope of practice for nuclear medicine technologists. Commenters also concluded that regulatory action requiring monitoring and reporting would not improve rates of extravasation.

One commenter who represents the Technologists Section of the Society of Nuclear Medicine and Molecular Imaging (SNMMI) stated that acting patients' overall experience and satisfaction in the care they are extravasations are undesirable outcomes of injections, sometimes resulting in the need for another injection or even having to reschedule the patient to return, and that they have a significant detrimental effect on image quality as well as negatively impacting the patient's overall experience and their satisfaction in the care they are receiving. The commenter continued by saying that nobody wants to see an extravasation, but that regardless of the extra steps and care a clinician may take, extravasations can still occur. The commenter noted that nuclear medicine patients are often seen many times over for follow-up care after a procedure, and that in the commenter's and her colleagues' many years of experience as nuclear medicine technicians, they had seen no evidence that diagnostic radiopharmaceutical extravasation causes harm to patients. However, the commenter stated they represent SNMMI, an organization focused on safety and quality of practice, and that they support ensuring that all technicians understand the effect of extravasation on quality and accuracy of patient studies. Therefore, the Nuclear Medicine Technologist section of SNMMI was proposing a quality initiative that would reiterate the importance of quality injections, revisiting best practices and discussing technical considerations for optimizing venipuncture procedures. The commenter closed by stating that the issue of radiopharmaceutical extravasation is best addressed at the institutional level, and that regulatory action is not appropriate at this time. This opinion was echoed by other commenters, who repeated that extravasation is best managed locally at the institution level as a quality improvement process initiative.

Another commenter identified themselves as a physician who participated in a study sponsored by the PRM-35-22 petitioner. The commenter began by stating that in their experience, extravasation of radiotracers has never caused a medical problem, and they did not believe extravasation should be regulated. The commenter stated that while the petitioner's monitoring technology is a technological improvement, monitoring for extravasation would not prevent extravasation. The commenter continued by saying they supported the other medical professional societies (SNMMI, American College of Nuclear Medicine, and the American Society of Nuclear Cardiology) in their opinions that extravasation is a practice of medicine issue that does not require regulation. The commenter stated that reporting extravasations as medical events would not improve or impact patient safety, and unnecessary medical event reporting could actually divert resources away from more important safety issues.

Another commenter, who is a former member of the NRC's Advisory Committee on the Medical Uses of Isotopes (ACMUI), emphasized the lack of clinical consequences of radiopharmaceutical extravasations and pointed out the distinction between regulatory oversight and practice of medicine. The commenter acknowledged that the major impact of extravasation is the potential compromise to the quality of a diagnostic scan, however, this is a practice of medicine issue that is beyond the scope of regulators and regulatory action. The commenter said that requiring extravasations to be reported would be a "slippery slope" in terms of regulators adjudicating quality of scans and measures by clinicians to improve the quality of scans. The commenter closed by reiterating that over-regulation and intervention by regulators into medical practice is one of many reasons to reject PRM-35-22.

One commenter noted that at their medical facility, a new monitoring procedure is in place for Lutathera® therapy to allow for quick initiation of actions to minimize potential skin dose in the event of extravasation. Another commenter noted that their facility does not monitor for extravasation, because that would add significant time to the patient imaging procedure, and that for therapies, it would require finding "camera time," which is not normally included for

therapy patients. Another commenter said they monitored for extravasation through routine imaging, and if there was “pooling,” it would be found on the images.

A commenter discussed how a partial or full extravasation can be caused by patient intervention, and that this is especially an issue for pediatric nuclear medicine, where a specialized team dedicated to pediatric venipuncture is used to establish IVs in young patients. The commenter worried that if extravasations were classified as medical events, it would have a chilling effect and discourage physicians from going into nuclear medicine, especially pediatric nuclear medicine. The commenter also noted that external beam radiation therapy often causes wet burns, i.e., wet desquamations, and “These things happen every day all over the nation. It’s one of the side effects of radiation therapy. Nobody reports them.” And these burns are a “far, far bigger problem than anything in nuclear medicine,” and they are handled at the hospital-level and are not regulated.

A current member of the NRC’s ACMUI who is not a member of the extravasation subcommittee provided comments opposing the regulation of extravasation. The commenter noted that there are multiple mechanisms that exist to evaluate and promote the safe administration of radioactive materials within the broader scope and practice of medicine, including regulation and monitoring by the Centers for Medicare and Medicaid Services, the U.S. Food and Drug Administration, and the Joint Commission on Accreditation of Healthcare Organizations. In the case of the Joint Commission, the commenter said that the healthcare environment is routinely evaluated, including documented training, continued education, and competencies of staff—which includes the handling of IV lines, administration of pharmaceuticals, medication management, etc. Under these quality initiatives, injection quality techniques by staff or larger process problems are investigated and remediated, and that this would certainly include any issues related to compromised IV lines or painful extravasations, and would include incident reporting, root cause analyses, and corrective and preventative action plans. The commenter went on to explain that they believed that the majority of extravasations are due to patient movement and vascular access issues, and not clinician error, and that revising the NRC rules to require monitoring, evaluation, and dosimetry for every extravasation “would impose significant burdens to healthcare institutions which already have varied processes in place to minimize extravasation and/or clinical practice issues.” The commenter then mentioned an often-cited study that indicates there are minimal adverse effects from diagnostic extravasations. The commenter cited another study that “concluded that the incidents of radiopharmaceutical adverse events was 2.1 for every 100,000 administrations.” The commenter stated that PRM-35-22 conflates diagnostic extravasation with extravasation of higher-dose therapies and the effects of vesicants in chemotherapy, and that studies support the conclusion that there are very few incidents of severe tissue damage related to even therapeutic extravasations. The commenter went on to note that tissue damage often heals without complication and no treatment is necessary. The commenter closed by saying that the petitioner’s injection quality monitoring device would be welcome as a quality improvement and educational tool, but that a rulemaking to require extravasations be reported as medical events would be inappropriate and unnecessary given quality improvement opportunities and practices already under the broader scope of medicine.

Another commenter strongly opposed any rulemaking related to extravasations and reiterated the low risk associated with diagnostic nuclear medicine procedures and the low probability of untoward consequences, unlike CT extravasations where large contrast loads can result in skin sloughing and compartment syndrome.

Another current ACMUI member, also not on the extravasation subcommittee, opposed regulating extravasations and stressed that the NRC needs to carefully assess the impact of any additional regulations. The commenter cited the chilling effect of undue regulatory burden, discouraging physicians from performing these types of nuclear medicine procedures. The commenter stated that instead of regulations, the medical community needed to focus more on better training, education, and quality management programs to create awareness, improve injections, and minimize extravasations.

A commenter said that the benefits of nuclear medicine procedures outweigh the potential risks related to extravasation, and that if additional regulation is put into place, the benefits to the patient could easily be lost because nuclear medicine traditionally operates on a "thin margin" and the COVID-19 public health emergency has reduced revenues of medical centers by billions of dollars. The commenter closed by saying that adding regulatory cost without a clear benefit would be harmful to the nuclear medicine field, and that the current regulatory structure is appropriate as it "perfectly balances risk and benefit."

A nuclear medicine physician and radiation safety director associated with the Department of Veterans Affairs expressed "deep" concerns about any effort to regulate extravasations, saying it would place an undue burden on Veterans Affairs nuclear medicine departments and radiation safety officer staff throughout the nation without any clinical care benefit to be gained.

Another commenter cited that there were roughly 20 million nuclear medicine procedures per year, and that could result in about 200,000 medical events, and that the NRC needed to carefully consider the regulatory burden associated with a rulemaking to make extravasations reportable as medical events. The commented also noted that the problem with using a dose-based criterion is that dosimetry assessing extravasation would not be a "trivial exercise," due to the unknown volume of extravasate and varying concentration of radioactive material into some sort of interstitial tissue. The commenter said that the dose estimate methods discussed in the studies referenced by staff and previous commenters were kind of a "shot in the dark, right, because there's no good data on how quickly it was absorbed. There's not good data on the geometry." The commenter reiterated that the NRC needed to consider these practical considerations, or the "applied health physics evaluation," for how licensees would conduct dosimetry in order to screen out most extravasations, that most licensees don't have the resources to conduct complex dose reconstructions. The commenter noted that even planar imaging to estimate extravasation dose may be problematic. The commenter suggested that perhaps instead the criteria should be patient injury or something similar.

A former member of the NRC's ACMUI made a comparison of extravasation skin doses to skin doses from interventional radiology, which are typically several Gray or hundreds of rads, and when there are observable skin effects, they are "mild, transient, and self-limiting." The commenter stated that extravasations, especially when mitigation measures are taken, have little-to-no clinical effects. The commenter cited another nuclear medicine therapy that involves "intentional" extravasation, and "there's no documentation at all of any adverse skin or other effects." The commenter stated that extravasation should be put into these perspectives, and that additionally, "estimating radiation dose from an extravasated radiopharmaceutical is far from trivial." The commenter closed by saying there was very little basis for regulatory oversight and categorizing extravasations as medical events.

A patient advocate commenter echoed concerns about a chilling effect on nuclear medicine, wondering what would happen to patient access to these procedures if additional regulation required the reporting of 100,000 or more medical events. The commenter wondered how

licensees and regulators would go through the data, and what expense would that add to patient care and availability of treatments. The commenter thought that some facilities would choose to discontinue procedures requiring that level of reporting. The commenter closed by saying that harmful extravasations should be reported, but even in that case, it appears the appropriate response would be to focus on increased training.

An Agreement State representative stated that monitoring for extravasation should not be required by regulators, but perhaps it should be a corrective action post-medical event. The commenter went on to say that a clinician will know if they had an extravasated dose or not. Another commenter noted that other types of extravasation, such as those of chemotherapy agents—which can result in a medical issue—cannot be monitored and or always prevented, and wondered why regulators would be concerned about radiopharmaceutical extravasations because those can be detected with imaging.

One commenter thought that therapeutic extravasations would be reported under the current regulations if it caused “unintended permanent damage,” and noted that extra care is taken when administering therapeutic radiopharmaceuticals, but such events may happen regardless. The commenter went on to say that the outcome of such events would depend on the activity deposited at the injection site and the removal rate, which cannot be predicted. Another commenter followed up by saying that dose estimates are theoretical, “ultimately the skin will be the dosimeter,” and those results may not be fully appreciated until months later. Another commenter noted that dose estimation would have to be done using some Monte Carlo-based software, because you couldn’t assume it was just a point-source at the injection site.

Numerous other commenters reiterated the difficulty that most nuclear medicine facilities would have with dosimetry for extravasations, especially facilities in a community setting where they do not have access to a medical physicist to perform these types of very lengthy and involved calculations. Another commenter elaborated on problems with a dose-based criterion for reporting extravasations as medical events: “One problem with the dose-based definition is that nature of extravasation itself. Every patient has a different habitus, different rate of diffusion, different volume of extravasate, different agent, and different activity.” Another commenter noted extravasations that could exceed a 50-rem dose criterion “seems to be a very miniscule portion of nuclear medicine radiopharmaceuticals on the market.” Another commenter stated that it is very difficult to pinpoint why an extravasation occurs, and that some patients just have weaker blood vessels and are more likely to experience extravasations. The commenter went on to say that that they did not support any changes to the regulations but if the NRC required extravasations to be reported as medical events the agency would need to provide guidance on methods to calculate skin dose.

Another commenter said that medical event reporting is not a process improvement mechanism but rather a punitive system, involving public reporting of event information within 24 hours, and (for NRC licensees, at least) triggering a reactive on-site inspection. The commenter said that extravasations are already handled by internal processes for quality improvement.

Another commenter pointed out that every medical procedure has risks, and the physician is responsible for explaining the risks and benefits to the patient, and the patient accepts or not. Another commenter pointed out that repeat scans are uncommon, and that it would be practically impossible to implement a specific threshold for reporting extravasations. This commenter went on to explain that their facility implements ongoing quality control/quality improvement initiatives, where they monitor for extravasations and address them as part of the

practice of medicine. The commenter then stated that they believed PRM-35-22 was an attempt to generate sales of the petitioners' technology.

Support for Regulating Extravasations

One commenter stated that there is technology that can prevent extravasation, and pairing that with quality improvement processes would improve injection administration techniques. This commenter supported regulating extravasations, staying that is would be appropriate and ethical. They continued by stating that data had been submitted to the NRC showing that extravasations are not rare, and questioned how anyone could assert that that patients are not harmed when clinicians have not measured the extravasation doses? "Absence of evidence is not evidence of absence." The commenter said that the way to determine whether extravasation is harmful is to monitor and measure to collect data, and that monitoring for extravasations would provide feedback that would allow clinicians to improve their technique. The commenter acknowledged that monitoring alone would not be adequate, but it was the only place to start. The commenter also clarified that monitoring for radiation exposure was not about adjudicating the quality of the imaging scan.

Another commenter identified themselves as a retired quality/compliance vice president for a large medical device company, and that a "40-year pass" for extravasations that could result in a dose larger than the current reporting requirements for medical events seems wrong. The commenter said that while monitoring for extravasations may never completely prevent an extravasation, it does offer data that could be used for improvement through feedback and training, which would ultimately be better for patients. The commenter suggested that medical event reporting requirements could be delayed while clinics improved their practices, if needed, so that concern about regulatory burden could be minimized. The commenter closed by stating that it seemed "very inappropriate to not want to improve, especially for the patients."

A nuclear medicine patient commenter explained their serious concerns about how extravasations are allowed to go unreported, but if the same dose of radiopharmaceutical was "spilled on the skin" it would require reporting. The commenter strongly supports regulating extravasations because they believe even a one percent extravasation rate is too much, let alone a 15 percent rate, and this issue is about patients.

Other Comments

David Crowley, Chair of the Organization of Agreement States, noted that some Agreement State radiation control programs do require medical event reporting of extravasations that exceed the current dose criteria, it's just the NRC that excludes them from the definition of medical events. Mr. Crowley encouraged licensees to reach out to their Agreement State programs to determine how extravasations should be reported to the Agreement States.

One commenter asked for more details regarding Congressional interest in extravasations. NRC staff noted that most of the interest came from lawmakers representing North Carolina.Letters were received from Senator Thom Tillis (NC) (ADAMS Accession No. ML19311C468); Representative David Price (NC) (ADAMS Accession No. ML19353C961); Representatives Price, Butterfield (NC), and Holding (NC) (ADAMS Accession No. ML20182A224); and comments supporting PRM-35-22 from Senator Tillis (ADAMS Accession No. ML20272A044) and from Representatives Price, Holding, Butterfield, Cline (VA), Riggleman (VA), and McBath (VA) (ADAMS Accession No. ML20336A268).

Another commenter questioned, “We are being told the events are common and the events are rare. Which is true?” The NRC staff responded that statistics from peer-reviewed studies show that overall rates of extravasation (of all pharmaceuticals) can range from 0.1 to 16 percent, however, what is rare is a radiopharmaceutical extravasation causing observable effects that require medical follow-up. Another commenter followed-up on this comment and stated that a meta-analysis from a 2017 European Journal of Nuclear Medicine and Molecular Imaging report showed radiopharmaceutical extravasation rates lower than one percent.

One commenter asked whether the NRC would be able to review the over 400 public comments received on PRM-35-22 by the end of January, when the NRC plans to provide a draft report on extravasation to the ACMUI. The staff answered that the comments were related to the petition for rulemaking, and the staff’s technical evaluation effort is separate from the petition review. However, the petition review working group in the NRC’s Division of Rulemaking is summarizing and responding to the petition comments, and they are keeping the Medical Radiation Safety Team staff informed of the comments. Another commenter noted that in PRM-35-22, some of the images maybe showed lymphatic uptake of the extravasated radiopharmaceutical, and any extravasation evaluation should consider absorbed dose beyond the point of injection to axillary lymph nodes. The commenter noted that an alpha- or beta-emitting radiopharmaceutical might give high exposure to the lymph drainage.

One commenter questioned whether the staff’s evaluation was considering just diagnostic administrations or also therapeutic. NRC staff clarified that the staff’s evaluation included looking at that issue, i.e., if extravasation were regulated, should the regulations be inclusive of both diagnostic and therapeutic injections, or just focus on one or the other.

Another commenter asked about ACMUI’s position on extravasation, which can be found in their final recommendation report at ADAMS Accession No. ML19316E067.

Two commenters stated that extravasations were already captured by regulations at 10 CFR 35.3045, “Report and notification of a medical event.” NRC staff clarified that extravasations are currently not required to be reported as medical events because a Commission decision in 1980 excluded extravasation from medical event reporting. The staff did note that as part of their evaluation, they are determining whether extravasations could fit under any of the existing medical event reporting criteria in 10 CFR 35.3045.

One commenter stated that they believed that the NRC staff collaborated with the petitioner and Congress, and that the NRC’s Inspector General should look into this. NRC management responded to this comment by stating that there was no collaboration on the part of NRC staff, noting that this commenter had submitted these concerns to the NRC previously and that the concerns had already been sent to the NRC’s Office of the Inspector General.

One commenter stated that the petitioner’s company approached their medical facility with their device and said that the company requested to collect patient information related to device use, which the commenter asserted was to sell patients’ personal information instead of determining the utility of the device, as the company maintained. A representative of the petitioner’s company responded to this commenter stating that the company did not request any protect health information and the “insinuation” that the company collects information in order to sell it is “categorically false.”

Next Steps: The NRC staff will determine whether extravasations should be reported as medical events, and if so, what is the appropriate reporting threshold for these events. The

NRC Medical Team staff is coordinating their review with NRC rulemaking staff, and will make a recommendation to the Commission on whether to accept or deny PRM-35-22. To stay updated on the staff's evaluation of extravasations and other medical regulatory items of interest, subscribe to the NRC's Medical List Server by sending an e-mail to Medical-GC.Resource@nrc.gov with the word "subscribe" in the subject line.

ENCLOSURE:
NRC Meeting Participants

U.S. NUCLEAR REGULATORY COMMISSION MEETING
ON RADIOPHARMACEUTICAL EXTRAVASATIONS

December 8, 2020

Meeting Participants

Maryann	Ayoade	U.S. Nuclear Regulatory Commission (NRC)
June	Cai	NRC
Vanessa	Cox	NRC
Said	Daibes Figueroa	NRC
Suzanne	Dennis	NRC
Daniel	DiMarco	NRC
Lisa	Dimmick	Medical Radiation Safety Team Leader, Presenter, NRC
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Monica	Ford	NRC
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Vincent	Holahan	NRC
Donna-Beth	Howe	NRC
Ian	Irvin	NRC
Janelle	Jessie	NRC
Penny	Lanzisera	NRC
Sarah	Lopas	Medical Radiation Safety Team, Facilitator, NRC
Pamela	Noto	NRC
Vered	Shaffer	NRC
Jill	Shepherd	NRC
Katie	Tapp	NRC
John	Tappert	NRC
Celimar	Valentin	NRC
Weijun	Wang	NRC
Duane	White	NRC
Duncan	White	NRC
Tara	Weidner	NRC
Lynnae	Wilkins	NRC
Irene	Wu	NRC
Robert	Ackermann	Michigan Medicine
Sukhjeet	Ahuja	SNMMI
Max	Amurao	
Janell	Anderson	North Dakota Dept. of Environmental Quality
Sheldon	Appell	Baxter
Christina	Arenas	
Jaime	Barnes	Cook Children's Medical Center
Rochelle	Batdorf	Ohio State University

Enclosure

Michael	Baxter	American Pharmacists Association
Cheryl	Beegle	National Institutes of Health
Michael	Bellamy	MSKCC
Kendall	Berry	Fox Chase Cancer Center
Bernard	Bevill	Arkansas Department of Health
Dmitry	Beyder	
Vihar	Bhakta	
Robert	Bicknell	New Mexico Environment Department
Jerry	Bingaman	State of Tennessee
Margaret	Blackwood	
Karen	Blanchard	Texas Department of State Health Services
Katherine	Boyd	VA NHPP
Becca	Branum	
Adam	Brown	
Andrew	Brown	Cardinal Health Nuclear & Precision Health Solutions
Haley	Brown	State of Nevada Radiation Control Program
Jeff	Brunette	
Tonia	Bryant	
Tina	Buehner	Society of Nuclear Medicine & Molecular Imaging
Susan	Bunning	MITA
Karen	Burgard	
Mary	Burkhart	IEMA
Paul	Burns	
David	Bushnell	VHA
Janice	Campbell	Beaumont Health
Philip	Campbell	University of Washington
Kari	Cann	
Paul	Carby	APhA
James	Carey	MPC, Inc
Todd	Carpenter	Oregon Health Authority
Cason	Coan	ADPH Radiation Control
Trisha	Coffman	
Thomas	Collins	NM Radiation Control Bureau
Jacqueline	Cook	U.S. Nuclear Regulatory Commission
Jim	Cordes	Neall Gross
Whitney	Cox	IEMA
Lee	Cox	State of North Carolina
Elaine	Crescenzi	PA DEP
Corey	Creveling	
David	Crowley	NC Radiation Protection Section
Bruce	Curran	VCU Health System
Randal	Dahlin	Iowa Department of Public Health
Miguel	de la Guardia	Cook Children's Med. Cntr.
Karen	Deibert	NDDEQ
Matt	Dennis	

Terry	Derstine	PA DEP
Lora	Deuitch	
Ariel	Doucet	Virtua
Jeff	Dovyak	Shared Health
Jacob	Edelman	Dana-Farber
Jamie	Eisenberg	
Deirdre	Elder	UCHealth
Jennifer	Elee	LDEQ
Jenna	Engelking	
William	Erwin	
Karl	F	
Lynne	Fairobent	FDA
Asfaw	Fenta	VDH
Erik	Finkelstein	NY City Dept of Health
Karen	Flanigan	NJDEP Radioactive Materials Program
John	Follette	State of Nevada Radiation Control Program
Beth	Franklin	Atrium Health
Scott	Fuller	
Sandy	Gabriel	
Drew	Garner	
Farrah	Gaskins	
Noelle	Geier	Froedtert & the Medical College of Wisconsin
Jen	Gersman	
Munir	Ghesani	
Cindi	Gilbert	
Judy	Glass	SLHS
Brian	Goldstein	
Jenny	Goodman	NJ Department of Environmental Radiation
William	Gorge	
Johnny	Graves	
Valerie	Gray	
Timothy	Greist	
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Nina	Gutierrez-Garcia	
Amir	H. Khandani	
Matt	Hadden	
Michael	Hall	Emory University
David	Hamby	Renaissance Code Development
Stanley	Hampton	Eli Lilly and Company
Barbara	Hamrick	UCI Health
Laura	Hanson	UAMS
Yvette	Harden	VA Ann Arbor Healthcare System
Billie	Harvey	

Hillary	Haskins	Oregon Health Authority - Radiation Protection Services
Xin	He	
Chris	Hernandez	Veterans Administration
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Kathleen	Hintenlang	
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Donna	Janda	
Dan	Januseski	
Janelle	Jesikiewicz	UPENN EHRS
Valerie	Jewells	UNC
Scottie	Jones	Hospital
Tracy	Jue	
Rebecca	Junod	U.S. Nuclear Regulatory Commission
Lori	Kaczmarek	Association for Vascular Access
Brian	Kelley	
Kassia	Kelly	
Jessica	Kendrick	FOX CHASE CANCER CENTER
Josh	Knowland	Lucerno Dynamics LLC
Arda	Konik	
Catalina	Kovats	Children's National Hospital
Christine	Krieman	
Sasikala	Krishnasarma	TDEC-DRH
Kevin	Kunder	FDOH Bureau of Radiation Control
Yuji	Kuzuhara	
Ian	Lake	
Sue	Langhorst	
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Samantha	Lav	
Georgia	Lawrence	
Ivania	Lazo	
Dao	Le	
Bryan	Lemieux	University of KY HealthCare
Sam	Leveritt	Cardinal Health NPHS #7120
Ramon	Li	CDPHE
Ralph	Lieto	
Samantha	Lockerby	Einstein Healthcare Network
Nancy	M Swanston	UT MD Anderson Cancer Center
Josh	Mailman	
Carol	Marcus	UCLA

Alicia	Mares	
Anna	Marks	
John	Martell	Washington State Department of Health
Jacob	Martin	
Richard	Martin	American Association of Physicists in Medicine
Melissa	Martin	Therapy Physics Inc
Jeff	Mason	
Nic	Mastascusa	University of Iowa Hospitals and Clinics
Osama	Mawlawi	MD Anderson Cancer Center
Candi	McDowell	University of Pennsylvania
Michelle	McGuirk	Allegheny Health Network
Josh	McIlvain	DTC
Tara	Medich	Massachusetts General Hospital
Heather	Merchantz	
Richelle	Millican	
Kathy	Modes	
Angie	Morgan Hill	Arkansas Department of Health
Les	Morrison	Kansas City VAMC
Mitchel	Muhleman	
Robin	Muzzalupo	IEMA
Regen	Newton	michigan medicine
Janice	Nguyen	
Jennifer	Noll	PA DEP
Jorge	OIdan	UNC-Chapel Hill
Brooke	Olson	NDDEQ
Elba	Orduna	Doctors' Center Hospital
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Zoubir	Ouhib	
SNMMI	OUTREACH	Society of Nuclear Medicine and Molecular Imaging
Alan	Packard	SNMMI
Virginia	Pappas	Society of Nuclear Medicine and Molecular Imaging
Ronald	Parsons	State of Tennessee-Radiological Health
Netra	Patel	
S	Perrin	
Michael	Peters	American College of Radiology
Tricia	Peters	Ridley-Tree Cancer Center
Phillip	Peterson	
Anastasia	Petrova	BD
Neil	Petry	
Josephine	Piccone	
Brooke	Pipes	
Carmine	Plott	Novant Health Forsyth Medical Center
Jacob	Powell	
Sandra	Ramirez	
Kimyli	Recca	

Steve	Regn	
Jennifer	Rice	
Joseph	Ring	Beth Israel Deaconess Medical
A. Robert	Schleipman	Mass General Brigham
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Gloria	Romanelli	
Michael	Rubadue	Ohio Department of Health
Manar	Sakalla	Medstar Georgetown
David	Scalise	NH DHHS
Tracy	Scherer	
Casey	Schmitz	University of Oklahoma Health Sciences Center
David	Schuster	Emory University
Katie	Scott	PA DEP
Brian	Serencsits	
Sheila	Shaffer	Beaumont Health System - Royal Oak Hospital
Michael	Sheetz	
Beth	Shelton	State of Tennessee
Aaron	Short	KDHE
Dominic	Siewko	Jubilant Radiopharma
Michelle	Simmons	
Roy	Sions	Saint Luke's Health System
Roger	Sit	University of North carolina at Chapel Hill
Eric	Skotak	Texas Department of State Health Services
Levi	Slager	
Susan	Slane	SJSlane Consulting
Michael	Snee	
Dan	Snyder	Geisinger
Jill	Southerland	KDHE
Nancy	Stanley	NJ Department of Environmental Protection
Kimberly	Steves	Kansas Dept of Health and Environment
Allyson	Stout	KY Department for Public Health, Division of Public Health and Safety
David	Stradinger	ND Dept of Environmental Quality
Glenn	Sturchio	Mayo Clinic
Susan	Suchan	
David	Switzer	
Andrew	Taylor	
Wendy	Terrenoire	
Judy	Thompson	
Michelle	Thompson	UPPI
Christopher	Tighe	University of Pennsylvania
Christopher	Tighe	University of Pennsylvania
Michael	Timmerman	Dartmouth-Hitchcock
Cindy	Tomlinson	ASTRO
David	Townsend	

David	Turberville	AL Office of Radiation Control
James	Uhlemeyer	KDHE
Richard	Wahl	Mallinckrodt Institute of Radiology
Paul	Wallner	
Deborah	Wenke	
Nancy	Wersto	FDA/HHS
William	White	Rush University Medical Center
Sharon	White	Univ. of Alabama at Birmingham
Kevin	Williams	
Mathew	Williams	MGUH
David	Williams	Thomasville Pediatrics
Sean	Wilson	Carilion Clinic
Melonie	Wissing	VHA Ann Arbor Healthcare System
John	Witkowski	UPPI LLC
Harvey	Wolkov	Sutter health
Terry	Wong	Duke University
Edward	Wroblewski	
Jason	Young	Mayo Clinic
Christin	Young	UVM Medical Center
Pat	Zanzonico	Memorial Sloan Kettering Cancer Center, Dept of Medical Physics
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