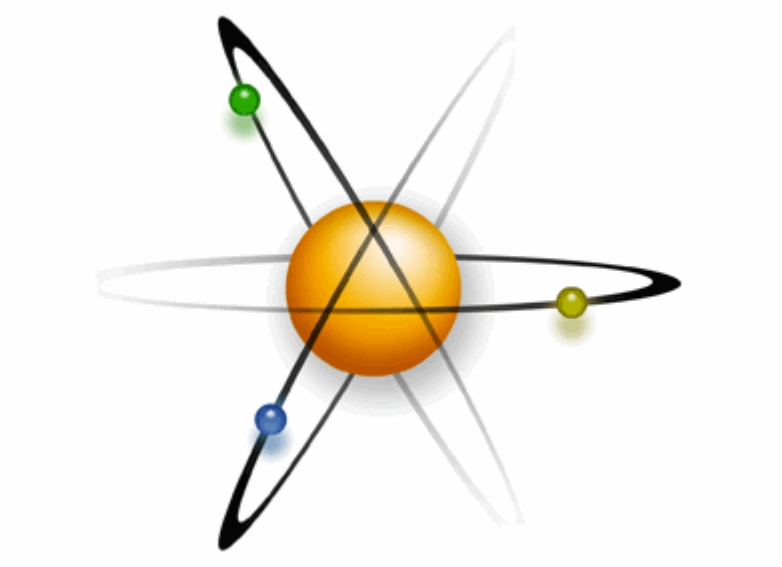
ADVISORY COMMITTEE ON THE MEDICAL USES OF ISOTOPES

FALL 2023 MEETING
OCTOBER 23-24, 2023

Meeting Handout



MEETING AGENDA
ADVISORY COMMITTEE ON THE MEDICAL USES OF ISOTOPES
October 23 – 24 2023
Two White Flint North Building (Meeting Room T2D30), Rockville, Maryland

NOTE: Sessions of the meeting may be closed pursuant to 5 U.S.C. 552b to discuss organizational and personnel matters that relate solely to internal personnel rules and practices of the ACMUI; information the release of which would constitute a clearly unwarranted invasion of personal privacy; information the premature disclosure of which would be likely to significantly frustrate implementation of a proposed agency action; and disclosure of information which would risk circumvention of an agency regulation or statute.

Monday, October 23, 2023 CLOSED SESSION		
9:00 – 10:00	**1. Badging and Enrollment**	**ACMUI**
OPEN SESSION		
10:00 – 10:15	**2. Opening Remarks** Mr. Einberg will formally open the meeting and Mr. Williams will provide opening comments.	**C. Einberg, NRC** **K. Williams, NRC**
10:15 – 10:30	**3. Old Business** Ms. Armstead will review past ACMUI recommendations and provide NRC responses.	**L. Armstead, NRC**
10:30 – 10:45	**4. Open Forum** The ACMUI will identify medical topics of interest for further discussion.	**ACMUI, NRC**
10:45 – 11:30	**5. Medical Events Subcommittee Report** Dr. Harvey will provide an analysis of FY21 and FY22 medical events.	**R. Harvey, ACMUI**
11:30 – 12:15	**6. Overview of NRC Requirements for Veterinary Release** Dr. Tapp will provide an overview of the NRC requirements and guidance for the release of animals administered radioactive material.	**K. Tapp, NRC**
12:15 – 1:30	**LUNCH**	
1:30 – 2:15	**7. ICRP Publication 153** Mr. Davila will provide an overview of ICRP Publication 153, Radiological Protection in Veterinary Practice.	**A. Davila, Tulane University**
2:15 – 2:35	**8. Financial Assurance for Disposition of Category 1 and 2 Byproduct Material Radioactive Sealed Sources** Mr. Whited will provide an overview of the rulemaking effort to revise the financial assurance requirements in 10 CFR 30.35 for the disposition of Category 1 and 2 byproduct material radioactive sealed sources.	**R. Whited, NRC**
2:35 – 3:20	**9. Recent Radiopharmaceutical Medical Events** Dr. Tapp will provide an overview of medical events related to the use of Lu-177 radiopharmaceuticals.	**K. Tapp, NRC**
3:20 – 3:35	**BREAK**	
3:35 – 3:50	**10. Special Recognition for Dr. Metter** Commissioner Wright will make a special presentation to Dr. Metter.	**Cmsr. Wright, NRC**
3:50 – 4:05	**11. Thoughts on Leaving the ACMUI** Dr. Metter will provide her farewell remarks to the Committee	**D. Metter, ACMUI**

	and to staff.	
4:05 – 4:20	**12. Open Forum** The ACMUI will identify medical topics of interest for further discussion.	**ACMUI, NRC**
4:20 – 4:35	**13. Administrative Closing** Ms. Armstead will provide a meeting summary and propose dates for the spring 2024 meeting	**L. Armstead, NRC**
	BREAK	
Tuesday, October 24, 2023 CLOSED SESSION		
8:30 – 9:30	**14. Credit Card Training**	**M. Ricker, NRC**
9:30 – 10:30	**15. Ethics Training**	**J. Scro, NRC**
10:30 – 11:00	**16. Allegations Training**	**S. Hawkins, NRC**
11:00 – 11:30	**17. INFOSEC Training**	**B. Stapleton, NRC**
11:30 – 11:35	**18. Group Photo**	**ACMUI**
	ADJOURN	

2020 ACMUI Recommendations and Action Items

	ITEM	DATE	STATUS		Target Completion Date for NRC Action
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.	9/21/2020	*Accepted*	Open	Spring 2024

2021 ACMUI Recommendations and Action Items

	ITEM	DATE	STATUS		Target Completion Date for NRC Action
7	The ACMUI formed a new subcommittee on the Liberty Vision Y-90 Manual Brachytherapy source. The subcommittee is expected to provide a draft report and any recommendations at the spring 2022 ACMUI meeting.	10/04/2021	*Accepted*	Open	Spring 2024
10	The ACMUI endorsed the Radionuclide Generator Knowledge and Practice Requirements Subcommittee Report and the recommendations provided therein.	10/04/2021	*Accepted*	Open	March 2026

	ITEM	DATE	STATUS		Target Completion Date for NRC Action
15	The ACMUI endorsed the ACMUI RG. 8.39 Subcommittee report on CivaDerm and the recommendations therein.	12/15/2021	*Accepted*	Propose to close	Summer 2023

2022 ACMUI Recommendations and Action Items

	ITEM	DATE	STATUS		Target Completion Date for NRC Action
4	The ACMUI endorsed the Y-90 microsphere ME Subcommittee report and the recommendations therein.	12/5/2022	*Accepted*	Open	Fall 2024
6	The ACMUI established two subcommittees: one to create generic process checklists to be used during medical administrations and one to review the DFA draft proposed rule. The ACMUI also reestablished the Nursing Mothers guidelines to update the 2019 guidelines.	12/5/2022	*Accepted*	Open	Fall 2023

2023 ACMUI Recommendations and Action Items

	ITEM	DATE	STATUS		Target Completion Date for NRC Action
8	During the ACMUI Spring 2023 meeting, the ACMUI requested additional tentative dates from the staff for its Fall 2023 meeting.	5/15/2023	*Accepted*	Propose to close	Fall 2023

OPEN FORUM

(No Handout)

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Medical Events Subcommittee Report

Richard P. Harvey, DrPH

Advisory Committee on the Medical Uses of Isotopes

October 23, 2023

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Subcommittee Members

- Richard Harvey, DrPH (Chair)
- Michael Folkert, M.D.
- Richard Green, B.S.
- Darlene Metter, M.D.
- Zoubir Ouhib, M.S.
- Harvey Wolkov, M.D.

- Consultant: John Angle, M.D.
- NRC Staff Resource: Daniel DiMarco, M.S.

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Subcommittee Charge

- Review Medical Events (MEs) to advise the Advisory Committee on the Medical Use of Isotopes (ACMUI) and United States Nuclear Regulatory Commission (NRC) about emerging trends that may need regulatory attention.

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Background

- The NRC and ACMUI review MEs that occur throughout the country on a regular basis.
- MEs occur when radioactive material use in healthcare results in unexpected radiation dose to patients. (Please refer to 10 CFR 35 Subpart M – Reports and more specifically 10 CFR 35.3045 – Report and Notification of a Medical Event for more information.)
- The Medical Events Subcommittee of the ACMUI reviews the data to analyze the nature of medical events, identify emerging trends and provide recommendations to the ACMUI and NRC.

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Medical Event Review

- FY21 – October 1, 2020 to September 30, 2021
- FY22 – October 1, 2021 to September 30, 2022

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Summary

- Two overarching themes remain
  - Human Error
    - Communication/feedback
    - Failure to work in teams
  - Inexperience
    - Rapidly evolving use of radiopharmaceuticals
    - Dissemination of use to smaller institutions with lower frequency of procedures performed

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Specific Issues

- Increasing MEs: new and increasing use of current therapeutic radiopharmaceuticals
- ^{90}Y microspheres remain the most common MEs.
    - ACMUI Action: Added 2 specialty-specific subcommittee members
    - ACMUI recommendation: AU adhere to manufacturer recommendations (i.e. avoid aggregation: use recommended catheter size and needle gauge)

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35.200 Use of Unsealed Byproduct Material for Imaging and Localization

Medical Events Summary

	2017	2018	2019	2020	2021	2022	Total
Cause							
Wrong Drug	0	0	0	0	1	0	1
Wrong Dosage	2	0	0	0	1	0	3
Wrong Patient	1	0	0	0	2	0	3
Extravasation	1	0	0	0	0	0	1
Human Error	0	0	1 (8 patients)	0	0	0	1 (8 patients)
Total	4	0	1	0	4	0	9

4/4 (100%) possibly preventable by time out in 2021
(Wrong Drug, Wrong Dosage & Wrong Patient)

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35.300 Use of Unsealed Byproduct Material, Written Directive Required

Medical Event Summary

	2017	2018	2019	2020	2021	2022	Total
WD not done or incorrectly	2	1	2	0	0	1	6
Error in delivery (# capsules)	1	0	1	0	0	1	3
Wrong Dose	0	0	0	0	4	3	7
Equipment	0	1	4	0	2	1	8
Human Error	0	0	1	2	3	4	10
Wrong Patient	1	0	1	0	0	0	2
Wrong Drug	0	0	0	0	1	0	1
Total	4	2	9	2	10	10	37

For 2021 & 2022: Time out 5/10 (50%), 3/10 (30%)
(Wrong Drug, Wrong Dosage & Wrong Patient)

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35.400 Manual Brachytherapy

Medical Event Summary

	2017	2018	2019	2020	2021	2022	Total
Applicator issue (e.g. jam, eye plaque dislodged)	0	0	0	2	0	1	3
Wrong site implanted (e.g. penile bulb, bladder)	1	1	1	2	2	0	7
Activity/prescription error (e.g. air kerma vs mCi, enter wrong activity in planning software)	1	0	1	0	1	0	3
Prostate Dose	5	11	3	0	0	0	19
New Device	0	1	0	0	0	0	1

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35.400 Manual Brachytherapy

Medical Event Summary

	2017	2018	2019	2020	2021	2022	Total
Wrong Source	0	0	0	1	0	0	1
Patient Health (?patient intervention)	0	0	0	1	0	0	1
Wrong Patient	0	0	0	0	1	0	1
Total	7	13	5	6	4	1	36
"Time Out" may have prevented	1	0	5	1	2	0	9
Lack of experienced/ inattention may have played a role	1	0	1	1	0	0	3

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35.400 Manual Brachytherapy

After 2019, many MEs were recategorized (dose to activity-based)

Potential ME issues:

- Lack of attention
- Inexperience

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35.400 Manual Brachytherapy

Potentially ~25% (9/36) of ME from 2017 to 2022 may be prevented with the use of a "Time Out" (wrong site, wrong source and wrong patient):

- "Time Out" or checklist for 2021: ¾ (75%)
- Retraining of an infrequently performed procedure (not a factor in MEs observed in 2021 or 2022)
- Increased attention during procedure (not a factor in MEs observed in 2021 or 2022)

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35.600 Use of a sealed source in a remote afterloader unit, teletherapy unit, or gamma stereotactic unit

	2017	2018	2019	2020	2021	2022	Total
Wrong position	2	3	4	7	0	1	17
Wrong reference length	2	1	4	2	2	2	13
Wrong plan	0	2	0	0	0	0	2
Wrong dose/source strength	0	1	0	0	0	0	1
Machine/applicator malfunction	2	3	1	1	1	2	10
Software/hardware failure	2 (9 patients)	0	1	1	0	0	4 (9 patients)
Treatment planning	0	0	0	2	1	2	5
Human Error	0	0	0	0	1	4	5
Total	8 (14 patients)	10	10	13	5	11	57 (14 patients)

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35.600 Use of a sealed source in a remote afterloader unit, teletherapy unit, or gamma stereotactic unit

Medical Event Summary

	2017	2018	2019	2020	2021	2022	Total
Location							
Breast	0	1	0	1	0	0	2
Gynecological	7 (14 patients)	7	8	10	4	2	38
Skin/neck	0	1	0	2	1	5	9
Bronchus	0	0	0	0	0	0	0
Prostate	0	0	0	0	0	0	0
Brain	1	1	2	0	0	0	4
Unknown	0	0	0	0	0	4 (7 patients)	4 (7 patients)
Total	8 (14 patients)	10	10	13	5	11 (7 patients)	57

GYN tumors most common site of ME

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MEs that may have been prevented by "timeout" (wrong plan or dose)

- 2017 0/8 events
- 2018 3/10 events
- 2019 0/10 events
- 2020 0/13 events
- 2021 0/5 events
- 2022 0/11 events

Total 3/5 (%)

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35.600 Use of a sealed source in a remote afterloader unit, teletherapy unit, or gamma stereotactic unit

MEs caused by "infrequent user/inattention"

This is difficult to determine based on information in NMED. For this assessment, assumed wrong position is a surrogate for "infrequent" user/inattention

- 2017 2/8 events
- 2018 1/10 events
- 2019 1/10 events
- 2020 9/13 events
- 2021 0/5 events
- 2022 1/11 events

Total 14/57 (25%)

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35.1000 Radioactive Seed Localization

Medical Events Summary (No additional events)

	2018	2019	2020	2021
Total Medical Events	0	1	0	1
Cause:				
Delayed seed removal (patient intervention)	0	1	0	0
Lost seed	0	0	0	0
Wrong implant site	0	0	0	0
Seed migration	0	0	0	1

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35.1000 Intravenous Cardiac Brachytherapy

- **Medical Events Summary (no additional events)**

	2017	2018	2019	2020	Total
Did not follow proper procedure	0	0	1	0	1
Tortuous vessel anatomy	0	1	1*	0	2
Catheter issue	0	1	0	1	2
Total	0	2	2	1	5

*AU felt this is “patient intervention”
No time out issues
Difficult to assess the unfamiliarity issue, but possibly played a role in some

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35.1000 Gamma Knife® Perfexion™ Icon™ and Esprit™

Medical Events Summary

	2017	2018	2019	2020	2021	2022	Total
Total Medical Events	0	1	2	2	0	2	7
Cause:							
Back-up battery power source failure	0	1	0	0	0	0	1
Patient set-up error	0	0	0	1	0	0	1
Patient movement	0	0	2	0	0	0	2
Wrong site (treatment plan)	0	0	0	0	0	0	0
Wrong site (human error-shifting of co-registration images)	0	0	0	1	0	1	2
Patient motion management system failure	0	0	0	0	0	1	1

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35.1000 ^{90}Y Theraspheres

Medical Events Summary

	2017	2018	2019	2020	2021	2022	Total
Total Medical Events	15	14	15	15	23	23	105
Cause:							
> 20% residual activity remaining in delivery device/leakage	7	11	9	12	10	2	51
Delivery device set-up error	2	2	1	1	1	0	7
Wrong dose (treatment plan calculation error)	4	0	1	0	0	3	8
Wrong site (catheter placement error & size)	2	0	0	2	1	7	12
Wrong dose vial selected*	0	1	4	0	1	1	7
Wrong dose (calibration error)*	0	0	0	0	3	1	4
Aggregation of microspheres	0	0	0	0	7	9	16

For 2021 & 2022: Time out 4/23 (17%), 2/23 (9%) – Wrong Dose*
Infrequent/inattention 10/23 (43%), 2/23 (9%) – > 20% Residual

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35.1000 ^{90}Y SirSpheres

Medical Events Summary

	2017	2018	2019	2020	2021	2022	Total
Total Medical Events	8	7	11	8	18	9	0
Cause:							
> 20% residual activity remaining in delivery device/leakage	7	2	8	8	2	1	0
Wrong dose (treatment plan calculation error)	0	2	0	0	2	1	0
Wrong site (catheter placement error & defective catheter)	1	2	2	0	4	0	0
Wrong site (WD error)	0	1	1	0	1	1	0
Aggregation of microspheres	0	0	0	0	9	6	0

2021 & 2022: Time out: 1/18(6%), 1/9(11%) - Wrong Site (WD)
Infrequent/inattention: 2/18(11%), 1/9(11%) - >20% Residual

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Actions to Prevent 35.1000 ^{90}Y Microsphere Medical Events

- Ensure familiarity with the mechanics of ^{90}Y microsphere delivery device and setup procedures
- Confirm all data and calculations in treatment plan
- Perform “Time Out” to assure all elements of treatment are in accordance with Written Directive

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Possible Elements of a "Time Out"

- Identity of patient via two identifiers (e.g. name and DOB)
- Procedure to be performed
- Radiopharmaceutical
- Activity
- Dosage –second check of dosage calculation and that the WD and dosage to be delivered are identical
- Others as applicable
  - units of activity (LDR prostate)
  - anatomic location
  - patient name on treatment plan
  - treatment plan independent second check has been performed
  - reference length (HDR)
  - Implant site location (RSL)

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Acronyms

- 10 CFR – Title 10 of the *Code of Federal Regulations*
- AUs – authorized users
- FY – fiscal year
- GYN – gynecological
- HDR – high dose-rate
- LDR – low dose rate
- mCi – milliCurie
- ME – medical event
- RSL – radioactive seed localization
- WD – written directive
- Y – Yttrium

U.S. Nuclear Regulatory Commission
Advisory Committee on the Medical Uses of Isotopes

Subcommittee on Medical Events

Draft Report
Submitted on September 21, 2023

Subcommittee Members:
Michael Folkert, MD, PhD (Brachytherapy Radiation Oncologist)
Richard Green, BS (Nuclear Pharmacist)
Richard Harvey, DrPH (Radiation Safety Officer; Chair)
Darlene Metter, MD (Diagnostic Radiologist)
Zoubir Ouhib, MS (Therapy Medical Physicist)
Harvey Wolkov, MD (Radiation Oncologist)

Consultant: John Angle, MD (Interventional Radiologist)

NRC Staff Resource: Daniel DiMarco, MS

Subcommittee Charge: Review medical events (MEs) to advise the Advisory Committee on the Medical Uses of Isotopes (ACMUI) and U.S. Nuclear Regulatory Commission (NRC) about emerging trends that may need regulatory attention.

Background: The subcommittee reviewed medical events from Fiscal Years 2021 and 2022 as part of its ongoing biannual review.

Findings: Medical events in Fiscal Years 2021 and 2022 were relatively low but there appears to be an increase in medical events related to 10 CFR 35.300 and 10 CFR 35.1000 uses. The volume of procedures involving ^{177}Lu radiopharmaceuticals has increased during this period and this has resulted in an increased number of medical events in the category of 10 CFR 35.300.

Medical events related to 10 CFR 35.1000 uses have increased for treatments involving ^{90}Y microspheres (for both TheraSpheres and SIR-Spheres). Reducing the number of medical events involving ^{90}Y microspheres may be accomplished through improved education with emphasis on appropriate administration of the microspheres and proper set-up of the delivery device. In addition, a “time-out” may be a tool that can be implemented to reduce the number of medical events for procedures using ^{90}Y microspheres.

The committee recognizes past effort and continues to discuss medical events that may benefit from a “time-out” or those that may be the result of infrequent/inexperience use. Improved education and use of a “time-out” may be beneficial in preventing medical events.

The subcommittee will continue to examine medical events involving radiopharmaceuticals approved for use under 10 CFR 35.300 as well as treatments performed with ^{90}Y microsphere procedures (10 CFR 35.1000). Furthermore, the subcommittee will monitor trends that may continue and appear to be significant during the biannual review periods.

Concluding Remarks: The ACMUI Subcommittee on Medical Events appreciates the opportunity to continue reviewing these events. Emphasis will be placed on radiopharmaceuticals in 10 CFR 35.300 and 10 CFR 35.1000, specifically ^{90}Y microsphere procedures, to discern if there are emerging trends in medical events involving these treatments. The subcommittee welcomes any comments and/or recommendations.

Respectfully submitted, September 21, 2023
Subcommittee on Medical Events
Advisory Committee on the Medical Uses of Isotopes (ACMUI)
U.S. Nuclear Regulatory Commission (NRC)

Veterinary Release

Katie Tapp, PhD
Medical Radiation Safety Team
Division of Materials Safety, Security, State, and Tribal Programs
Office of Nuclear Material Safety and Safeguards
October 23, 2023

Regulations for Release of Patients

- 10 CFR Part 35 is specifically for medical use of byproduct material.
- 10 CFR 35.75, in part, allows medical licensees the ability to authorize release of patients if the dose to another individual from exposure to the patient is **not likely** to exceed 5 mSv (0.5 rem).
  - This is a *per release* limit.
- 10 CFR Part 35 is specifically for medical use of byproduct material, *not veterinary use*.
  - Therefore, 10 CFR 35.75 *does not apply* to release of animals administered radioactive material.

Veterinary Release Regulations

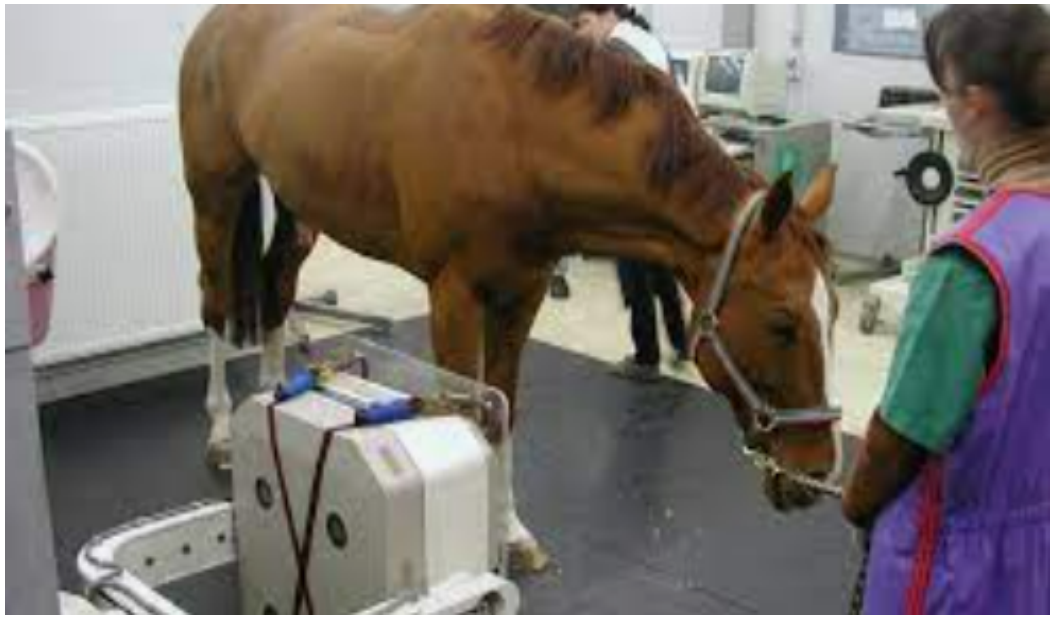
- 10 CFR Part 20 public dose limits apply to animal release.
- Licensees must have release procedures approved in a license condition prior to use.
- These dose limits are:
  - 1 mSv (0.1 rem) per year from **all licensed operations.**
  - 0.02 mSv (2 mrem) in any one hour from external sources.
- Licensees are required to demonstrate:
  - by measurement or calculation that the dose to the individual who is likely to receive the highest dose does not exceed the annual public dose limit,
  - or that an individual cannot exceed these limits if they are continuously present near the source (i.e., animal).

Veterinary Release Guidance

- Appendix D of NUREG-1556, Volume 7, Revision 1, “Consolidated Guidance about Materials Licenses, Program-Specific Guidance about Academic, Research and Development, and Other Licenses of Limited Scope.”
  - Licensee should provide owner with written instructions to reduce dose to members of the public. The instructions should provide a margin for dose reduction but should NOT be relied upon as the primary way of keeping members of the public below the annual dose limit.
  - Informs licensees / applicants that criteria for release must be submitted in an application for review and approval, before implementation.

Veterinary Release Guidance (cont.)

- Provides specific guidance only for release of cats treated with iodine-131:
  - Cats are held not less than 4 complete days after administration
  - The dose rate is less than 0.01 mSv/hour at 6 inches (or 0.0025 mSv/hr at a foot)
  - Written instructions are provided to owners, AND
  - Licensee can demonstrate that a member of the public would not receive a dose from a cat that would exceed 0.02 mSv (2 mrem) in any one hour and 1 mSv in a year.
- Guidance states other release criteria may be accepted on a case-by-case basis.



Instruction Guidance

- The NUREG recommends including the following items in instructions:
  - the regulatory limits and the need to keep doses as low as reasonably achievable
  - the potential radiation fields surrounding the animal and potential dose with time at various distances
  - maintaining distance from people in public places and the home
  - minimizing time in public places (e.g., walks on public sidewalks, parks, beaches, grooming salons)
  - precautions to reduce the spread of radioactive contamination
  - the handling and storage of animal excreta, and the duration of storage if held for decay
  - the permitted extent and duration of contact by individuals with the animal, and handling
  - of contaminated bedding and other objects with which the animal comes into contact
  - the length of time each of these precautions should be in effect

Exubrion Template Procedure

- In October 2020, the NRC staff completed an evaluation of Exubrion's proposed release criteria and procedure for future licensees to use to release dogs treated with their product, Synovetin OA®.
- Synovetin OA® is a tin-117m colloid used to treat osteoarthritis in dogs' joints.
- The specific proposal NRC reviewed was for treating both dog's elbows with a maximum of 111 MBq (3 mCi) per elbow or 222 MBq (6 mCi) total.
- For consistency and efficiency, the NRC evaluated a template procedure developed by the manufacturer for future licensees use. As described in the licensing guidance, licensees still have to provide the procedure as part of their application for use if they wished to use it.

Exubrion Template Procedure

- Exubrion's proposal was to allow release of a dog with a measured dose rate of less than 0.45 mR/hr at 1 m.
- To provide confidence than dose limits will not be exceeded, the proposal included a multilayer approach, which included
  - A technical assessment to evaluate common dog-human interactions that could exceed the dose limit.
  - Release procedure which includes a prescreening questionnaire to determine if the dog would need to stop or modify behaviors which were determined could exceed the dose limit, or potentially exclude release if the behavior could not be modified.
  - Release procedure which states the license will only provide the treatment if they are confident the owner understands the need to comply with dose limits, behaviors would be modified as necessary, and patient specific instructions that are signed by the owner.
- The NRC found Exubrion's proposed procedure provides adequate assurance that public dose limits will not be exceeded when licensees perform adequate prescreening and instructions are followed.

Prescreening Questionnaire

- Includes open-ended question about typical human-dog contact and how long it lasts
- Includes yes/no questions to common behaviors which might need to be modified to ensure dose limits are not exceeded, including
  - Sleeping in the same bed
  - Lap sitting or coach sitting
  - Interactions with children
- Yes/No questions if behaviors which cause close contact could be modified were identified
- The questionnaire is used to bin animals into certain groups based on the typical dog-human behavior pattern to determine instruction duration is necessary to ensure compliance

NRC Conclusions and on-going work

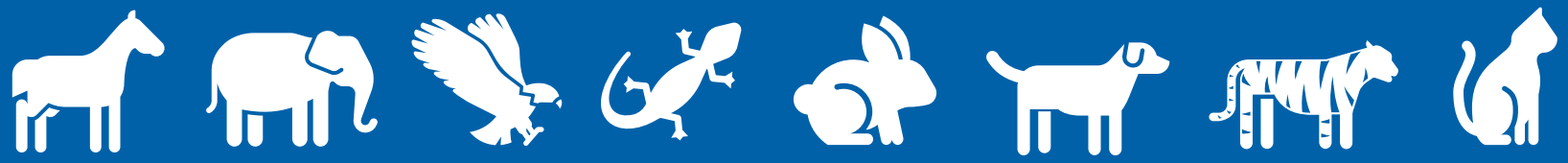
- The NRC found Exubrion's proposed procedure provides adequate assurance that public dose limits will not be exceeded when licensees perform adequate prescreening and instructions are followed.
- This evaluation was specific to the procedure provided. Modifications need to be reviewed on a case-by-case basis to ensure same conclusions apply before licensing and use.
- NRC determined need to develop compressive animal release guidance and rulemaking to provide clarity.
  - NRC and OAS established a working group to develop a rulemaking plan to codify release of animals administered radioactive material.
  - Deferred to work on higher priority rulemakings.

Acronyms

- hr – hour
- MBq – Megabequarel
- mCi – millicurie
- mR – milliroentgen
- mSv – millisievert
- NRC – Nuclear Regulatory Commission
- OAS – Organization of Agreement States

Overview of ICRP Publication 153

Presented by
Anthony DAVILA
Tulane University



NRC ACMUI
October 2023

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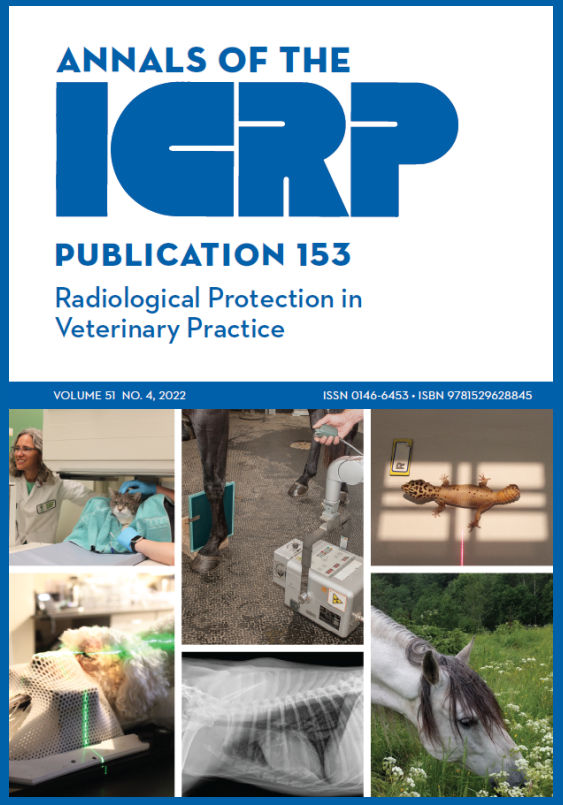
Radiological Protection in Veterinary Practice



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- Annex B. Ethical issues associated with the protection of animals and the environment

Summary of the motivation for explicit consideration of radiological protection in veterinary practice

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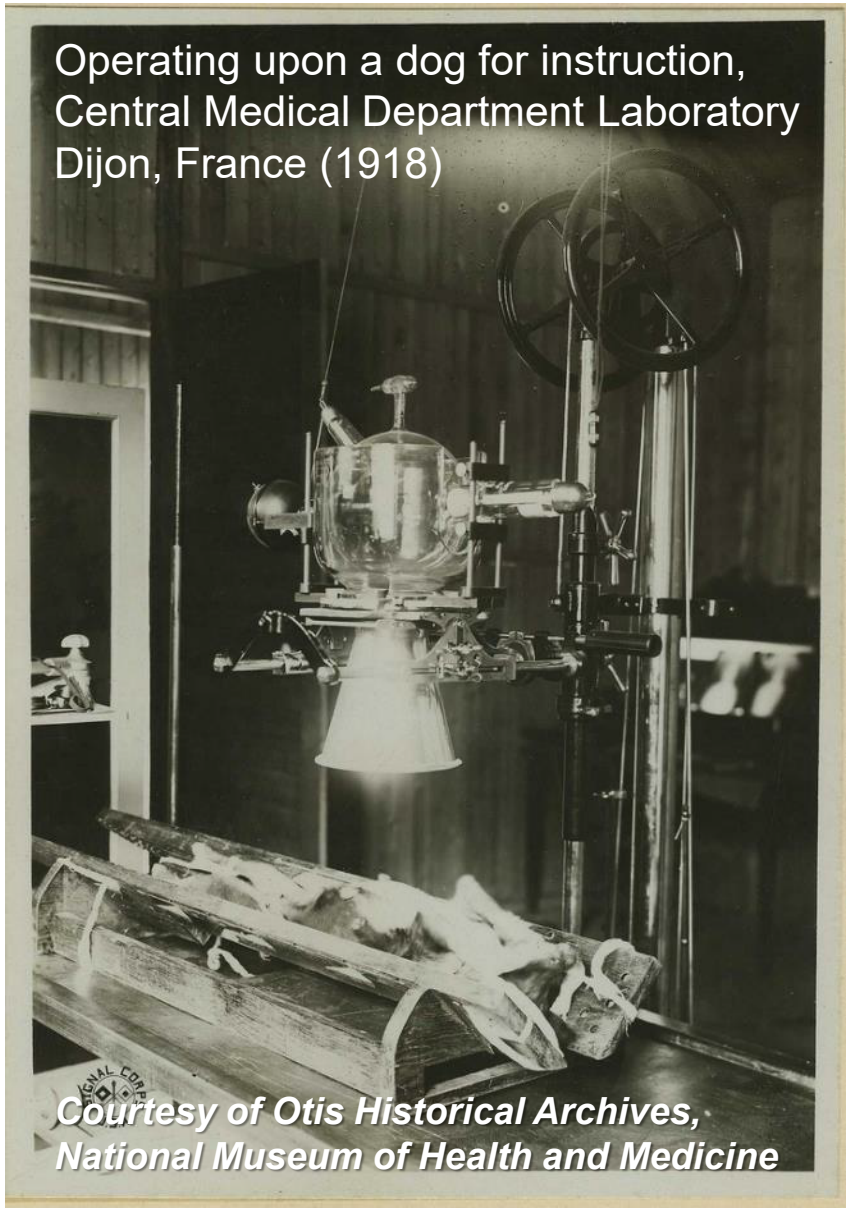
Why now?

- Veterinarians have long employed ionizing radiation; the chair of the First (1905) and Second (1906) Radiological Congresses was a veterinarian
- Early on, applying a few simple rules could sufficiently limit the risks to staff, owners/handlers, etc., and animal patients not believed to be exposed to any real risk
- Over the past several years though, applications and availability have grown and diversified considerably



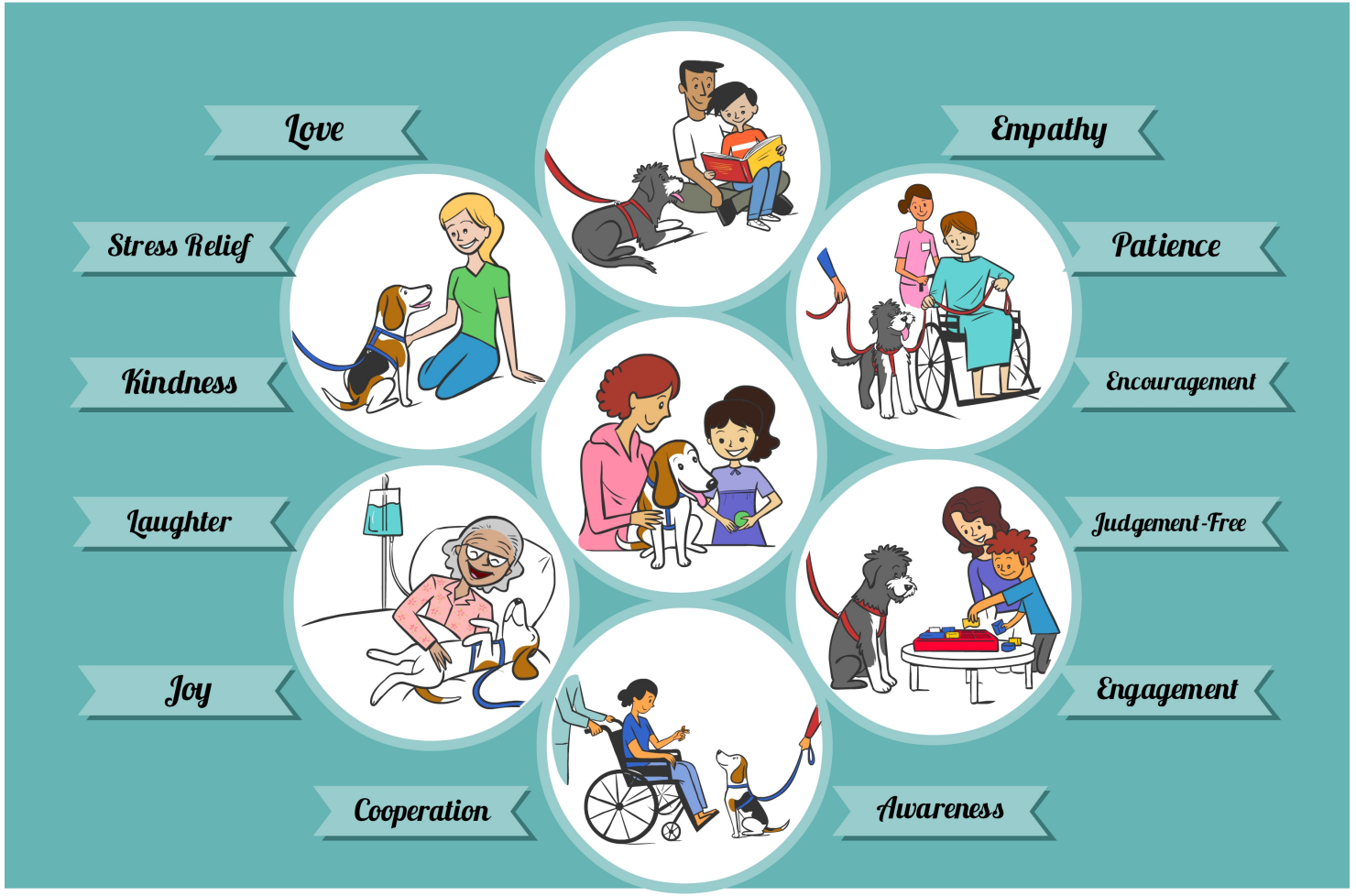
Kealy (2002) *Vet Radiol Ultrasound* 43:213
Schnelle (1968) *Veterinary Radiology* 9:5

Many companion animals are considered '**part of the family**' and entitled to the best care available.

The same may be true for working animals, endangered species, exotic and sports animals

Monetary value may further stimulate interest in an animal's welfare

Human Animal Interactions and the Human Animal Bond



Support for this project was provided by the Josiah Charles Trent Memorial Foundation Endowment Fund.

Bouma et al. (2021) *Int J Environ Res Public Health* 29:193; Shir-Vertesh (2012) *Am Anthropol* 114:420; Walsh (2009) *Fam Process* 48:462

Many companion animals are considered '**part of the family**' and entitled to the best care available.

The same may be true for working animals, endangered species, exotic and sports animals

Monetary value may further stimulate interest in an animal's welfare

There is also increasing awareness of the **inter-connectedness** of human, animal, and environmental health and welfare

https://www.cdc.gov/

Bouma et al. (2021) *Int J Environ Res Public Health* 29:193; Shir-Vertesh (2012) *Am Anthropol* 114:420; Walsh (2009) *Fam Process* 48:462

Objective and scope of the publication with elaboration on historical background and modern motivation

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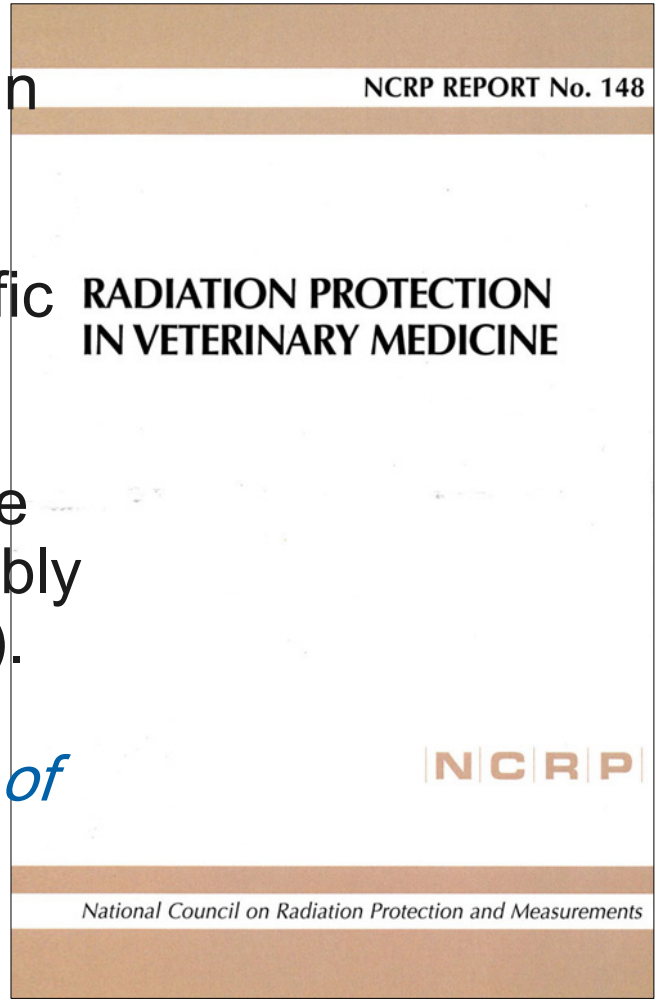
Relevant Guidance

"The reasons for using radiation in veterinary medicine are to either obtain optimum diagnostic information or to achieve a specific therapeutic effect while maintaining the radiation dose to the radiological personnel and the general public as low as reasonably achievable (the ALARA principle). *Similarly, it is also important to avoid all unnecessary irradiation of the animal patient* [emphasis added]."



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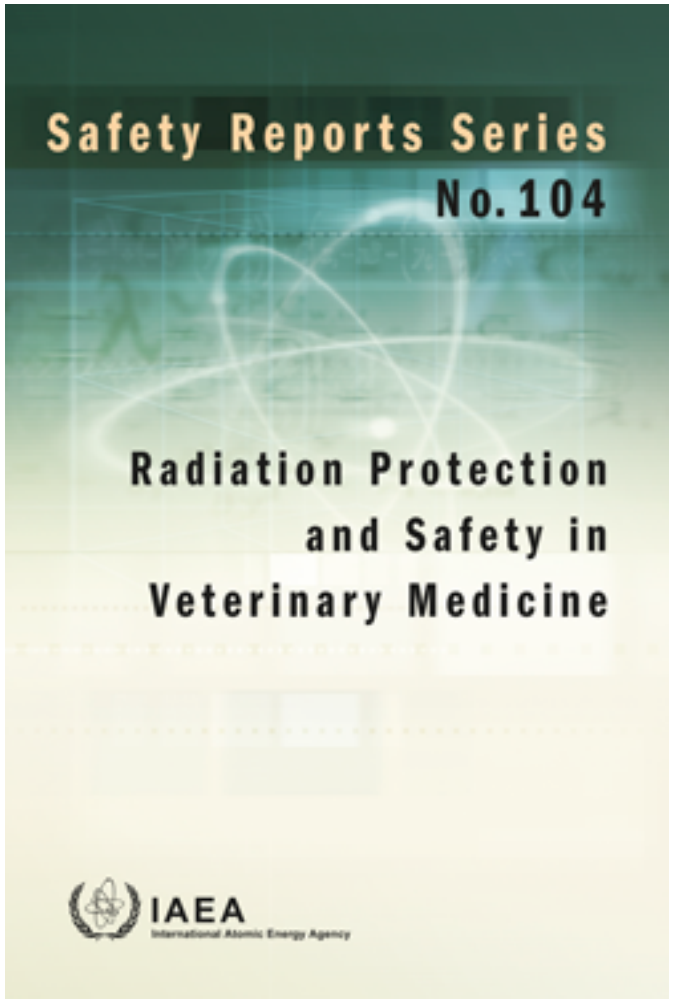

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Brief review of dosimetric quantities, the biological basis of RP, the system of RP, and practical protection strategies; intended for a wide - ranging audience

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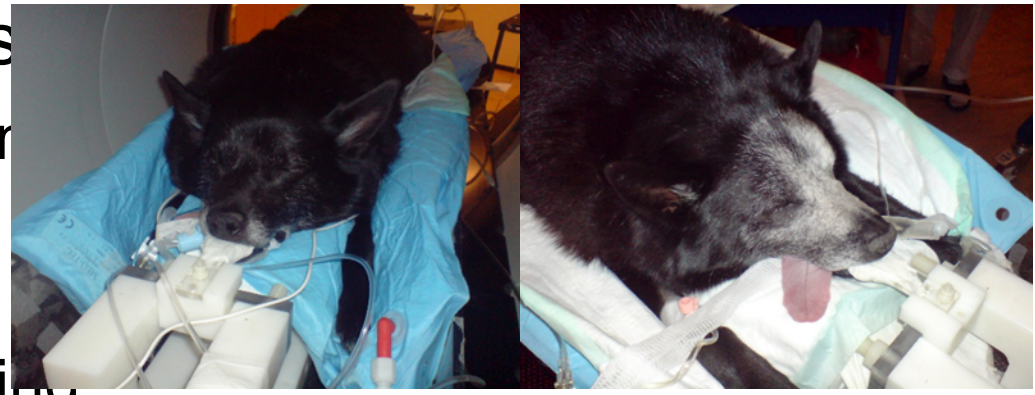
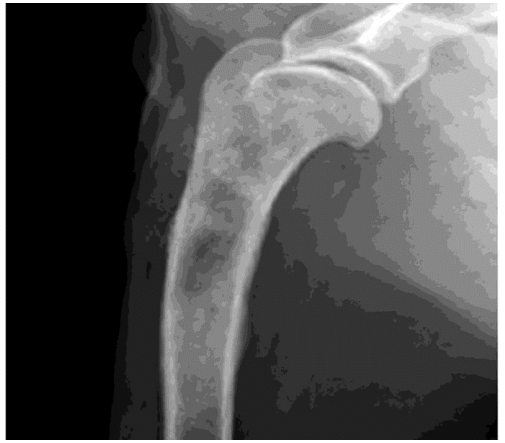
Biological Basis for RP

- Tissue Reactions (Deterministic effects
  - Misconception: “Radiation doses in veterin medicine are not high enough to produce deterministic effects.”
  - High dose radiological procedures are being increasingly adopted.
- Stochastic Effects
  - Misconception:
    “Animals don’t live long enough to get radiation induced cancer.”
  - Shorter latency periods for short lifespans



Leukotrichia 3 months after IMRT for sinonasal neoplasia. ICRP 153



Osteosarcoma in a dog 5 years after treatment for mast cell tumour. Pentreath et al. 2020

Review the ethical basis of the system of RP with connections to veterinary and environmental ethics

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Ethical Theories

Utilitarianism

- Furthering of the collective interest
- Preferability of certain actions based on their outcomes
- Optimisation

Deontology

- Respect for individuals and their rights
- A set of obligations or rules for human society
- Dose limits

Virtue Ethics

- Promotion of integrity, discernment, and wisdom
- Virtuous life based on a certain concept of human nature
- Justification

- Building off the framework of ICRP Publication 138
- Core Values: Beneficence/non - maleficence, Prudence, Justice, Dignity
- Procedural Values: Accountability, Transparency, Inclusiveness

ICRP

Ethical Values

Core ethical and procedural values with additional interpretation

Beneficence/
Non - maleficence

↓

Animal
welfare

Justice

↓

Solidarity

Prudence

↓

Sustainable
development

Dignity

↓

Reverence
for life

Accountability

↓

Stewardship

Transparency

↓

Respect for
Autonomy

Inclusiveness

↓

Empathy

- The extension of the core and procedural values is to help clarify these values for the specific RP application
- Reflects the desire for a consistent approach among human, environmental, and veterinary aspects of RP
- Note that there are a variety of interrelationships between values; this is not a hard one-to-one link

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Similarities and differences between human medicine and veterinary practice highlighting unique veterinary challenges

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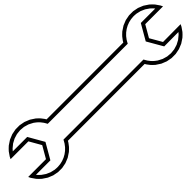
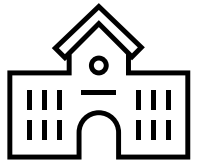
Unique Aspects

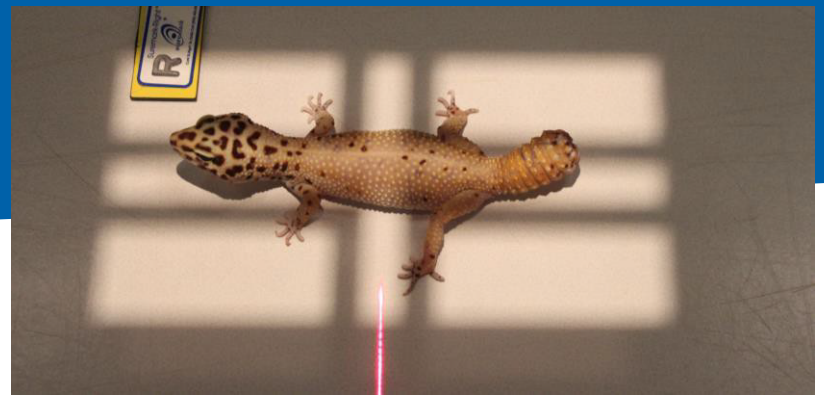
- Environmental
  - Not specifically designed for radiological procedures
  - Animal enclosures, farms, in the field
- Equipment
  - Prevalence of second - hand from human medicine
  - Dedicated veterinary equipment that falls under industrial standards
- Competence
  - Lack of RP training in veterinary curriculum
  - Lack of specialized staff
  - Lack of medical/health physicist involvement
- Regulations/Guidelines
  - Lack of appropriateness criteria, DRLs
  - Lack of regulatory harmonization
  - Lack of guards against self - referral and self - presentation

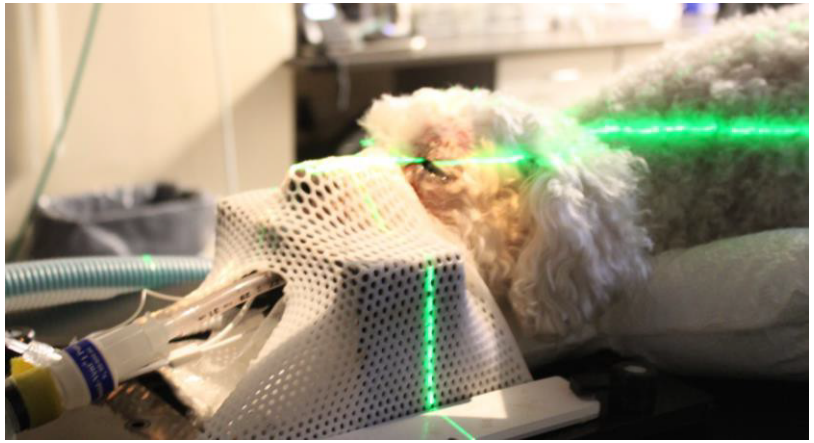


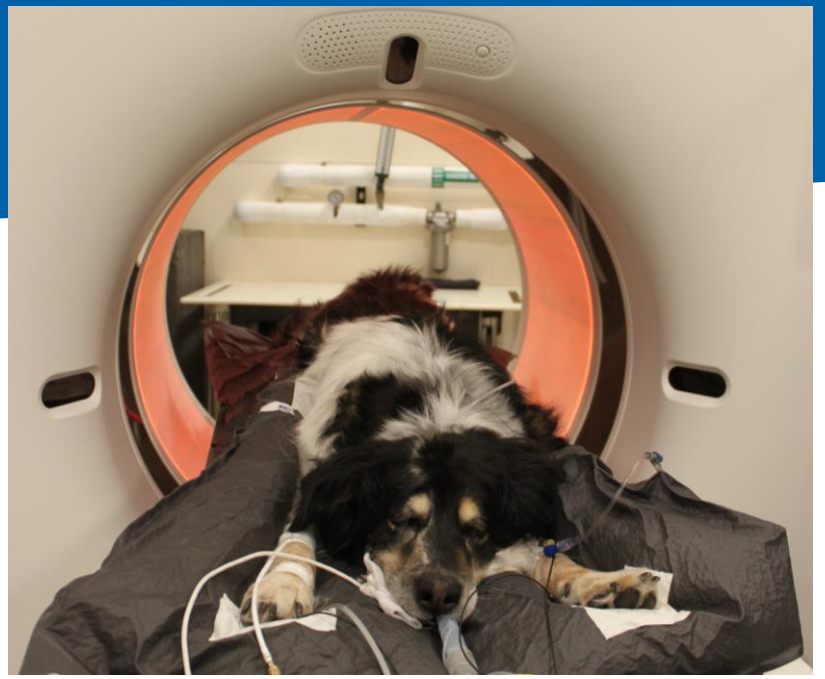


Veterinary patients come in all shapes and sizes and available technologies are consistent with human medicine

Photo by Gail Tabone
src: https://senecaparkzoo.org/tusk-x-rays-on-an-elephant/







Photos courtesy of Dr. Elissa Randall, Colorado State University

Discussion of justification, optimisation , and application of dose limits (in the context of animal patients as well as workers and the public)

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Justification (1)

Level	Human medicine	Recommended for veterinary practice
Level 1 (General use)	Proper use of radiation in medicine is accepted as doing more good than harm to society. Now taken as a given.	Proper use of radiation in veterinary medicine is accepted as doing more good than harm to society. Now taken as a given.
Level 2 (Specific procedure and objective)	A specified procedure with a specified objective is justified if it will improve the diagnosis or treatment or if it will provide necessary information about exposed individuals .	A specified procedure with a specified objective is justified if it will improve diagnosis or treatment of a defined group of animal patients or if it will provide necessary information about exposed animals .
Level 3 (Particular procedure for the patient)	The application of a radiological procedure is justified if it is judged, in advance, to do more good than harm to the individual patient .	The application of a radiological procedure is justified if it is judged, in advance, to do more good than harm to the individual animal patient .

Justification (2)

- Medical Procedures
  - Appropriate training and education
  - Suggestion : develop decision support tools
  - Equipment RP assessment
  - Level 3 – procedure should answer clinical question
- Non - medically indicated investigations
  - Imaging of asymptomatic animals
    - Hip/elbow dysplasia screening in dogs
    - Presale radiographic exams of horses
  - Should be consistent with current clinical evidence
  - Level 2 – clinical evidence, demonstrable relationship between the imaging findings and the goal of the screening

Optimization

- Optimization is always aimed at achieving the best level of protection under the prevailing circumstances through an ongoing, iterative process.
  - Appropriate design and construction of installations and careful selection of equipment
  - Day - to - day strategies
- Priority is safety of humans
- Not to be confused with dose minimization
- Factors to consider:
  - Other occupational hazards
  - Use of sedation/ anaesthesia

Application of dose limits

- **Carer** – an individual who may be exposed to radiation as a volunteer helper providing support or care for a patient in a context that is not associated with their occupation.
- Veterinary medicine animals have not been legally recognized as “patients” so carer designation not applicable though in many circumstances there is a direct benefit to both animal and owner.
- The concepts of patient and carer ideally should be tailored to be applicable within reason in veterinary practice.
  - Hospitals stays and release criteria
- **Suggestion** : additional studies looking at doses to owners/handlers from veterinary nuclear medicine procedures.

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Recall…

Exposure **categories**

Occupational : exposure received as a direct consequence of one's job

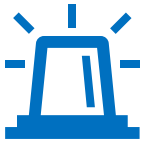
Medical : Patients, carers, research volunteers

Public : exposure that is not occupational or medical

Exposure **situations**

Planned : planned introduction and operation of sources

Existing : already exist when a decision on control must be made



Emergency : unexpected situations requiring urgent attention

Protection of animals in the context of environmental protection addresses the **collective impact** , e.g., preservation of species and maintaining biodiversity and, as currently written, the medical exposure category appears to **apply solely to human medicine** .

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Where do animal patients fit then?

- Veterinary applications of ionizing radiation are comparable to human medical exposures, but because this involves subjects other than humans, local governments and regulatory agencies manage exposures received in a veterinary setting in different ways.
  - However, if —from a regulatory perspective —veterinary practice is considered comparable to an industrial application, this may lead to an approach whereby the animal is considered an object, without consideration that it is a sentient living creature, or neglecting unique but necessary aspects (e.g., safety of patients under anesthesia)
- The Commission now specifies that the system includes protection of the individual animal in special circumstances.
  - Animal patients undergoing radiological veterinary procedures comprise one case among others including animal research subjects and pets/domestic animals in a radiological emergency (e.g., Publication 146)

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Review of key takeaways of the publication

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Main Points (1)

- The objective of this publication is to provide an initial set of relevant observations, considerations, and general recommendations related to radiological protection in veterinary practice, intended for a wide-ranging audience.
- Radiological protection challenges specific to veterinary practice arise from the different combinations of personnel and members of the public who may be involved, and from operational environments required when dealing with animals.
- The priority of radiological protection in veterinary practice is that of the humans involved, but the exposure of animals should also be the object of explicit attention because, like humans, animals are subject to potential tissue reactions or stochastic effects resulting from exposure to radiation.

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Main Points (2)

- In veterinary practice, the core and procedural ethical values of the system of radiological protection are elaborated on with discussion of additional interpretations of these values, including animal welfare, sustainable development, solidarity, reverence for life, stewardship, respect for autonomy, and empathy.
- Veterinary applications of ionizing radiation, and their ensuing protection challenges, are, to a large extent, comparable to situations in human medical applications, and could benefit from similar approaches, such as the three levels of justification, and optimization as a process to ensure that the likelihood and magnitude of exposures and the number of individuals exposed are reasonable and appropriate for the situation at hand, considering economic, societal, and environmental factors.

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Discussion of individual and organizational functions and anticipated obligations relevant to RP in veterinary practice

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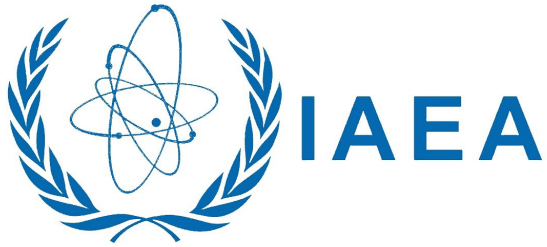
Roles and Responsibilities (1)

United Nations Scientific Committee on the Effects of Atomic Radiation

International Commission on Radiological Protection

International Atomic Energy Agency



Roles and Responsibilities (2)

Hospital/Practice

- Installation
- Location
- Fit - for - purpose
- Quality assurance program

Radiological Practitioner

- Appropriateness of the procedure
- How the procedure is performed
- Inform and instruct non - staff members

Training Programs

- Provision of adequate education and training
- Explicitly address RP

- **Role** – an individual's or organisation's position or function
- **Responsibility** – the anticipated obligation, duty, or commitment associated with a particular role

Elaboration on humanity's relationship with and responsibility to animals and the environment

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Ethical Issues in Veterinary Practice

- Animal Ethics
  - What is the difference, morally speaking, between humans and animals?
- Animal Welfare
  - How individual animals' lives may be improved or impoverished through our actions/inactions
- 3 Party Problem
  - Veterinarian, animal patient, animal owner/guardian
  - To whom should the vet 's primary responsibility be?

Bottom line

"The Commission hopes that highlighting radiological protection concerns and related knowledge gaps will inspire **additional research and development** related to the evidence - based use of ionising radiation in veterinary practice in support of the justification process; **dedicated facilities and equipment** ; improved **understanding** of the radiosensitivity of different types of animals; and **practice guidelines** in support of exposure management and other relevant areas to **promote health and safety** of personnel, the general public, and the environment, while further **improving the quality of care** for the patients and healthy animals submitted to radiological procedures."

Future considerations?

- Decontamination of livestock following an emergency
- The animal as the comforter
- Other working animals (e.g., search and rescue)
- Research animals
- More dosimetric data


Animal assisted therapy, Langley Air Force Base


Split Creek Farms baby goats (N. Martinez)

Toronto Police Service dog

Thank you for your attention!

Contact info:
Anthony Davila, MS
adavila@tulane.edu

SCAN ME TO
ACCESS P153

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Financial Assurance for Disposition of Category 1-3 Sealed Sources

October 23, 2023

Ryan Whited, Sr. Project Manager
Low-Level Waste and Projects Branch
Division of Decommissioning, Uranium Recovery and Waste Programs
Office of Nuclear Material Safety and Safeguards

Background

- NRC's regulations in 10 CFR 30.35 provide a threshold above which decommissioning financial assurance (FA) is required
- Most Category 1-3 radioactive sealed sources fall below the threshold, and there is no requirement for end-of-life financial planning
- This does not relieve the licensee from the responsibility of proper end-of-life management
- Financial burden associated with source disposition may be significant

NRC Staff Activities - 2016

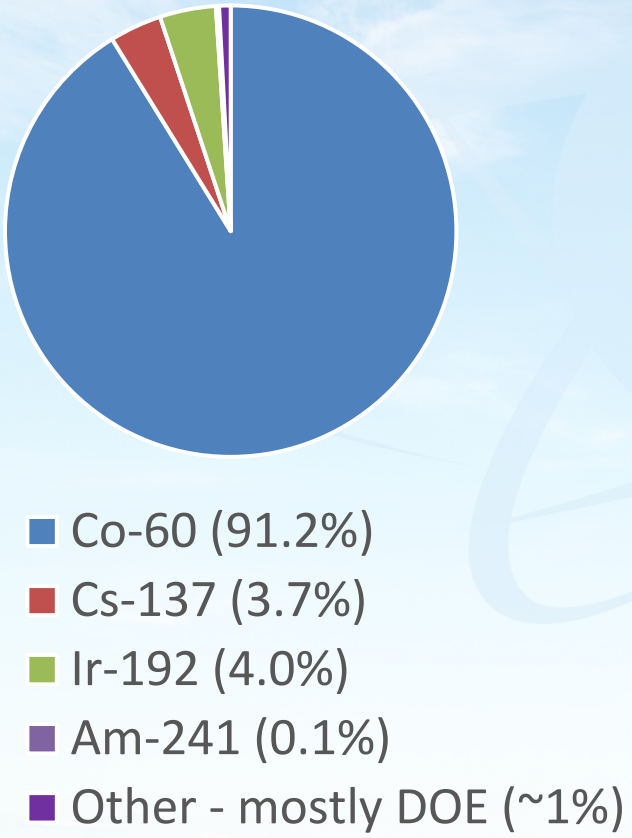
- Objective was to determine if additional FA requirements for certain sealed sources were needed.
- Scoping study documented in SECY-16-0046 (April 7, 2016).
- Rulemaking plan provided in SECY-16-0115 (October 7, 2016). The NRC staff recommended that:
  - The Commission approve the initiation of rulemaking to expand the financial assurance requirements in 10 CFR 30.35
  - The scope of the rulemaking should be limited to Category 1 and 2 byproduct material sealed sources tracked in the National Source Tracking System (NSTS)

Commission Direction - 2021

- On December 8, 2021, the Commission issued SRM-SECY-16-0115, directing the staff to:
  - Expand 10 CFR 30.35 to require FA for disposition of Category 1 and 2 byproduct material sources tracked in the NSTS
  - Carefully explore options to mitigate potential adverse impacts on existing and future licensees, particularly medical users, and those who benefit from using these radioactive materials
  - Consider and seek public comment on whether FA requirements should also be extended to Category 3 sources
  - Develop and seek public comment on a risk-informed basis for establishing FA requirements, considering factors such as the overall risk and total cost of disposal

Category 1 & 2 Sources

National Source Tracking System (~84,000 total sources)



- Focus on Co-60, Cs-137, Am-241
  - Ir-192 has a 74-day half life (no FA requirements)
  - Other radionuclides (e.g., Sr-90, Pu-238) mostly owned by DOE
- To understand the number of licensees affected and the disposal costs, we need to understand devices as well as sources

Rulemaking Status

- The NRC staff is preparing a regulatory basis for rulemaking to implement the Commission's direction
  - Established working group including representatives from the NRC Regions and Organization of Agreement States
  - Coordinating with the U.S. Department of Energy's National Nuclear Security Administration and the Conference of Radiation Control Program Directors
  - Met with low-level waste (LLW) disposal facility operators, LLW brokers, and sealed source/device manufacturers and distributors
  - Identifying and analyzing potential regulatory options, such as FA based on device type and changes to decommissioning funding plan requirements

Issues / Challenges

- Availability of cost data to support FA requirements
- Assessing disposition pathways for many different source and device types
- Complexity of the U.S. LLW disposal landscape
- Limited disposal examples / lack of a disposal pathway for some high-activity sealed sources
- Evaluating impacts of additional requirements on many diverse licensees

Summary

- NRC staff preparing a regulatory basis to expand FA requirements for Category 1 & 2 (and possibly Category 3) byproduct material sealed sources
- Developing and analyzing several potential regulatory options
- Anticipate providing the draft regulatory basis for ACMUI review in Spring 2024

Questions?

Radiopharmaceutical Medical Events

Katie Tapp, PhD
Medical Radiation Safety Team
Division of Materials Safety, Security, State, and Tribal Programs
Office of Nuclear Material Safety and Safeguards
October 23, 2023

RADIOPHARMACEUTICAL WRITTEN DIRECTIVE

- A written directive must be dated and signed by an authorized user before the administration of I-131 sodium iodide greater than 1.11 megabecquerels and any therapeutic dosage of unsealed byproduct material.
- For administration of therapeutic dosage of unsealed byproduct material other than sodium iodide I-131, the written directive must include:
  - radioactive drug,
  - dosage,
  - and route of administration.
- Licensees must have and follow procedures to provide high confidence that each administration is in accordance with the written directive.

RADIOPHARMACEUTICAL MEDICAL EVENTS CRITERIA

DEVIATION MEDICAL EVENT CRITERIA

Dose Threshold

- 0.05 Sv (5 rem) effective dose equivalent
- 0.5 Sv (50 rem) to organ or tissue
- 0.5 (50 rem) shallow dose equivalent to skin

+

Deviation

- ± 20% prescribed dosage
- Outside prescribed dose range
- ± 50% prescribed single fraction dose

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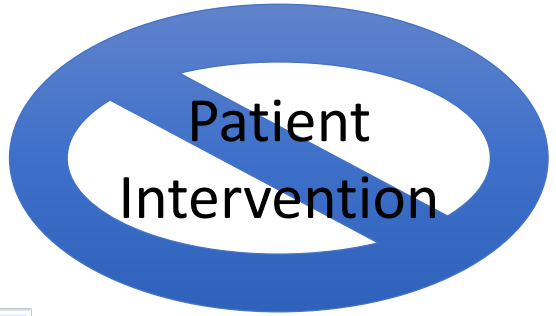
Protecting People and the Environment

ERROR MEDICAL EVENT CRITERIA



Dose Threshold

- 0.05 Sv (5 rem) effective dose equivalent
- 0.5 Sv (50 rem) to organ or tissue
- 0.5 (50 rem) shallow dose equivalent to skin

+

Cause

- Wrong Patient
- Wrong Drug
- Wrong Route
- Wrong Mode

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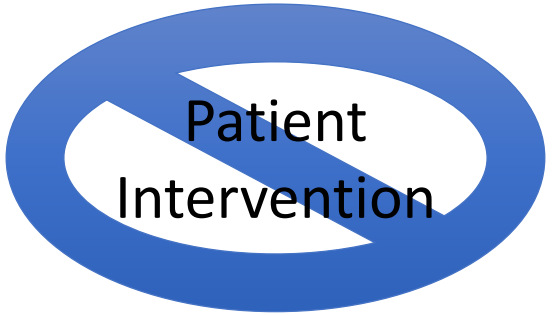
WRONG SITE MEDICAL EVENT CRITERIA



Dose Threshold

0.5 Sv (50 rem) or more than expected to that site if administration had been given in accordance with the written directive prepared or revised before administration

+

Deviation

50 percent or more than expected dose to that site if administration had been given in accordance with the written directive prepared or revised before administration

U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

PATIENT INTERVENTION REPORT

Any event resulting from intervention of a patient in which administration results or will result in unintended **permanent functional damage** to an organ or physiological system, as determined by a physician.

Patient intervention means **actions** by the patient or human research subject, whether intentional or unintentional, such as dislodging or removing treatment devices or prematurely terminating the administration.

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REPORTING BEST PRACTICES

- We use medical event reports to look for trends and generic issues.
- The report should allow an uninvolved individual to have a full understanding of the event.
- Helpful details include:
  - Manufacturer, model, or specifications of supporting equipment associated with the event such as IV pump or gauge size.
  - Relevant information that preceded the event.
  - What staff was present.
  - How the event was identified.
  - Include short and long-term corrective actions and how they are linked to the event.
  - Clearly highlight if the event or corrective actions involve a common industry-wide practice or procedure.

RADIOPHARMACEUTICAL MEDICAL EVENTS EXAMPLES

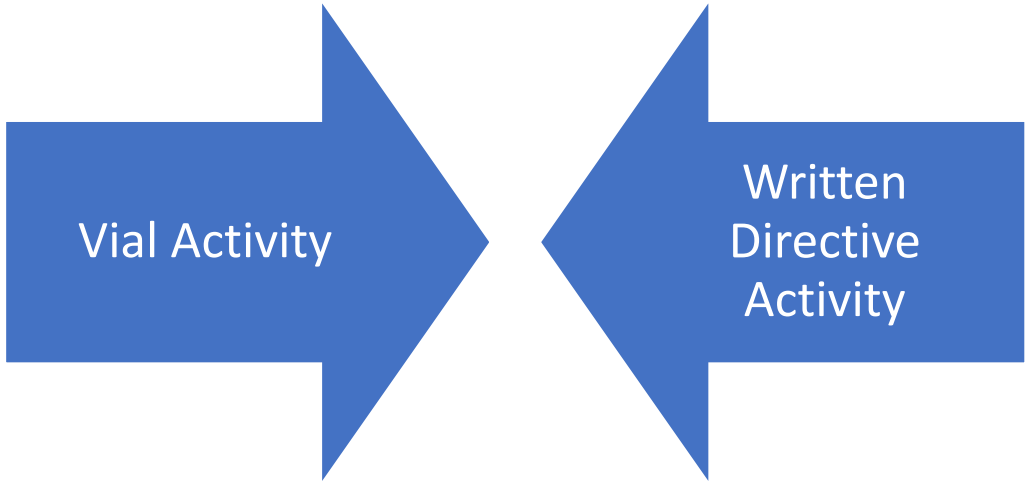
VERIFICATION OF WRITTEN DIRECTIVE

- There are increasing uses of radiopharmaceuticals.
  - January 2018 – Lu-177 Lutathera® was approved by the FDA for treatment of some gastroenteropancreatic neuroendocrine tumors.
  - March 2022 – Lu-177 Pluvicto® was approved by the FDA for treatment of some prostate cancers.
  - Numerous ongoing clinical trials with current and new radiopharmaceuticals.
- The NRC has had 1 event reported where patients received the wrong radiopharmaceutical, with 1 patient receiving Lutathera® and the other patient receiving Pluvicto®.
- Both Lu-177 radiopharmaceuticals recommend a standard dosage of 200 mCi for multiple fractions unless patient conditions warrant a reduction in dosage.
- The NRC has had **5 events** reported over the last 2 years when the AU prescribed smaller dosages based on patients' lab results, but the patient was administered the full standard dose of 200 mCi.

STANDARDIZED DOSES EXAMPLE

- Lu-177 Lutathera standard dosage protocol is 7.4 GBq (200 mCi) every 8 weeks for a total of 4 doses.
- A patient was prescribed 3.7 GBq (100 mCi) by the AU due to kidney disease but received a 7.62 GBq (206 mCi).
- Administering technologist did not review the written directive and drew the standard dose.
- Root cause was failure to follow established protocols and lack of communication in department.
- Corrective actions include a “daily huddle” to communicate key information and secondary verification requiring a physician signature on written directive.

VERIFICATION OF ACTIVITY



- 10 CFR 35.63 requires that a licensee determine and record the activity of each dosage before medical use.
- During this check, it is **IMPORTANT** that the activity be checked against the written directive immediately prior to administration because **failure to do so has been the cause of several numerous events**.

VERIFICATION OF ACTIVITY EXAMPLE

- Patient was scheduled to receive 3.47 MBq of Ra-223 Xofigo.
- On the day of treatment, patient's procedure was cancelled due to low blood pressure.
- Licensee kept dosage in hot lab for decay.
- One month later, the patient came back for treatment.
- Received the dosage from original vial, which resulted in an administration of 0.63 MBq.
- Demonstrates the need to verify dosage with the written directive immediately prior to treatment.

PROTOCOL AND SCHEDULING

- Protocols are becoming more complex and sometimes include multiple steps or other treatments in addition to the radiopharmaceuticals.
- In addition, certain drugs may interfere with distribution of the drug in the body.
- **Note** – Not all incidents involving incorrect protocol scheduling or drug interference are reportable per NRC regulations. However, these events can be medically important and sometimes do qualify as medical events.
- The NRC has been notified of several of these types of events.

PROTOCOL EXAMPLE

- During a typical Lutathera treatment, an amino acid infusion begins 30 minutes prior to the radioactive drug administration protect the kidneys by lowering the dose.
- In one event, a patient's Lutathera treatment began without the amino acid infusion as the amino acid line was still clamped.
- The technologist realized this approximately 20 minutes after the Lutathera treatment began and started the amino acid infusion.
- The licensee calculated the kidneys received an estimated dose of 740 cSv (rem) instead of intended 490 cSv (rem) and reported the event.
- Corrective actions included moving the amino acid solution to a separate primary IV line which would alarm if it is still clamped, training nursing staff, and adding a pause to ensure the amino acid infusion has begun before starting the Lutathera.

SCHEDULING EXAMPLE

- While a patient was undergoing a Lu-177 Lutathera infusion, they informed the AU they received chemotherapy the day before.
- The normal protocol for Lutathera treatment is for the chemotherapy to be done after the infusion so the AU immediately stopped the infusion leading to an underdose to the patient and a medical event.
- This event demonstrates that AUs should check the status of the patient's entire protocol, especially if multiple departments are involved, prior to each administration.

SET UP AND ADMINISTRATION INCIDENTS

- In the last 2 years, **6 events** have been reported due to expected set up issues associated with newer procedures.
- Everyone should be trained on new administrations and the equipment they may handle in the procedure.
  - Do not forget about support staff.
  - Do not forget about those who handle equipment or perform set up before administration even begins.
- Cold mock administrations (including set up) with entire team significantly reduce the chance of an event.

SET UP AND ADMINISTRATION EXAMPLE

- A nurse removed an occluding clamp and opened the roller clamp on a flush bag line at the beginning of an I-131 Iomab-B treatment.
- Led to leaking tube in the infusion system.
- Resulted in patient receiving only 53% of prescribed dose but no contamination.
- Root cause was failure to train staff on this specific procedure.
- Corrective action was to ensure nuclear medicine and radiopharmacist were trained in the infusion pump and would be solely in charge of the pump for future patients.

SET UP AND ADMINISTRATION EXAMPLE

- During a Xofigo administration, a three-way stopcock was used to allow for administration of saline and radium dichloride.
- An incorrect cap was used on the unused port of the three-way stopcock.
- The cap that was used was designed to maintain sterility of the port connection, but not prevent flow, which led to a leak.
- Root cause was failure to train the staff on the equipment prior to the administration.

LEAKS

- In the last 2 years, **7 events** have had an associated leak or spill.
  - **4 events** were expected to be associated with incorrect set up.
  - **3 events** were associated with infusion tubing but no set up issues were noted.
  - Leaks occurred in Lutathera, Pluvicto, and Xofigo administrations.
- One licensee reported they tested additional tubing from the same lot and identified that more tubing leaked. They removed entire tubing lot.

SUMMARY

- The NRC has seen an increase in medical events associated with radiopharmaceuticals as new drugs come into the market.
  - Many events are associated with the increased complexity and lack of training of staff with new protocols.
  - Many types of events are new to the NRC, such as leaks and set up issues associated with radiopharmaceutical delivery.
  - NRC expects to continue to see new medical events as more protocols enter the clinic.
- The NRC is in the process of developing an information notice to inform licensees to events that have been reported and industry recommended corrective actions.

Acronyms

- AU – Authorized User
- cSv – Centisievert
- GBq – Gigabecquerel
- I-131 – Iodine 131
- Lu-177 – Lutecium 177
- mCi – Millicurie
- Ra-223 – Radium 223
- Sv – Sievert
- NRC – Nuclear Regulatory Commission

SPECIAL RECOGNITION For Dr. Metter by Cmsr. Wright

(No Handout)

DR METTER'S THOUGHTS ON LEAVING ACMUI

(No Handout)

OPEN FORUM

(No Handout)

March 2024

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
25	26	27	28	29	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18 TENTATIVE ACMUI DATE	19 TENTATIVE ACMUI DATE	20	21 RSS MEETING	22 RSS MEETING	23 1. RSS MEETING 2. PURIM HOLIDAY
24 PURIM HOLIDAY	25	26	27	28	29	30
31 3. EASTER	1					

Notes

1. RSS MEETING, March 21 - 23
2. PURIM HOLIDAY
3. EASTER

April 2024

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
31	1	2	3	4	5	6
7	8 *TENTATIVE ACMUI DATE*	9 *TENTATIVE ACMUI DATE*	10	11	12	13
14 AHA Annual Meeting	15 AHA Annual Meeting	16 AHA Annual Meeting	17	18	19	20
21	22 **Passover**	23 **Passover**	24 **Passover**	25 **Passover**	26 **Passover**	27 **Passover**
28 **Passover**	29 **Passover**	30 **Passover**	1	2	3	4
5	6	*Notes*	1. American Hospital Association Annual Meeting, April 14 - 16,		2. Passover	