

**TEXAS A&M UNIVERSITY**

**RADIATION PROTECTION PROGRAM: 2019 REVIEW**

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Environmental Health and Safety

Radiological Safety

June 2020

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## **INTRODUCTION**

This document provides a review of the Radiation Protection Program for Texas A&M University over the 2019 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 2019. 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**

<b>License No.</b>	<b>Issuing Agency</b>	<b>Expiration Date</b>	<b>Description</b>
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)	September 30, 2029	Radioactive Materials License, TAMU, College Station, Bryan, Houston and Galveston
L05683	Texas Department of State Health Services (TDSHS)	August 31, 2024	Radioactive Materials License, TAMU College Station, Bryan, 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, 2029	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. One amendment was completed in 2019 to increase the amount of S35 and C14 for use aboard the JOIDES. 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 Texas A&M University College Station, Bryan, Houston and Galveston, Texas. Three amendments were completed during 2019, Amendment 152 for decommissioning cost estimate, amendment 153 for the addition of two locations, Bryan and Houston, amendment 154 for renewed license that includes the Veterinary use of radioactive materials. The license was renewed and the new expiration date is September 30, 2029.

### **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. Four amendments were completed in 2019. Amendment 38 for site address update for Dallas, amendment 39 for the addition of Cf-252 and Cs-137 sealed sources, amendment 40 for adding activated metal samples, amendment 41 reducing the number of soil moisture gauges. 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 2019 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 RELIS, Beeville, Prairie View A&M University, Galveston and Lufkin. Two amendments were completed in 2019, increasing the number of units and also adding the HSC-Bryan Campus and Kingsville. The registration was renewed and the expiration date is September 30, 2023.

**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. One amendment was completed in 2019 to add one more addition unit in JOIDES. The registration was renewed and the expiration date is February 28, 2026.

**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. One amendment was completed in 2019, to add Texas A&M University, Rellis Campus. The registration expires in April 30, 2019.

**RADIOLOGICAL SAFETY PROGRAM ORGANIZATION (LV)**

**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.

<b>Members</b>	<b>Department</b>
John Ford, Ph.D., Chair	Nuclear Engineering
Jonathan Sczepanski, Ph.D.	Chemistry
Joseph Reibenspies, Ph.D.	Chemistry
Thomas Welsh, Ph.D.	Animal Sciences
Kris Hagel, Ph.D.	Cyclotron Institute
Waruna Kulatilaka, Ph.D.	Mechanical Engineering
Jay Griffin, DVM	Large Animal Clinical Sciences
Bryan Tomlin, Ph.D.	Center for Chemical Characterization
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 2019, 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 2019, there were a total of 127 RAM permits, 66 RPD permits possessing a total of 137 RPDs, and 94 laser permits possessing a total of 426 laser units.

### **Radiological Safety Training**

During 2019, several types of training were offered by EHS. There was 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 2019 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 2019, 30 portable survey instruments were sent to the manufacturer for calibration, and about 149 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. Leak tests are performed quarterly. These services are also provided, as a courtesy, to users

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possessing sources authorized under a general license. In 2019, leak tests were performed for 94 sealed sources, and 24 generally licensed sources.

**Table 2– Summary of training provided by RSS in 2019**

Training Type	Number of Times Offered in 2019	Number of Individuals Completing Training
General Radiation Safety (Classroom)	19	186
General Radiation Safety (WebEx) Distance Learning for Remote Sites)	offered with monthly	
Veterinary Radiation Safety (Classroom)	19	181
General Laser Safety (Online)	--	689
General Radiation Producing Device -RPD (Online)	--	332
General Radiation Safety Refresher (Online)	--	243
Veterinary Radiation Producing Device -Vet RPD (Online)	--	224
<b>Total</b>	<b>28</b>	<b>1855</b>

### **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 12/1/2018-11/30/2019 and were reconciled on December 9, 2019.

### **Review of External Dosimetry Data**

This section addresses external dosimetry for the calendar year 2019. Through the end of 2019, 1300 individuals were monitored for external occupational radiation exposure. Of those monitored, 536 people (about 40%), had no reportable whole-body deep dose equivalent (DDE) above background. Of the remaining 764 individuals, two received doses exceeding 10% of the whole-body annual limit, or 500 mrem. One individual received 1083 mrem and the other received 1158 mrem. The remainder received doses ranging from 1 mrem to 376 mrem. The cumulative dose for all individuals monitored for the entire year was 21 person-rem. The average deep dose equivalent for those who received a measurable dose was approximately 16 mrem. A



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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. Personnel were also monitored for whole-body shallow dose equivalent (or “skin dose,” SDE), dose equivalent to the lens of the eye (LDE). The highest DDE reported in 2019 was 1158 mrem, SDE of 1159 mrem and LDE of 1157 mrem. In addition to whole body dosimeters, some users were issued extremity dosimeters to measure dose to the hand, when applicable. The highest extremity equivalent noted for 2019 was 3039 mrem.

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 <sup>th</sup> year students	361	337	5843	16	197
Athletics	2	0	0	0	0
Betel	3	0	0	0	0
Bio	1	0	0	0	0
CCCA	3	0	0	0	0
Cyclotron Institute	416	13	82	0	21
Ebeam	6	5	18	3	5
EHS	30	10	51	2	18
GI	20	5	17	1	9
Human Clinical	2	0	0	0	0
IBT	1	0	0	0	0
Joides	1	1	4	4	4
LA/MedSurg	18	10	116	6	87
LA/ResInt	29	18	155	5	30
Monthly	42	38	6999	167	1158
NucEng	31	29	514	17	53
SA/FacMed	16	15	507	32	102
SA/ResInt	70	68	1579	23	121
SA/Spec	23	22	524	23	110
Soil & Crop	2	0	0	0	0
School of Public Health	11	0	0	0	0
Staff/Anes	18	18	908	50	376
Staff/LAICU	17	11	55	3	28
Staff/LAMed	25	19	790	32	184

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Staff/LAOR	28	26	397	14	60
Staff/Misc	7	5	100	14	24
Staff/RAD	3	3	58	19	37
Staff/SACardio	4	2	48	12	33
Staff/SADental	1	1	11	11	11
Staff/SAER	26	26	825	32	87
Staff/SANeuro	5	3	22	4	15
Staff/SAOnco	3	3	11	4	6
Staff/SAOR	27	25	387	14	32
Staff/SAOrtho	6	4	76	13	37
Staff/SASX	6	5	86	14	44
Staff/SAZooMed	2	2	22	11	15
Staff/SAIntMed	8	8	190	24	41
TAES	2	1	2	1	2
TAES2	3	0	0	0	0
TIPS	30	13	632	21	222
Ward Ober	1	1	1	1	1

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

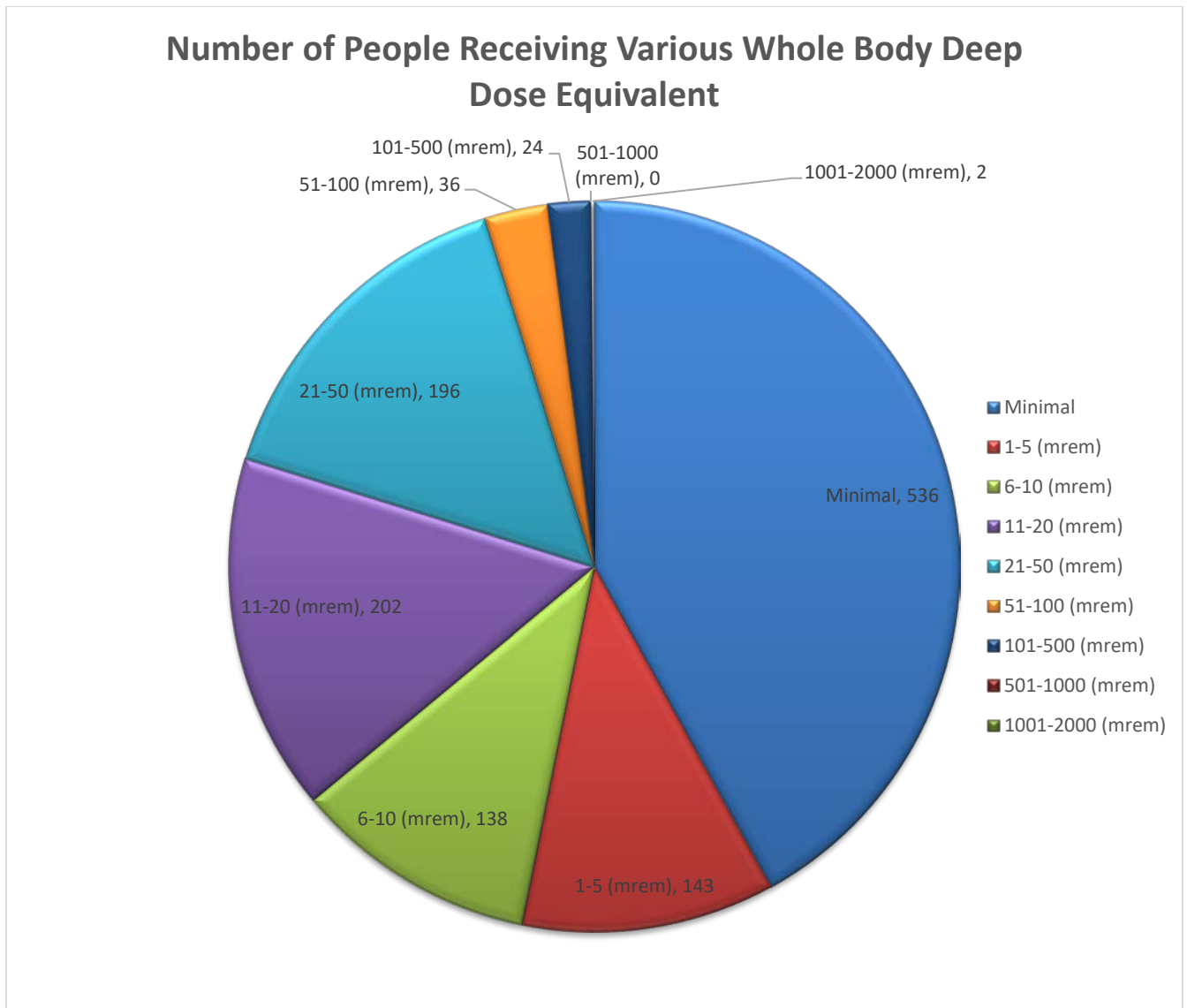


Figure 1 - The number of people receiving various values of whole body deep dose equivalent exposures is shown. M: “Minimal” indicates no measureable dose above background.

**Review of Internal Dosimetry Data**

There were 88 routine post-work thyroid screening bioassays performed for I-125. About 20 urine bioassays were performed. No bioassays were performed for I-131. None of the bioassays performed required additional investigation.

**Radioactive Waste Disposal**

In 2019, two 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 March 14, 2019, 4.57 m<sup>3</sup> of short-lived waste containing F-18, P-32, I-125, Tc-99m and In-111 for a total activity of 2.632 mCi, and 336.31 pounds of long lived waste containing H-3 and C-14 with an activity of 0.041 mCi was sent to the landfill. On October 8, 2019, 4.84 m<sup>3</sup> of short-lived waste containing P-32, Tc-99m, F-18, In-111 and I-125 for a total activity of 2.121 mCi and 377.87 pounds of long lived waste containing H-3 and C-14 with an activity of 0.129 mCi was sent to the landfill.

Four liquid waste disposals were conducted in 2019. The total activity of all radionuclides released via the sanitary sewer in 2019 was 1.57 mCi. The total activity concentration for the year was 6.82E-09 µCi mL<sup>-1</sup>. The sum of the ratios of the radionuclides disposed was 2.97 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 the Texas low-level waste disposal facility was conducted through the waste broker Bionomics, Inc. Four shipments were made from Texas A&M university, College Station. Table 6 shows the summary of waste disposed of through Bionomics. In addition, on May 24, 2019, 9 (55 gallon) drum of very low levels dry waste and 2 (55 gallon) drum of exempt vials were shipped out from Institute of Biosciences and Technology, Houston.

**Table 4 - Summary of 2019 Landfill Disposals**

Date	Radionuclide	Volume (m <sup>3</sup> ) or Weight (pounds)	Activity (mCi)
03/14/2019	<sup>3</sup> H and <sup>14</sup> C	337.3 lbs	0.0406
	All Other Short Lived including <sup>18</sup> F	4.57 m <sup>3</sup>	2.632
10/08/2019	<sup>3</sup> H and <sup>14</sup> C	377.87 lbs	0.129
	All Other Short Lived	4.84 m <sup>3</sup>	2.121

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**Table 5 – Summary of 2019 Liquid Disposals to the Sanitary Sewer**

<b>Radionuclide</b>	<sup>3</sup> H	<sup>14</sup> C	<sup>32</sup> P	<sup>35</sup> S	<sup>125</sup> I
Yearly Total (milliCi)	0.007	0.143	0.007	0.059	1.35
Activity Concentration (uCi/mL)	3.05E-11	6.21E-10	3.04E-11	2.57E-10	5.88E-09
25TAC289.202(gg) Table III limits (uCi/mL)	1E-02	3E-04	9E-05	1E-03	2E-05
Ratios of Concentration to limits	3.05E-9	2.07E-6	3.378E-7	2.57E-7	2.94E-4

Sum of the ratios : 2.97E-04 which is less than 1

**Table 6 – Summary of 2019 Waste Disposals through Bionomics**

<b>Date</b>	<b>Number</b>	<b>Container</b>	<b>Category</b>	<b>Activity (mCi)</b>
02/08/2019	1	55 gallon drum	Dry Solid Waste	18.75
	1	55 gallon drum	Vials (Exempt)	0.7
	1	55 gallon drum	DT generator head-H-3	<400
	1	30 gallon drum	DT generator head-H-3	<400
	1	Fiber board box	Filters and flood source	<0.01
05/24/2019	1	55 gallon drum	Vials (Exempt)	<0.001
8/29/2019	3	55 gallon drum	Dry Solid Waste	0.04
	1	55 gallon drum	Vials( Exempt)	<0.002
	1	10 gallon drum	Carcasses	1.63
	1	10 gallon drum	Low activity sources and standards	<2
11/12/2019	2	55 gallon drum	Vials (Exempt)	0.51

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	2	55 gallon drum	Dry Solid Waste	2.8
	1	10 gallon drum	Sources	

### **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.

Standard operating procedures for Synovetin OA ( Homogeneous Tin (Sn-117m) Colloids) an intra-articular therapy for osteoarthritis in dogs was reviewed and submitted for authorization from State.

#### **Annual Radiological Safety Laboratory Reviews**

In 2019, a total of 58 radiological safety laboratory reviews/inspections were performed on the TAMU main campus. Moreover, RSS completed inspections of 16 remote site RAM permits under license L05683 and 10 RPD permits under 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**

Radiation Dosimetry audit was performed by Joseph Reibenspies on March 26, 2019.

Audit findings/recommendations:

- Concerns addressed in 2016 audits were discussed.
- All records reviewed from 2016-2018 were dated and signed.
- Calibration records were up-to-date.
- Archival records maintained on site and their content summary have been digitized. EHS maintains five years of hard copy material on site. Content of these records are maintained electronically.
- Extra personnel to help digitize archival records.
- It is recommended that someone with experience in records management be hired to digitize and manage these important records.

RSS comment: A half-time program aide position to support the above operations is approved and RSS is looking to fill the position.

Laboratory surveys and Instrumentation audit was performed by Thomas Welsh on August 19, 2019.

Audit findings/recommendations:

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- No deficiencies were noted upon review of several hundred surveys of lab and instrument inspections.
- Prior auditors were concerned that the radiation safety program manual was shows as dated 2004. Perhaps a statement regarding the last review date can be added to the manual when the institutions permit is renewed.

RSS comment: A statement reflecting the date of review was added in the program manual while the manual was under review by the State.

Training program audit was performed by Jonathan Sczepanski on December 2, 2019.

Audit findings/recommendations:

- Audit revealed that the training program provided by the ORS is in compliance with current state regulations, and no deficiencies, or areas of concern regarding course content, organization, and record keeping were noted.
- Currently notification of online refresher training is handled manually by RSS. Software updates are considered that will make automation possible in 2020. Long term goal for integrating general radiation safety training with train trap was also discussed.
- New class room format for the general radiation safety training course expected was discussed.
- Recommends that the ORS establish training metrics to track and assess the effectiveness of all courses offered by the ORS that will allow future auditors to determine if the changes/updates to the training program are effective.

RSS comment: EHS software upgrade will potentially handle automated notification of training reminders. The new EHSA software will go live by July 2020. RSS is working on the hands-on radiation safety training for class room and will consider developing a training metrics to follow the effectiveness.

### **State Inspections**

L05683 (Site 001, Prairie View A&M, TX): State inspection was performed on January 11, 2019. No violations noted and radiation safety program in compliance.

L00448 (Site 000, College Station, TX): State inspection was performed on June 25, 2019. Two severity level III violations were noted.

- Licensee held radioactive waste and sources (not in use) for longer than 24 months.
- Areas of concern noted in laboratories during walk through.

*Comment: Response of corrective action was filed and brought the radiation safety program in compliance.*

R14497(JOIDES): State inspection /review of paperwork was conducted remotely on August 26, 2019. No violations noted within the scope of the inspection.

L00448 (Site 011, Galveston). State inspection was performed on October 11, 2019. No violations noted and radiation safety program in compliance.

NRC 42-09082-09. NRC inspection was performed on October 21, 2019. No violations were identified.

### **Radiological Incidents/Events**

#### **Contamination Incident**

- Low levels of contamination detected while moving equipment from an area at cyclotron Institute
- Miscommunication of the survey results by the Asst HP raised concern among the cyclotron personnel that ended up being reported to the state.
- RSS filed a detailed report to State and also consulted with the cyclotron staff. Very specific PPE requirements were implemented for conducting these operations in future.

#### **Veterinary Radiograph Incidental Exposure**

- It occurred during the pelvis radiograph of a very large bull.
- Bull was anesthetized and on the floor. However, two individuals had to hold the bull's hind legs forward to get a better image.
- In the process, the radiology technician was in very close proximity to the area being imaged.
- The dosimetry badges were sent out for processing after the procedure and the dose results were reasonable.
- No procedures were violated but different configurations for the animal holding were considered for future.

#### **Contamination Incidents**

- Minor contamination of S-35 found in ILSB lab.
- Lab personnel performed the cleanup but the waste was inadvertently placed in the regular waste container.
- Next morning custodial crew picked up the waste and placed it in the dumpster.
- The lab personnel retrieved the waste from the dumpster and notified radiation safety.
- Radiation safety verified the integrity of the waste bag and performed additional surveys.
- No radiological contamination in the area was found.
- Recommended specific areas and receptacle to hold radioactive waste and not to use regular waste container.

#### **Contamination from spilled wash water**

- Low levels of I-125 contamination was noted in vivarium after the wash water from the assay spilled on the floor.



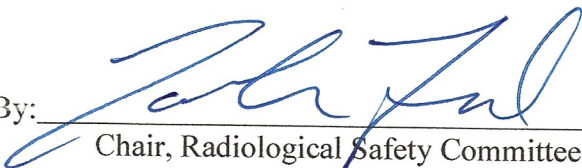
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- The area was cleaned and surveyed.
  - Radiation safety performed decontamination survey and the area was determined to be clean.
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Report Submitted By: Latha Vasudevan  
Radiological Safety Officer

Date: July 7, 2020

Reviewed By:   
Chair, Radiological Safety Committee

Date: July 30, 2020