

TEXAS A&M UNIVERSITY

RADIATION PROTECTION PROGRAM: 2018 REVIEW

Environmental Health and Safety

Radiological Safety

June 2019

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INTRODUCTION

This document provides a review of the Radiation Protection Program for Texas A&M University over the 2018 calendar year. Topics covered include an overview of the Protection Program scope and organization, followed by a review of several specific elements. Components which are vital to the strength of the program, such as training and maintenance of ALARA practices, are appraised. In addition to these items, a review of routine practices, such as waste disposal, internal and external audits and inspections, and changes to the program, are discussed.

TEXAS A&M UNIVERSITY LICENSES

Texas A&M University holds several federal and state licenses and registrations, which authorize the use of byproduct radioactive materials, source materials, special nuclear materials, and radiation-producing devices (both ionizing and non-ionizing). In accordance with state and federal regulations (25 TAC §289.202 (e) (3) and 10 CFR 20.1101(c), respectively) this report reviews the activities conducted under the licenses and registrations for the calendar year 2018. An overview of the various licenses maintained by Texas A&M University is provided in Table 1.

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Table 1 – Licenses maintained at Texas A&M

License No.	Issuing Agency	Expiration Date	Description
42-09082-09	United States Nuclear Regulatory Commission (USNRC)	October 31, 2033	Radioactive Materials License, Use aboard JOIDES (SEDCO/BP 471) and any other TAMU research ship
L00448	Texas Department of State Health Services (TDSHS)	Sep 30, 2016 (under timely renewal)	Radioactive Materials License, TAMU and Galveston
L05683	Texas Department of State Health Services (TDSHS)	August 31, 2024	Radioactive Materials License, TAMU, University Services Bldg., Riverside Campus, Prairie View A&M, Beeville, Bushland, Dallas, Lubbock, Overton, Plainview, Uvalde, Vernon and Weslaco
L06561	Texas Department of State Health Services (TDSHS)	July 31, 2023	Radioactive Material License, Texas A&M University Cyclotron Institute
R00304	Texas Department of State Health Services (TDSHS)	September 30, 2023	Certificate of Registration (RPD), TAMU, Riverside Campus, Lufkin, TAES-Beeville, Prairie View A&M and Galveston
R14497	Texas Department of State Health Services (TDSHS)	February 28, 2026	Certificate of Registration (RPD), JOIDES (D/V SEDCO/BP-471 aka JOIDES Resolution)
Z00116	Texas Department of State Health Services (TDSHS)	April 30, 2019	Certificate of Registration (Laser), TAMU

42-09082-09

The U.S. Nuclear Regulatory Commission issues this license. It authorizes the University to use selected radionuclides at temporary job sites at sea aboard TAMU and other research vessels. The license expires on October 31, 2033.

L00448

The Texas Department of State Health Services issues this broad-scope license. It authorizes the University to use radioactive material in College Station and Galveston, Texas. The technical renewal for this license was submitted in August 2016. The license is under timely renewal. There was one amendment issued in 2018. Amendment 151 was issued for addition of Am-241-Be sealed source.

L05683

The Texas Department of State Health Services issues this specific license. It authorizes the University to use radioactive material at designated remote sites inside Texas. Unlike license L00448, this license is relatively specific with regard to the radioactive materials that may be possessed, as well as the individuals authorized to use the materials. There were two amendments issued in 2018. Amendment 36 was for addition of Am-241-Be and Cs-137 in soil moisture density gauge. Amendment 37 was for adding a new PI at site 010 (Weslaco). The license expires on August 31, 2024.

L06561

The Texas Department of State Health Services issues this specific license. It authorizes the University to produce radioactive material for research and development at the Texas A&M University Cyclotron Institute in College Station, TX. Unlike the broad-scope license L00448, this license is relatively specific with regard to the radionuclides that can be produced using the cyclotron and the individuals authorized to possess and use those radionuclides. No amendments were issued in 2018, and the license expires on July 31, 2023.

R00304

This registration is issued by The Texas Department of State Health Services and authorizes the University to possess and use radiation producing devices on the College Station campus, with remote sites at RELLIS, Beeville, Prairie View A&M University, Galveston and Lufkin. The registration was renewed and the expiration date is September 30, 2023. No new amendments were issued in 2018.

R14497

This registration, issued by The Texas Department of State Health Services, authorizes the University to possess and use a diffraction x-ray unit aboard the D/V SEDCO/BP-471. This

vessel is also referred to as the JOIDES Resolution. The registration was renewed in 2018 and the expiration date is February 28, 2026. One amendment was filed in 2018 to add more units.

Z00116

This registration, issued by The Texas Department of State Health Services and authorizes the University to possess and use Class IIIB and Class IV lasers at the College Station campus. No amendments were issued 2018. The registration expires in April 30, 2019.

RADIOLOGICAL SAFETY PROGRAM ORGANIZATION

Radiological Safety Committee

The Radiological Safety Committee (RSC) advises the Texas A&M University administration on matters related to radiological safety and recommends policies and procedures it deems appropriate to ensure an adequate radiological safety program. The RSC consists of at least six voting members, including the Chair, appointed by the Vice President for Finance and Operations; plus three Ex Officio (non-voting) members as outlined below. The RSC acts as an advisory body to ensure that radioactive materials are safely used in accordance with As Low As Reasonably Achievable (ALARA) principles. The RSC also conducts a series of annual audits in which the entire program is reviewed over a period of three years. The RSC met three times during the 2018 calendar year.

Members	Department
John Ford, Ph.D., Chair	Nuclear Engineering
Jonathan Sczepanski, Ph.D	Chemistry
Joseph Reibenspies, Ph.D	Chemistry
Thomas Welsh, Ph.D	Animal Sciences
Kris Hagle, Ph.D	Cylotron Institute
Brian Applegate, Ph.D	Biomedical Engineering
Jay Griffin, DVM	Large Animal Clinical Sciences
Hays S. Rye, Ph.D.	Biochemistry & Biophysics
Craig Mariano, Ph.D	Nuclear Engineering
Ursula Winzer-Serhan, Ph.D	Neurosciences & Experimental Therapeutics
Christopher M. Meyer, CHP, <i>Ex-Officio</i>	Office of Safety and Security
Latha Vasudevan, Ph.D., CHP, <i>Ex-Officio</i>	Radiological Safety Officer
Christina Robertson, CIH, CSP, <i>Ex-Officio</i>	Environmental Health and Safety

Radiological Safety Staff

The Radiological Safety Staff (RSS) consists of individuals employed by Environmental Health and Safety, under direction of the Radiological Safety Officer (RSO). In 2018, the RSS consisted of the RSO, two Senior Health Physicists /Assistant RSO, one Associate Health Physicist, one

Assistant Health Physicist IV, two Assistant Health Physicists II, two Assistant Health Physicists I, a Senior Office Associate, and 5-6 student technicians. A part time program aide position was also occupied for supporting scanning of permit documents and storing in laserfiche repository.

RADIOLOGICAL SAFETY PROGRAM ELEMENTS

Overview of Permits

Texas A&M Radiological Safety maintains three different kinds of radiation permits: Radioactive Material (RAM) permits, Radiation Producing Device (RPD) permits, and Laser permits. The NRC and TDSHS licenses are blanket licenses for the entire university. To adequately maintain oversight, Radiological Safety issues permits, or sub-licenses, to principal investigators authorizing them to possess and use specific quantities of RAM or specific devices. As of December 2018, there were a total of 145 RAM permits, 65 RPD permits, and 90 Laser permits.

Radiological Safety Training

During 2018, several types of training were offered by EHS. There were a total of 28 classroom training sessions (including WebEx) offered and 1965 people were trained (both classroom and online). EHS offers General Radiation Safety and Veterinary Radiation Safety class room training as well as online refresher training, online General Radiation Producing Device (RPD) training, and online General Laser Safety training. A summary of training provided by the Radiological Safety Staff in 2018 is displayed in Table 2.

Instrument Calibrations

Radiological Safety provides response check services for instrumentation used by labs. Radiological Safety also facilitates the shipping and paperwork for instruments requiring calibration by outside entities. In 2018, 46 portable survey instruments were sent to the manufacturer for calibration, and 85 instruments were provided functional response checks by RSS and verified to be operational with an acceptable efficiency.

Sealed Sources & Leak Tests

Radiological Safety provides leak test services to authorized users with certified sealed sources. These services are also provided, as a courtesy, to users possessing sources authorized under a general license. Leak tests are performed quarterly. As of December 2018, leak tests were performed for 90 sealed sources, as well as 29 generally licensed sources.

Table 2– Summary of training provided by RSS in 2018

Training Type	Number of Times Offered in 2018	Number of Individuals Completing Training
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General Radiation Safety (Classroom)	12	223
General Radiation Safety (WebEx) Distance Learning for Remote Sites)	offered with monthly	17
Veterinary Radiation Safety (Classroom)	16	178
General Laser Safety (Online)	--	641
General Radiation Producing Device -RPD (Online)	--	316
General Radiation Safety Refresher (Online)	--	269
Veterinary Radiation Producing Device -Vet RPD (Online)	--	321
Total	28	1965

Special Nuclear Material

Special Nuclear Materials (SNM) that are possessed by the University should be accounted for and verified on an annual basis. The RSS performs inventory verifications and prepares reports as required by 10 CFR 74 and the Nuclear Material Management and Safeguards System (NMMSS). These NMMSS reports were filed for the period 12/1/2017-11/30/2018 and were reconciled on December 5, 2018.

Review of External Dosimetry Data

This section addresses external dosimetry for the calendar year 2018. Through the end of 2018, 1465 individuals were monitored for external occupational radiation exposure. Of those monitored, 739 had no reportable whole body deep dose equivalent (DDE) above background. Of the remaining 726 individuals, two received doses exceeding 10% of the whole body annual limit, or 500 mrem. The remainder received doses ranging from 1 mrem to 418 mrem. The cumulative dose for all individuals monitored for the entire year was 14.1 person-rem. The average deep dose equivalent for those who received a measurable dose was approximately 24 mrem. A summary of these data is provided in Table 3 and Figure 1. The average DDE values shown in this table are deep dose equivalent averaged over individuals receiving a non-zero dose. The highest DDE reported in 2018 were 1453 mrem. Personnel were also monitored for whole body shallow dose equivalent (or “skin dose,” SDE) and dose equivalent to the lens of the eye (LDE). The maximum SDE and LDE values were 1455 and 1463 mrem respectively. In addition to whole body dosimeters, some users were issued extremity dosimeters to measure dose to the hand, when applicable. The highest extremity shallow dose equivalent noted for 2018 was 2148 mrem.

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The individuals with the highest dose reported work in Nuclear Medicine and diagnostic radiology at the Veterinary Teaching Hospital. Diagnostic and interventional procedures, such as X-ray, computed tomography, and fluoroscopy are common in the Veterinary Teaching Hospital, and account for the majority of dose received on campus.

Table 3 - Summary of whole body dose (DDE) by subaccount number

Department	Number Measured	Number with Measured Dose	Cumulative DDE (mrem)	Avg. DDE (mrem)	Max. DDE (mrem)
4 th year students	358	342	6873	20	353
Athletics	2	0	0	M	M
Beutel	3	0	0	M	M
Bio	1	0	0	M	M
CCCA	2	0	0	M	M
CyclB	348	1	6	6	6
CyclC	242	13	66	5	9
Ebeam	7	7	11	2	3
EHS	32	7	26	4	11
GI	21	12	221	18	73
Human Clinical	2	1	3	3	3
IBT	1	0	0	M	M
Joides	7	0	0	M	M
LA/MedSurg	17	14	92	7	60
LA/ResInt	25	21	191	9	45
LARR	3	0	0	M	M
Monthly	41	38	5927	156	1453
NucEng	24	19	186	10	59
SA/FacMed	17	16	895	56	418
SA/ResInt	55	52	1634	31	142
SA/Spec	20	20	612	31	164
Soil & Crop	6	0	0	M	M
School of Public Health	11	0	0	M	M
Staff/Anes	19	17	520	31	76
Staff/LAICU	20	14	86	6	19
Staff/LAMed	25	20	757	38	186
Staff/LAOR	24	18	197	11	64
Staff/Misc	8	6	78	13	25
Staff/RAD	3	3	484	161	403
Staff/SACardio	4	2	22	11	13

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Staff/SADental	1	1	15	15	15
Staff/SAER	22	21	724	34	76
Staff/SANeuro	4	4	14	4	6
Staff/SAOnco	5	4	21	5	9
Staff/SAOR	30	25	459	18	47
Staff/SAOrtho	5	4	79	20	56
Staff/SASX	5	5	73	15	40
Staff/SAZooMed	2	2	13	7	7
Staff/SAIntMed	9	7	170	24	44
TAES	2	1	3	3	3
TAES2	2	0	0	M	M
TIPS	27	8	184	23	83
Ward Ober	5	3	20	7	9

*M : “Minimal” indicates no measurable dose above background

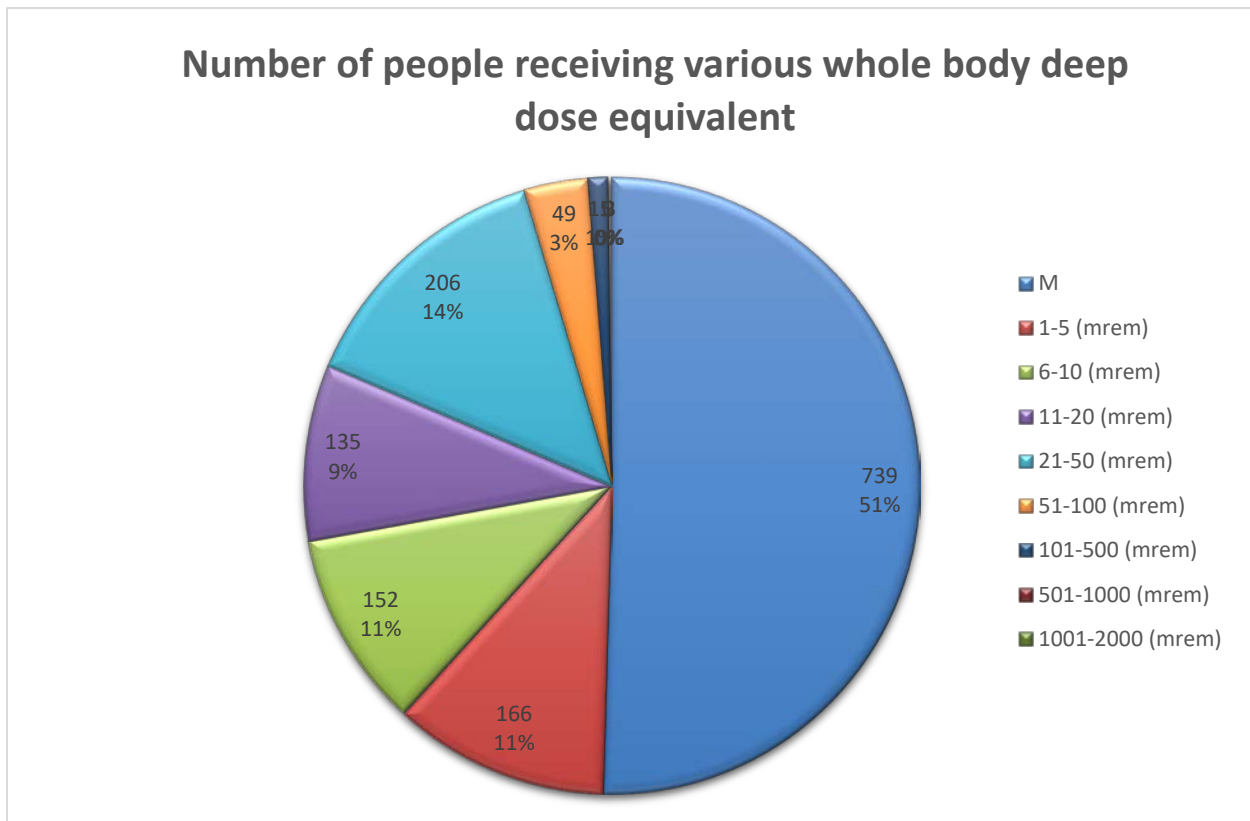


Figure 1 - The number of people and percentage of people receiving various values of whole body deep dose equivalent exposures is shown. M: “Minimal” indicates no measurable dose above background.

Review of Internal Dosimetry Data

There were 86 routine post-work thyroid screening bioassays performed for I-125. No bioassays were performed for I-131. None of the bioassays performed required additional investigation.

Radioactive Waste Disposal

In 2018, three solid waste disposals to the local landfill were conducted via disposal methods allowed under the Texas Administrative Code (TAC), 25 TAC §289.202(fff)(1)(A), 25 TAC §289.202(fff)(1)B, 25 TAC §289.202(fff)(4) and 25 TAC §289.202(ggg)(7). On February 12, 2018, 5.17 m³ of short-lived waste containing F-18, P-32, I-125, S-35 and In-111 for a total activity of 2.412 mCi, and 108 pounds of long lived waste containing H-3 and C-14 with an activity of 0.28 mCi was sent to the landfill. On May 24, 2018, 3.84 m³ of short-lived waste containing S-35, P-32, Cr-51, Tl-208, Au-198, In-111 and I-125 for a total activity of 6.28 mCi and 534 pounds of long lived waste containing H-3 and C-14 with an activity of 1.93 mCi was sent to the landfill. On October 11, 2018, 3.84 m³ of short-lived waste containing P-32, S-35, and I-125 for a total activity of 4.99 mCi and 771 pounds of long lived waste containing C-14 with an activity of 0.12 mCi was sent to the landfill. Table 4 shows the summary of landfill disposals.

Four liquid waste disposals were conducted in 2018. The total activity of all radionuclides released via the sanitary sewer in 2018 was 2.05 mCi. The total activity concentration for the year was 7.65E-09 µCi mL⁻¹. The sum of the ratios of the radionuclides disposed was 2.84 E-04 which is significantly less than 1. All of these values are well below the limits stated in 25 TAC 289.202 (gg) regarding the discharge of radionuclides via sanitary sewer. Table 5 shows the summary of liquid waste disposals.

Shipment of waste to an authorized low-level waste facility was conducted in 2018 through Bionomics, Inc. Three shipments were made in 2018. The first shipment was on May 16, 2018, the second shipment was on August 28, 2018 and the third shipment was on December 4, 2018. Table 6 shows the summary of waste disposed of through Bionomics.

Table 4 - Summary of 2018 Landfill Disposals

Date	Radionuclide	Volume (m ³) or Weight (pounds)	Activity (mCi)
02/12/2018	³ H and ¹⁴ C	108 pounds	0.28
	All Other Short Lived including ¹⁸ F	5.17 m ³	2.412
05/24/2018	³ H and ¹⁴ C	534 pounds	1.93
	All Other Short Lived	3.84 m ³	6.28

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10/11/2018	³ H and ¹⁴ C	771 pounds	0.12
	All Other Short Lived including ¹⁸ F	3.84	4.99

Table 5 – Summary of 2018 Liquid Disposals to the Sanitary Sewer

Radionuclide	³ H	¹⁴ C	³² P	³⁵ S	⁵¹ Cr	¹²⁵ I
Yearly Total (mCi)	0.193	0.023	0	0.095	0.0007	1.255
Activity Concentration (uCi/mL)	8.41E-10	1.02E-10	7.94E-10	4.15E-10	3E-12	5.49E-09
25TAC289.202(gg) Table III limits (uCi/mL)	1E-02	3E-04	9E-05	1E-03	5E-03	2E-05
Ratios of Concentration to limits	8.411E-08	3.389E-07	8.822E-06	4.148E-07	5.997E-10	2.746E-04

Sum of the ratios : 2.84E-04 which is less than 1

Table 6 – Summary of 2018 Waste Disposals through Bionomics

Date	Number	Container	Category	Activity (mCi)
5/16/2018	1	55 gallon drum	Dry waste	0.02129
	2	55 gallon drum	Vials (both exempt and LSC)	0.40001
	1	55 gallon drum	Organic LSC vials	0.14658
8/28/2018	1	55 gallon drum	Organic LSC vials	0.21275
	1	55 gallon drum	Exempt LSC Vials)	2.63313
12/4/2018	1	10 gallon Type A drum	Sealed Sources	0.0603
	1	55 gallon drum	Dry Waste	0.001

POLICIES & PROCEDURES

The radiological safety program manual and radionuclide laboratory procedures manual were revised and submitted for review as part of license L00448 renewal. The radiological safety procedure manual for veterinary use was updated and the addendum submitted for review.

Special Project Review - *Synovetin OA (Homogeneous Tin (Sn-117m) Colloids) an intra-articular therapy for osteoarthritis in dogs*

Vet school presented the project summary and radiological safety is working with vet school to develop standard operating procedures for the therapy.

Annual Radiological Safety Laboratory Reviews

In 2018, a total of 61 radiological safety laboratory reviews/inspections were performed on the TAMU main campus. Moreover, RSS completed inspections of 13 remote site permits under license L05683 and registration R00304. These reviews were conducted in addition to other visits to the labs such as package delivery, waste pickup, contamination/radiation surveys, etc. Laboratories that required follow-up visits by RSS due to minor discrepancies were completed.

Radiological Safety Committee Audit

Audit for Sealed Sources and Leak tests were performed by John Ford on March 20, 2018

Audit findings/recommendations:

- No programmatic deficiencies identified. Leak test procedures are clearly spelled out and the plan for notification of onsite and offsite source holders has been standardized and is in use
- Records are well organized and easy to access electronically on a network drive
- Suggestion to transfer and store calibration records of the liquid scintillation counter on the network drive

RSS comment:

- Calibration records are currently kept as hardcopy and the computer connected to the counter. EHS-Rad safety will be moving the calibration files from the computer hard drive and save them in a folder in the network drive.

Audit of Licenses and Permits was performed by Craig Marianno on August 7, 2018

Audit findings/recommendations:

- The audit revealed that EHS-Rad Safety keeps its record in an organized manner that is easily accessible either through hardcopy or the use of HPA.
- The results of the audit revealed no deficiencies or areas that could be improved

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RSS Comment: No deficiencies

Audit on Organization and Program Scope was performed by John Ford on December 13, 2018

Audit findings/recommendations:

- Scope and responsibilities are higher than anticipated. EHS-Rad Safety has been making adjustments to cover increasing responsibilities efficiently
- EHS-Rad safety short-handed-fairly high turnover rate
- Request for better transportation vehicle has been made by EHS-Rad Safety to visit remote sites more frequently
- Need to have a laser safety expert to handle the large number of lasers on campus
- EHS-Rad Safety currently share funds with other hazardous material disposals. A separate radiation material disposal funding is suggested.

RSS comment: EHS-Rad Safety has requested for a laser safety manger position for overseeing lasers on campus and was not approved.

Currently the radioactive material disposal charges are manageable under the hazardous material budget. However, EHS-Rad Safety is evaluating the radioactive material disposal charges for future.

State Inspections

L06561 (Site 000, Cyclotron Institute): State inspection was performed on September 20, 2018. No violations noted and radiation safety program in compliance.

L05683 (Site 009, Vernon, TX): State inspection was performed on February 20, 2018. No violations noted and radiation safety program in compliance

L05683 (Site 018, Bryan, TX): State inspection was performed on September 20, 2018. No violations noted and radiation safety program in compliance

R00304 (Site 000, Texas A&M Main campus): State inspection was performed on January 17, 2018. No violations noted and radiation safety program in compliance

R00304 (Site 002, RELLIS campus): State inspection was performed on January 18, 2018. No violations noted and radiation safety program in compliance

R00304 (Site 008, University Services Bldg.): State inspection was performed on January 18, 2018. No violations noted and radiation safety program in compliance

Radiological Incidents/Events

- A. A Liquid Scintillation Counter (LSC) from the Department of Chemistry LSC was transferred on Nov. 8, 2018 to surplus unknowingly with calibration sources (low activity, below the exempt level). From surplus the LSC was taken to metal scrapyards. Radiological safety searched for the LSC and the standards in the metal scrap and found the remnants of the unit that was crushed. A detailed report was filed with the State as notification as this is a generally licensed unit. There were no violations.

- B. Unintentional hand exposure occurred during a veterinary radiograph on November 5, 2018. The person holding the animal during X-ray was not wearing the lead and dosimetry ring. Radiological safety recreated the scenario and calculated dose and it was minimal. Radiology personnel were re-trained and emphasized the importance of wearing lead while holding animals during X ray.

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Report Submitted By: Latha Vasudevan
Radiological Safety Officer

Date: July 2, 2019

Reviewed By: 
Chair, Radiological Safety Committee

Date: July 9, 2019