CASE WESTERN RESERVE UNIVERSITY

DEPARTMENT OF ENVIRONMENTAL HEALTH & SAFETY

RADIATION SAFETY
ANNUAL REPORT 2017-2018

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INTRODUCTION

This report is submitted to the president and designated members of the senior administration of the University as required by the Radiation Safety Committee (RSC) Operating Guidelines and Case Western Reserve University's State of Ohio (Nuclear Regulatory Commission Agreement State) Broad Scope License. The report summarizes the activities of the Radiation Safety Office (RSOF) of the Department of Environmental Health & Safety (EHS) at Case Western Reserve University (CWRU). Its contents cover the period from 7/1/2017 – 6/30/2018.

SUMMARY

DEPARTMENT STRENGTHS

The RSOF is comprised of a staff with extensive and diverse backgrounds who can address and resolve a wide range of issues faced in radiation safety at CWRU. The RSOF has developed programs that meet or exceed regulatory requirements. These programs proactively anticipate new safety requirements by promulgation of new programs. The success of these agendas is enhanced by excellent administrative support.

DEPARTMENT OPPORTUNITIES

The RSOF enjoys excellent interaction with other departments that are developing safety-related initiatives and outside agencies that are dedicated to improving environmental quality in our facilities.

RADIATION SAFETY ACCOMPLISHMENTS FOR 2017-2018

Over the past year, the Radiation Safety division of EHS continued to improve the effectiveness of the Radiation Safety program. Notable new accomplishments included:

- Generated in-house savings accrued from meter calibration, recycling and decay-in-storage programs amounting to more than $19,440 in 2017-2018 through its services to the research community at CWRU.
- The 63rd Health Physics Society Annual Meeting met in Cleveland this summer from July 15 to July 20, 2018. The main sessions were held downtown at the Huntington Convention Center of Cleveland, but a number of our surrounding institutions played key roles as seminar hosts and as education centers for particular program subjects. Specifically, personnel from CWRU and University Hospitals (UH) assisted in coordinating meetings or served as lecturers. EHS staff members attended the national meeting, acquainted themselves with new instrumentation useful to CWRU's Radiation Safety Program and attended a variety of informative seminars. Some of our staff members were directly involved in organizing the venue for certain major seminars.
- Waste facility clean out of old sources, shielding and broken equipment and reorganization of the waste Facility.
- Successfully switched online training systems from Blackboard to Canvas
- Seamlessly changed website interface from Blackboard to Canvas
- Meter calibrations: decreased turn-around time for calibrating meters
- Clearances: facilitated placing clearance reports in a shared file to increase ease of audit of these important record.
- Set stage for update of irradiator security instruments.

RADIATION SAFETY GOALS FOR 2018-2019

The continuing goal of the Radiation Safety program is to position EHS for more effective interaction with the educational and research goals of the University through training and training development. A secondary goal is to increase the positive impact of CWRU safety programs on the surrounding community through educational and programmatic interaction with local partners and emergency responders. Specific efforts currently address:

- Dosimetry: reduce quantity of unreturned badges
- X-ray program: Implement new survey/inventory schedule
- Waste program: visit waste disposal sites which were not visited during the bid process; update radioactive waste logs to match new waste containers used by new radioactive waste vendor; ship off site all legacy/unknown waste by the end of the fiscal year
- Training: update online training and ensure transfer from Canvas to On-Site; ensure timely training for all RAD/ANR personnel; incorporate more safety related and day-to-day regulations to augment theoretical information
- Laser program: train backup specialist to conduct laser audits and laser training; update laser safety manual to new laser signage
- Sealed Source program: find a cheaper alternative of disposing unwanted radioactive sources
- Packages: establish a better relationship with purchasing
- Irradiators: reduce the number of alarms caused by User operational errors.
- Clearances: facilitate one clearance per day
- Meter calibrations: Learn how to calibrate Rad Eye meters for dose and efficiency
- Streamline electronic audit for the RSC
- Develop necessary radiation safety and radiation generating equipment (RGE) programs and evaluate their impact for the dental school in its new location/campus
- Meet with Cleveland Clinic radioactive materials (RAM) program leaders to examine new joint program interfaces that may arise in the new medical school.
- Jointly consider including a Cleveland Clinic program representative on the CWRU Radiation Safety Committee to coincide with opening of new Facilities at Cleveland Clinic location.
- Facilitate new technology to replacement of the radiation monitoring system units and their installation on an accelerated schedule in CWRU irradiator locations
- Examine and evaluate status of joint program relationships with University Hospitals (UH) radiation safety with special emphasis on dual user relationships and responsibilities. Arrange meetings with UH radiation safety personnel to review these issues

OHIO DEPARTMENT OF HEALTH LICENSE

CWRU has one Ohio Department of Health (ODH) Broad Scope license. The license covers possession and use of both nuclear accelerator-produced radioactive material (RAM) and naturally occurring RAM for experimental purposes. It also allows for the licensed use of four irradiators. A Broad Scope license site visit was last conducted by ODH on 5/22/2017.

The University has two ODH RGE registrations. The registration covers the receipt, possession, use, storage and disposal of radiation generating equipment including dental X-ray machines, X-ray diffraction units, and fluoroscopy units. The last ODH RGE (X-ray) inspection was conducted on 8/8/2017.

ODH LICENSE	EXPIRATION DATE	PURPOSE
011-011800-11	January 1, 2020	Broad Scope License
09-M-06944-12	May 31, 2019	Radiation-Generating Equipment Registration (All)
06-E-06944-020	May 31, 2019	Radiation-Generating Equipment Registration (Mobile Units)

DECOMMISSIONING FUNDING PLAN

The Broad Scope license and the decommissioning funding plan became effective 2/25/2010. The University was required to maintain a standby letter of credit to cover possible costs if the University's Broad Scope license is required to undergo rapid decommissioning. The expiration date for the standby letter of credit was 2/28/2016. Funds required for this letter of credit depended on the kind and amounts of RAM maintained in active use or waste by the University. Experimental procedures now use more sensitive methods that increasingly require less RAM. The University now operates under an agreement with ODH and that requires no letter of credit but is dependent on the University good financial standing. This agreement covers all possible decommissioning costs for RAM located at the University as long as the University's credit rating is maintained.

RADIOACTIVE MATERIAL USE AND STORAGE LOCATIONS

RAM is located at the following facilities:

- Main campus of Case Western Reserve University, 10900 Euclid Avenue, Cleveland, Ohio
- University Hospitals (UH), 2065 Adelbert Road, Cleveland, Ohio
- Wolstein Research Building (WRB), 2103 Cornell Road, Cleveland, Ohio

RAM is received and/or stored at the following sites:

- Shipping and receiving, 2232 Circle Drive, Cleveland, Ohio
- Wolstein Research Building, 2103 Cornell Road, Cleveland, Ohio

PURPOSE FOR RAM USE

The majority of isotope used at the University is for biomedical research. The most typical isotopes used are ^{14}C, ^{3}H, ^{125}I, ^{32}P, ^{33}P, and ^{35}S. Isotopes used in sealed sources contained within irradiators, scintillation counters, gamma counters, check sources and calibration standards are most commonly ^{137}Cs, ^{133}Ba, and ^{241}Am.

RADIATION SAFETY PROGRAM – RESPONSIBLE PARTIES

RADIATION SAFETY COMMITTEE

The RSC sets policy for the use of RAM for the University Committee. Members of this Committee are appointed by the president of the University and have responsibility for monitoring and enforcing compliance with the University's Radiation Safety Program as outlined in the University's Ohio Department of Health (ODH) Broad Scope license. Radiation Safety Committee members are chosen from diverse disciplines to provide comprehensive expertise. The Committee reviews all applications for use of RAM.

The 2017-2018 Radiation Safety Committee membership and their affiliations are listed below. The ODH is informed of committee membership changes. The Committee is also aided by input from ex-officio (non-voting) and visiting members (non-voting).

VOTING MEMBERS

Dr. Thomas McCormick Dept. of Dermatology BRB 530 LC - 4926 Term Expires: 10/15/2020 Chairperson Term Expires: 10/15/2020	Dr. W. David Sedwick Radiation Safety Officer (RSO) Dept. of Medicine EHS - Service Building, First Floor LC - 7227
Dr. Colleen Croniger Dept. of Nutrition BRB 925 LC - 4954 Term Expires: 10/15/2019	Dr. Eckhard Jankowsky Dept. of RNA Center HG Wood 137 LC - 4973 Term Expires: 10/15/2019
Dr. William Schiemann Dept. of Comprehensive Cancer Ctr WRB 2131 LC - 7284 Term Expires: 10/15/2020	Dr. Saba Valadkhan Dept. of Molecular & Microbiology HG Wood 210A LC - 4960 Term Expires: 10/15/2019
Dr. Tomoaki Ogino Dept. of Molecular & Microbiology HG Wood 207F LC - 4960 Term Expires: 2/3/2019	Dr. Donny Licatalosi Dept. of RNA Center HG Wood 106 LC - 4973 Term Expires: 1/11/2019
Dr. Suhrim Fisher Animal Resource Center BRB RB5P LC - 4925 Term Expires: 10/15/2020	

EX-OFFICIO MEMBERS

Richard Jamieson Vice President Dept. of Campus Services Administration Adelbert Hall 229 LC - 7173	Felice T. Porter EHS Asst. Dir./Asst. RSO Quality Assurance Specialist Service Bldg., First Floor LC - 7227
Bruce DeMeza University Hospitals Asst. RSO Bishop S621 LC - BSH 5056	R. Michael Sramkoski Senior Research Associate & Laser Specialist Comprehensive Cancer Ctr WRB 3405 LC - 7285

Joseph Nikstenas EHS Laser Safety Officer & Safety Specialist Service Bldg. First Floor LC - 7227	Marc Rubin EHS Senior Director Service Bldg. First Floor LC - 7227

SUPPORT STAFF

Department Assistant Service Bldg., First Floor

The Radiation Safety Committee acts as an advisory and enforcement body to ensure that all RAM are safely used in accordance with the 'As Low As Reasonably Achievable' (ALARA) principles. The Committee conducts audits each trimester, which address programmatic compliance. The RSC also conducts an annual audit in which the entire program is reviewed. The audits ensure:

- Specific program components conform to the licensed program as described in the CWRU Radiation Safety Manual and License.
- Accurate documentation for program conformance and license compliance is maintained.
- Adequate training is provided for all classes of workers.
- Oversight for RSOF activities is maintained through RSC familiarity with the daily function of the University Radiation Safety Program.

The Committee met on eight occasions during the 2017-2018 fiscal years to review applications for radioisotope use and action on other business. Four RSC meetings were cancelled because agenda items did not require immediate address. The minutes of the RSC meetings and executive committee actions are available in the RSOF, through the RSC or through the University's administration.

APPLICATIONS	**17/ 18**	**16/ 17**	**15/ 16**	**14/ 15**	**13/ 14**	**12/ 13**	**11/ 12**	**10/ 11**	**09/ 10**	**08/ 09**	**07/ 08**
New AU	3	3	1	3	7	2	7	3	9	5	7
Additional Isotopes	2	0	2	2	3	1	7	5	5	1	7
Radioisotope use in Animals	2	2	4	1	3	1	5	3	5	2	5
Sealed Sources	1	5	0	6	6	3	2	1	1	1	1
Sealed Sources Update	1	0	0	0	2	0	0	0	0	0	0
AU Reactivation	0	0	0	0	0	0	1	0	0	0	0
Possession Limit Increase	0	0	0	2	0	0	0	1	0	0	0
AU Protocol Update	4	7	2	7	15	14	10	12	0	0	0
TOTAL APPROVALS	13	17	9	21	36	21	32	25	20	9	20

Major topics acted upon or discussed by the RSC:

- Quorum RSC Meeting (7/2017)
- Joseph Nikstenas presented the laser summary report; Assessed Department of Energy laser safety modules to incorporate into EHS Training (9/2017)
- Three new staff members in EHS: (two chemical specialists, one fire/life safety specialist) were introduced to RSC. (9/2017)
- Training information has been updated from Blackboard to Canvas. (9/2017)

- Richard Jamieson reported that the Greenway Project will connect the campus walkway to Maltz Performing Arts Center. Health Education Campus (HEC) merged with operations, planning and management. Groundbreaking is scheduled for next week for CWRU's School of Dental Medicine only. (9/2017)
- W. David Sedwick (RSO) and Felice T. Porter (ARSO) presented the annual meeting. (10/2017)
- Joseph Nikstenas presented the laser summary report. The vendor, Kentex Laser Store, visited the CWRU Quad to share information about personal protection equipment for laser users. A dental school clinician has a new laser unit that will be used on patients. (10/2017)
- Dr. Suhrim Fisher from the Animal Resource Center (ARC) was appointed for a three-year term to the RSC. (10/2017)
- Drs. Thomas McCormick and William Schiemann have renewed their appointment for another three-year term to the RSC. (10/2017)
- Authorized users (AU) were sent notices that their RAM applications were due for the five-year renewal. (10/2017)
- The Blackboard training database has now been changed to The Canvas training database, but the 'check your training' link is still under construction. (10/2017)
- Richard Jamieson reported that groundbreaking for the new dental clinic was Tuesday, 10/2/2018. It was noted that Fall break is scheduled for 10/23-24/2017. (10/2017)
- Thomas McCormick thanked the RSC for all audits that were completed during the year and reminded them about the October audits. (10/2017)
- Laser Summary Report was presented by Joseph Nikstenas. (11/2017)
- The Quarterly Irradiator check will be conducted. RSC Trimester Audits were completed. Annual Report was reported. RSO invited the RSC to the EHS Christmas Party on Friday, 12/15/2017 at Noon in EHS Conference Room. (11/2017)
- Marc Rubin presented the Administration Report in absence of Richard Jamieson. The new Dental School project in underway. (11/2017)
- Thomas McCormick is working on an electronic audits tool for the RSC.
- Joseph Nikstenas presented the laser summary report. (12/2017)
- Felice Porter reported that the last EHS training day for the year was 12/20/2017 until January 2018. EHS will be closed the week of 12/25/2017 and the staff will be 'on call.' Gwendolyn Cox Johnson, EHS radiation department assistant, retired 11/30/2017 after 27 years of service. Valeria Jackson replaced Gwendolyn Cox Johnson. EHS plans to upgrade the 'OnSite Database' in 1/2018. Ohio Security Services will be added to the CWRU rave system. This will allow CWRU to be able to send out emergency messages to security if needed. EHS will meet with Joanne Brown, CWRU Architect, concerning specification for the new dental X-ray laboratories for HEC Project. (12/2017)
- Richard Jamieson reported that the residence halls will be closing for the Christmas break. The new Greenway Walkway is in progress. Staff and patient parking at the HEC will be available. There will be a shuttle plan for faculty, staff and students. The number of dual researchers between UH and CWRU will be determined. (12/2017)
- Thomas McCormick reported that the January RSC audits will be assembled for January 2018.
  Joseph Nikstenas presented the laser summary report. Joseph Nikstenas and Kumudu Kulasekere will attend the Department of Energy Medical Laser Conference in May 2018 at the University of Rochester in Rochester, NY. (3/2018)
- With the departure of Junran Zhang, radiation oncology has only one emeritus researcher, Nancy Oleinick. Mitchell Machtay, director, is in the process of searching for new researchers. (3/2018)
- State officials may want to conduct the Y2 program in Cleveland with EHS, police and security. (3/2018)
- Richard Jamieson reported that the HEC will be ready in Spring 2019. The Greenway Project Phase 2 was going well. Mailing facilities for CWRU, UH and CCF were reported to be combined since we are in such close proximity. Millis is now the Laser Core Facility. (3/2018)
- Thomas McCormick reported that April audits were forthcoming. (3/2018)
- Suhrim Fisher reported that the Animal Resource Center – Association for Assessment and Accreditation of Laboratory Animal Care (ARC - AALAC) site visit went well. The visit is done every three years in the ARC. The third floor of the Biomedical Research Building (BRB) is in the midst of a cleanup. (3/2018)
- Joseph Nikstenas presented the laser summary report. The RSC electronic audit template will be tested by the RSC during the April 2018 audits. One of three liquid scintillation counters (LSC) sustained damage from a ceiling leak in DOA. Insurance will replace this LSC. The 63rd Annual Health Physics Society Conference will be held in Cleveland, July 15-20, 2018. The Landauer dosimetry contract was renewed for another five years. There are several moves and relocations scheduled for researchers on campus. EHS will meet with HEC representatives in May 2018. Maintenance is required on two irradiators and the vendor has been contacted. (4/2018)
- Richard Jamieson reported that the HEC meetings will focus on working groups and the steering committee. HEC management will be done by a third party company. Greenway opening is in May 2018. (4/2018)

- Thomas McCormick reviewed the April electronic audit template. (4/2018)
- Joseph Nikstenas presented the laser summary report. National Health Physics convention will be held in Cleveland from July 15-20, 2018. EHS will assist in hosting some of the classes. EHS visited the new HEC. The Irradiators were repaired by the vendor, however, the technician will need to return for additional repairs. Marc Rubin inquired about chemical disposal of the cobalt irradiator. The department decided not to dispose of the irradiator due to high costs. (6/2018)
- The June Annual audit is scheduled for 7/9/2018. (6/2018)

SENIOR MANAGEMENT

The Radiation Safety Program monitors, inspects and audits RGE and source used by AUs and their personnel. Senior management oversight and support of radiation safety-related activities is guaranteed by attendance of the vice president for campus security at all RSC meetings. The RSC conducts independent audits of the Radiation Safety Program. The RSOF staff immediately responds to audit findings. Audit findings and responses are reported to senior management and the Committee. Richard Jamieson, Vice President of Campus Services, continues to provide direct administrative representation for Radiation Safety Programs.

RSOF AND AUTHORIZED USERS (AUs)

The AU and RSOF share responsibility for safety. The AU is directly responsible for the safe use of RAM in the laboratory. The Radiation Safety Office is responsible for ensuring that appropriate safety procedures are implemented and that AUs are fulfilling their responsibilities for monitoring safety during experiments carried out in their laboratories. Audits of laboratories are conducted by the RSOF to ensure compliance with CWRU's license. The audit program includes routine unannounced inspections of each AUs' laboratory.

ADMINISTRATIVE CONTROLS

Administrative controls are established and approved by the RSC for laboratories where RAM are/is used. Controls include signage, training, laboratory access and dosimetry. Written procedures document procurement, use and the disposal of all RAM at the University.

General safety compliance enforcement procedures prescribe sanctions for those who jeopardize safety or the continued favorable relationship between the University and the ODH. These procedures are designed to encourage the participation and cooperation of users of RAM and to promote safe use of such materials in a manner consistent with the rules and regulations of the ODH as interpreted by the RSC and the RSOF.

There are three classes of violations defined as minor, moderate and major severity.

Minor severity violations are listed under the following categories:

- Improper laboratory records
- Noncompliant RAM use and storage
- Maintenance of an unsafe laboratory environment

Moderate severity violations include the following:

- Food/cosmetics in laboratory
- RAM unsecured
- RAM in unauthorized areas
- Unapproved radiation laboratories
- Unapproved disposal of radioactive materials
- Unidentified contamination
- Failure to respond to written notices from the Radiation Safety Office

Major severity violations include the following:

- Falsification of records
- Unreported loss or theft of RAM
- Unapproved transfer of RAM

There were no major severity violations assessed over this year. Of the moderate violations listed below, 10 were the result of unsecured RAM found during after-hours security checks and routine compliance reviews. Three laboratories were assessed a moderate violation that had three or more minor violations during three compliance reviews by Radiation Safety during routine audits. Documented follow up and resolutions were completed for all major & moderate violations.

VIOLATIONS	17/18	16/17	15/16	14/15	13/14	12/13	11/12	10/11	09/10	08/09	07/08
Minor	43	70	78	81	134	93	112	64	53	103	83
Moderate	13	11	10	13	52	19	22	37	76	27	43
Major	0	0	0	0	0	0	0	2	0	0	0
Total	56	81	88	94	186	112	134	103	129	130	126

The assistant RSO, the RSOF staff and the RSO have updated and revised most of the department manuals, training, licenses, certificates and standard operating procedures in 2017-2018.

AU CATEGORIES:

RADIATION ACTIVE

AUs who actively use RAM are “radiation active” (RA). Laboratories of these AUs are inspected by the RSOF three times per year. Audits are more frequent if there are particular concerns in a laboratory. A listing of AUs and their RAM can be found in the Appendix.

RADIATION INACTIVE

These AUs do not currently use or possess RAM.

RADIATION ACTIVE STORAGE MODE

AUs who did not actively use RAM, but who wish to maintain their RAM inventory will, by their request, have their inventory placed in storage mode status this fiscal year.

DEPARTED (D)

AUs who no longer carry out research at CWRU, and whose laboratories have been decommissioned for RAM use, have been placed in the departed category this fiscal year.

AUs	17/18	16/17	15/16	14/15	13/14	12/13	11/12	10/11	09/10	08/09	07/08
RA	49	50	54	62	66	78	89	87	87	91	92
SM	20	15	20	8	13	15	13	16	3	4	5
RI	7	5	5	3	6	6	7	4	13	1	14
D	5	5	2	6	0	3	1	2	3	6	8
Total in Program	69	65	74	70	79	93	102	103	90	95	97

MASTER ISOTOPE LIST

The master isotope (see APPENDIX) list shows the University’s isotope inventory, the sum of the AUs’ inventory (excluding sealed sources) and the sum of the AUs’ possession limits relative to the National Regulatory Commission/ODH registration limit.

AU RADIOISOTOPE INVENTORY

The Radioisotope Inventory Report (see APPENDIX) lists researchers along with the amount of RAM material each is authorized to use, each AUs’ possession limits and the activity of isotopes on hand.

RADIATION SAFETY OFFICE (RSOF)

STAFFING

The RSOF operated under University approval with the following positions:

RSO (1)
Department Assistant (1)
Student (1)
Specialist Positions (4)
Asst. Director/Asst. RSO/Quality Assurance Specialist (1)

Training and education are central to our department's goal in developing diversified skills among our personnel who are required to respond to safety incidents and for maintenance of regulatory mandates. Specialists are encouraged to attend training and continuing education. Seminars, training and conferences attended or completed during 2017-2018 included radiological instrument training, RCRA selected hazardous waste training, 8-hour HAZWOPER refresher training and hazardous materials transportation security awareness.

EHS staff are responsible for maintaining the EHS website that houses all online departmental training programs and schedules, safety manuals, safety newsletters, material safety data sheets and safety information resources. The website is an essential resource for the campus community that requires continuous updating. EHS Staff also monitors and backs up all departmental databases.

EHS EMAIL

Since implementing the EHS email (does@case.edu and cwruehs@gmail.com), the number of inquiries and safety concerns raised by CWRU personnel has averaged fifteen emails per day. This communication has led to swift response and follow-up of safety concerns reported by our user community.

To report concerns of unethical activity, employees may contact the Integrity Hotline and provide information anonymously. They may call 866.483.9367 or go to https://www.caseintegrityhotline.com. They are encouraged to give the date, time, location and any other pertinent information concerning the incident.

TRAINING SESSIONS

It is the responsibility of the RSC to ensure that individuals using RAM are adequately trained to keep doses to personnel and releases to the environment per ALARA. The RSOF provides training for all personnel that use RAM or RGE/X-ray. Initial training must be completed before use of any radioactive materials or RGE/X-ray equipment. Annual retraining is required for the continued use of RAM. Ancillary workers (non-radiation workers) who occasionally have contact with RAM are retrained annually. Personnel that are trained include:

AU

An AU is a faculty member who has been approved by the RSC to use RAM.

RADIATION WORKER

A radiation worker is any person who uses RAM under the supervision of an AU.

ANCILLARY WORKER

An ancillary worker is a non-radiation worker who may have contact with laboratories or classrooms where RAM is used. This includes individuals working in facility services, protective services, In-house and contract custodial services, shipping/receiving, the ARC and research department assistants. During orientation, non-laboratory personnel are required to attend training that includes a radiation safety component.

RADIATION GENERATING EQUIPMENT (RGE) WORKER

An X-ray Worker is any person who uses RGE as part of the research program of an AU.

IRRADIATOR USERS

Personnel using irradiators are required to attend initial radiation safety training conducted by the RSOF and site-specific training with the manager of the irradiator. An irradiator worker is any person who has met the requirements for unescorted room access, including background and fingerprint checks and radiation safety, site-specific laboratory safety training.

TRAINING

The RSOF keeps a record of all dates of training, attendees and content of training. Records of refresher training offered online are also maintained. Classes and online sessions attended are essential components of CWRU's safety philosophy. Training is audited on a monthly basis by the assistant RSO to ensure compliance.

New isotope user training classes are offered at least two times per month. Annual radiation safety retraining is done online. X-ray training classes are conducted once a month. AUs are responsible for machine and performance-specific annual refresher training for workers who use X-ray equipment in their laboratory programs. Fluoroscopy users are required to complete a fluoroscopy training module (kindly provided by UH Cleveland Medical Center) in addition to the general X-ray and site-specific trainings. Fluoroscopy Right-To-Know training is provided on an as-needed basis to individuals who desire to observe fluoroscopy procedures. Additionally, there are monthly training classes for users of Class 3B and Class 4 lasers. The RSOF requires annual retraining for all workers involved with these units and this training is offered online.

All non-laboratory personnel are required to attend hazard communication and ancillary radiation training. Groups trained now include custodial, plant, ARC, shipping, security departments, and contractor workers. Employees who do not complete training are restricted from working in areas where RAM are used.

TRAINING	17/18	16/17	15/16	14/15	13/14	12/13	11/12	10/11	09/10	08/09	07/08
Radiation	133	118	61	92	168	239	279	186	279	223	240
Online Retraining	342	349	563	615	652	409	405	311	215	418	430
X-ray	22	43	58	50	48	76	72	86	52	97	96
Ancillary	710	741	619	279	685	601	382	146	345	403	382
Laser	59	40	46	41	35	71	89	38	48	66	41
Laser Online	68	22	67	27	39	16	32	42	35	28	15

Over 1,334 laboratory workers were trained through the Radiation Safety Program in 2017-2018, which is a high point over the last 10 years. This increase reflects an effort on the part of the RSOF to provide full training instead of ancillary training to all workers in laboratories where isotope is in active use.

FACILITIES AND EQUIPMENT

CWRU administration and the RSC ensure that appropriate facilities, equipment and trained personnel are available for the safe operation, storage and disposal of licensed material. The RSO and assistant RSO are responsible for overseeing the review of applications and inspection of all facilities, equipment and personnel that use licensed material. Facilities that are available at CWRU for the use of licensed material include:

AW Smith	Bingham	Biomedical Research
Bishop	Bolwell	DeGrace
Dental	Glennan	HG Wood
Lerner Tower	Kent Hale Smith	Med East/Robbins
Millis	Olin	Pathology
RBC	Rockefeller	Service
Wearn	West Quad (CCSB)	White
Wickenden	Wolstein Research	Wood Research Tower

LABORATORIES

There are 227 laboratories on campus equipped to use licensed material and equipment. The laboratories typically include chemical safety hoods, survey meters, protective clothing, analytical detection and measurement equipment, waste receptacles and decontamination supplies.

LABORATORY USE	# OF ROOMS
Radiation	153
X-ray	22
Laser	52

Radiation Safety Office (RSOF)

Facilities and equipment used by the RSOF to support laboratory inspection or isotope storage are located in the Service Building on the first floor, the School of Medicine (DOA990) and the Wolstein Building (1118, 1119, & 1120).

RSOF Laboratory:

The RSOF is located in the Service Building on the first floor, 2220 Circle Drive. The laboratory in the RSOF is equipped with a Perkin Elmer Tricarb 4910 liquid scintillation counter (additional machines are located in both radioactive waste facilities) and a Packard Cobra II Auto gamma counter. The RSOF maintains bioassay equipment consisting of a single-channel analyzer and a detector for monitoring thyroid uptake of ^{125}I. The department also has a multi-channel analyzer with a sodium iodide detector. These instruments are used for bioassays and the quantification of air samples for Environmental Protective Agency (EPA) audits as well as for identification of unknown isotopes found during radiation inspections. The RSOF laboratory also houses a chemical hood, survey meters, an MCA that was upgraded (2016) to a USB version, new software & computer, decontamination supplies and essential analytical and calibration equipment.

Radioactive Waste Facilities:

Medical School Waste Facility (DOA990):

This facility has a separate office and a process/storage room for radioactive material and disposal activities. This facility is maintained at negative pressure and has a filtered air exhaust system. It also has a waste compactor, waste shredder, chemical and walk-in hood, survey meters, liquid scintillation counter, air monitoring equipment and emergency response equipment. The liquid scintillation counter was replaced due to water damage in 5/2018.

The storage area contains racks for the proper storage of solid and liquid waste. Waste streams consist of dry solid, bulk liquid and liquid scintillation vials. Dry solid waste and the liquid scintillation vials are packed in standard 55-gallon drums. Liquid waste is stored in five-gallon carboys and placed in spill trays to contain leakage. The floor of the waste facility was repaired of cracks and resurfaced in 2/2016. Radioactive animal carcasses are kept in a designated freezer in the ARC until they are disposed. More than half of the racks were disassembled in 2017. Also, old, broken, and unwanted equipment and materials were disposed.

Wolstein Building Waste Facility:

Room 1120 in this facility is a counting room that also contains a chemical hood and a liquid process/storage area. Room 1119 contains a walk-in chemical hood and solid process/storage area and Room 1118 is used for disposal activities. The liquid process/storage area and solid process/storage area are used for short-term storage only. This area maintains negative pressure relative to surrounding building spaces.

Room 1120 has also been developed as a combined chemical and RAM emergency response center. It contains spill supplies, a liquid scintillation counter, survey meters for both count and dose rates, a computer that provides access to our OnSite web database and safety data sheets in the event of radioactive/ chemical spills.

IODINATION EQUIPMENT

Special hoods, air pumps and activated charcoal-filter exhausts are placed in laboratories that conduct iodinations. Four iodination hoods are in storage. In 2014, one iodination hood was loaned to an associate facility and in 2016, the hood was donated to the Scripps Research Institute. Their locations are as follows:

WRB 1119 - Radiation Waste Facility Storage (1)
DOA 990 – Storage (3)

ANIMAL RESOURCE CENTER

Conventional animal care facilities are located in the Robbins Building, Wearn Building, MetroHealth Hospital, the Small Animal Imaging Research Center and the Wolstein Research Building. These facilities are used by AUs to conduct animal studies with radioactive, chemical, and biological materials. A variety of animals (mice, rats, hamsters, rabbits, groundhogs, ferrets and large animals such as sheep, dogs and pigs) are housed in the Robbins as needed. The Wearn and Wolstein facilities predominantly house mice and rats. Contaminated items are stored in the ARC freezer in Robbins until disposal. Animals used in studies involving radioactive materials are not housed in the Wolstein facility. A major renovation was completed in the Robbins during 2009 which included the addition of an ultra-barrier facility. One irradiator behind the ultra-barrier is currently not in use.

EQUIPMENT CALIBRATION

Annual calibration procedures consist of an electronic assessment of survey instruments, plus a measurement of their performance using calibrated isotope reference standards. Survey meters that require dose rate calibrations or repairs are not calibrated by the RSOF. These instruments are sent to an appropriate vendor by the AUs' laboratory. Instruments requiring simple repairs are repaired in-house.

The Packard Auto Gamma 5000 counter in the service building's radiation laboratory was replaced by a Packard Cobra II auto gamma counter in 2016. Due to a water leaking from the DOA990 ceiling, the LSC in DOA990 office sustained water damage and was replaced through the University insurance claim. The new Perkin Elmer Tricarb 4910 replaced the Packard 2100TR Liquid Scintillation Counter in 5/2018. The old LSC in the Radiation laboratory was moved to the WRB laboratory, while the WRB LSC was moved to DOA990 Office. The gamma counter calibrations are conducted monthly for the EHS radiation laboratory and as needed for the Liquid Scintillation Counters in the radiation laboratory, DOA 990 and WRB 1119. The continuous air monitor (CAM) and the connected air pump in DOA 990 are out of service and calibration is on hold. The LSCs in the radiation laboratory, WRB 1119 and in DOA 990 were serviced and cleaned.

RADIATION SAFETY PROGRAM

PURCHASE OF RADIOACTIVE MATERIALS

AUs and their approved designees purchase radioactive material. All radioactive isotope purchases must be approved by the RSOF before the order is processed through purchasing.

AUs must be approved for the isotope and the quantity of isotope ordered. The activity, when added to the AUs' existing inventory, cannot exceed the AUs' approved possession limit for that isotope. Replacement shipments, trial kits and free samples also must be approved by the RSOF. All deliveries are sent to the shipping and receiving for RSOF inspection and clearance before delivery to the AUs' laboratories.

TRANSFER OF RADIOACTIVE MATERIALS

The RSOF reviews and approves the transfer of all RAM internally (on campus) and externally (off campus) to, or from, an AU. Before initiating a transfer, either the internal or external transfer form must be completed and forwarded to the RSOF for approval. There were 85 isotope transfers approved this year.

RECEIPT OF RADIOACTIVE MATERIALS

Every package of radioactive material is inspected by the RSOF for contamination, dose rates and evidence of damage or breakage. If a package is contaminated or has dose rates greater than 10 mR/hr at 1 meter or 200 mR/hr at the surface, the package is held by the RSOF and the laboratory is contacted. An inspection sticker and the RAM package receipt form is placed on the package to confirm that inspection has been completed by the RSOF. The campus mail group delivers packages to most laboratories. Laboratories located across Adelbert Road or Cornell Road use direct pickup. Direct pickup by a laboratory designee alleviates the need to complete the bill of Lading since the package is carried to the laboratory and not transported in a vehicle. The AU or designee is required to survey all radioactive material packages upon receipt for contamination and evidence of damage or breakage.

Radioisotope use, for biomedical research, results in frequent movement of radioactive materials to and from the campus. The Broad Scope license requires that shipments be surveyed within three hours of arrival. In the past year, 137 isotope shipments (totaling 363 mCi) were inspected and approved by the RSOF upon receipt on the campus. A few shipments/transfers off campus were also made by laboratories. The RSOF assisted these laboratories by making sure that paperwork was properly prepared and proper labeling was used on the packages.

DISPOSAL OF RADIOACTIVE MATERIALS

Exclusive of decay of isotope in laboratories and minor inventory changes, isotopes were removed from laboratories by either 44 isotope waste pickups by the RSOF staff or by 21 AU-directed disposals into the sanitary sewers. The following table presents a breakdown by isotope of radioactive materials entering and leaving laboratories.

ISOTOPE	ORDERS		TRANSFERS	
	#	mCi	#	mCi
^{133}Ba	1	0.00095	0	0
^{11}C	0	0	22	92.12
^{14}C	4	0.56	0	0
^{57}Co	2	10.51	0	0
^{137}Cs	0	0	1	0.02429
^{64}Cu	0	0	0	0
^{18}F	0	0	39	141.13
^{68}Ga	0	0	18	45.16
^{68}Ge	3	0.97109	0	0
^{3}H	11	9.08966	0	0
^{125}I	5	0.02467	4	0.40872
^{32}P	102	295.61	0	0
^{33}P	3	0.88628	0	0
^{210}Po	1	5.0	0	0
^{35}S	5	39.84209	0	0
^{99m}Tc	0	0	1	0.00033
Total	137	362.49474	85	278.84334

RADIOACTIVE MATERIALS	17/18	16/17	15/16	14/15	13/14	12/13	11/12	10/11	09/10	08/09	07/08
Orders	137	164	193	241	261	329	331	358	311	428	832
mCi	363	383	578	732	634	781	760	662	655	714	1,692
Pickups	44	176	306	250	237	64	236	275	417	556	548
Sewer Disposals	21	53	69	50	61	41	90	59	89	76	90
Transfers	85	123	77	61	72	119	151	119	84	98	33
mCi	641	462	173	814	1,261	273	543	802	426	324	40

SEALED SOURCES

CWRU's sealed source inventory contains 86 sealed sources. Of these, 79 sealed sources are required to be inventoried every six months. Seven sealed sources require six-month leak tests as stated in our ODH license. This includes six gamma sources and one neutron source.

There are three high-dose irradiators and two low-dose irradiators on campus. Both of the low-dose irradiators and one of the high-dose irradiators are not in use. There are two active high-dose irradiators. These irradiators are the only radioactive material sources that could produce significant external dose hazards should their shielding be compromised.

See the Appendix for a list of sealed sources on campus. These sources are not included in the general summary reports for radioactive materials. This fiscal year, three sealed sources were returned to the manufacturer and seven new sources were received. The RSOF has actively encouraged AUs to dispose of sealed sources for which there is no anticipated use.

INVENTORY	17/18	16/17	15/16	14/15	13/14	12/13	11/12	10/11	09/10	08/09	07/08
Sealed Sources	86	94	93	93	94	149	142	147	213	211	213
Exempt	79	89	88	88	89	144	134	138	203	201	190
Irradiator	3	3	3	3	3	3	4	4	4	5	4
Neutron	1	1	1	1	1	1	1	1	1	1	1

IRRADIATORS

Six licensed low-to-high activity radiation sources are possessed for biomedical and other research. These include a ^{241}Am-Be neutron source (in waste storage), three high dose irradiators that contain ^{137}Cs sources, and two low dose irradiators when charged with ^{192}Ir and ^{60}Co (out of service). Currently, two high dose irradiators are in use and the third is out of service. The ^{60}Co irradiator is considered low dose. There were 26 irradiator users. Of these, four were new users and 12 had access removed.

The number of Individual workers authorized to use irradiators are shown in the following table.

IRRADIATOR	17/18	16/17	15/16	14/15	13/14	12/13	11/12	10/11	09/10	08/09	07/08
Total Workers	26	34	30	38	36	51	48	47	52	68	55
Total Active Irradiators	2	2	2	2	3	3	4	4	4	4	4

RADIATION SURVEY METER CALIBRATIONS

CWRU's ODH Broad Scope license requires annual calibration of portable survey meters. Properly calibrated meters are necessary for laboratories to perform accurate radiation surveys. AUs are responsible for the annual calibration, maintenance and repair of their survey instruments. Count rate calibrations on survey instruments and minor repairs are provided by the RSOF as a free service. The EHS provided in-house services that generated $9,820 in cost savings over the fiscal year in lieu of using outside vendors.

CALIBRATION/ SERVICE	COST PER SERVICE	COST SAVINGS
82 meters	$90/meter	$7,380
12 Rad Eye meters	$200/meter	$1,000
0 pumps	$70/pump	$0
16 thyroid assays	$90/assay	$1,440
4 pre-filter changes	$92/ set of 4/quarterly	$0
	TOTAL COST SAVINGS	$9,820

The RSOF calibrated 95 survey meters in the last fiscal year. There were no meters removed from service. Certificates of calibration are kept in the RSOF for all meters in service at the University. Records for all meters include instrument efficiencies for isotopes used in laboratories. The DOA pre-filters are on a 90-day change out schedule. EHS no longer the changes of the pre-filters. Facilities services does this now. Both fan units for the walk-in hood have not been changed since they do not run unless the walk-in hood is used. The HEPA filters for the walk-in hoods are two double filter units located in DOA Radiation Area. There are two single filter units for the chemical hood and decay area (located above the DOA office). The fan for the compactor has been repaired. Currently, there are two pre-filters and two HEPA filters that are regularly changed for two units.

This year, no pumps for radioactive materials were calibrated for use in an iodination hood and the CAM. The CAM system and air pumps are not in service and have not been calibrated since there were no iodinations.

CALIBRATION/ SERVICE	17/18	16/17	15/16	14/15	13/14	12/13	11/12	10/11	09/10	08/09	07/08
Meter Calibration	95	91	115	112	109	134	136	121	142	172	170

METERS IN USE	17/18	16/17	15/16	14/15	13/14	12/13	11/12
Hi-Q	1	2	2	1	2	1	1
Inovision	1	2	1	1	1	2	2
Ludlum	63	61	81	87	68	92	93
RPI Mini Monitor	6	10	13	8	8	13	15
Technical	1	1	1	1	1	1	1
Victoreen	2	4	6	4	5	10	9
WB Johnson	6	7	10	10	9	15	15
Fluke Biomedical	1	1	1	1	0	0	0
Research Product	1	1	1	1	0	0	0
Rad Eye	12	2	2	0	0	0	0

METER CALIBRATION BY MONTH	17/18	16/17	15/16	14/15	13/14	12/13	11/12
7/2017	24	12	18	17	19	22	10
8/2017	12	8	12	10	8	6	14
9/2017	9	7	8	6	1	2	1
10/2017	4	5	7	6	5	4	8
11/2017	4	4	6	1	1	21	21
12/2017	6	8	8	12	17	13	7
1/2018	1	0	7	9	11	7	10
2/2018	0	0	12	15	10	8	14
3/2018	23	8	10	13	12	16	7
4/2018	4	17	8	10	8	9	13
5/2018	7	9	7	12	16	15	15
6/2018	1	7	12	1	1	11	16

RAM SECURITY

RAM and potentially hazardous chemicals must be secured against unauthorized access or removal when unattended. All refrigerators, freezers or other storage units with RAM labels that are located in unsecured areas must either have a security lock to limit access to the refrigerator or freezer or must contain a secured and labeled lock box within the storage unit. Access to isotope inventory must also be controlled when no authorized individual is in the area and constant surveillance cannot be maintained. Security checks by the RSOF are conducted on a monthly basis after normal working hours to ensure that radioactive materials are properly secured. All buildings underwent radiation security inspections each month. Only minor violations of required security procedures were found. Involved AUs were notified, corrective actions recommended and remediation was monitored at the next inspection.

RAM SECURITY CHECKS	17/18	16/17	15/16	14/15	13/14	12/13	11/12	10/11	09/10	08/09	07/08
Violations	10	10	7	13	40	7	16	24	71	19	37

PERSONNEL MONITORING

Personal radiation dosimeters are issued through the RSOF to radiation workers and personnel who have the potential to receive a measurable radiation dose while working at the University. All laboratory workers, visitors to the laboratory, maintenance workers and contractors working in a laboratory are candidates for inclusion in the dosimetry program. Other personnel may

request dosimeters, which are provided by the RSOF. Radiation workers who are issued dosimeters must complete the new radiation worker training class and fill out an occupational exposure history form. Dosimeters are to be returned promptly at the end of each cycle of use so that the RSOF can take timely action consistent with implementation of ALARA in the event any significant exposure to radiation is detected by the dosimeter.

The contract for dosimetry was renewed with Landauer, Inc. which provides radiation monitoring services. The dates of the contract are for 7/1/2015 to 6/31/2018 with two one-year renewal options.

PREGNANT WORKER PROGRAM

Any radiation worker who is, or thinks she may be pregnant is advised to complete a declaration of pregnancy form found on the EHS website https:// case.edu/ehs/ under the 'radiation safety' link and send it to the RSOF. Counseling is provided and an additional dosimeter is issued to the worker that is read every month. This additional fetal dosimeter is worn to conservatively measure any dose to the developing baby. One woman did confirm her pregnancy and during her monitoring, no fetal doses above background radiation levels were detected.

NEUTRON USERS

For experiments and procedures involving the use of neutron sources, personnel monitors sensitive to neutron radiation must be worn. These can be obtained from the RSOF. There were two neutron dosimeter users during the fiscal year.

USERS OF RGE/ X-RAY

The RSOF provides special dosimeters for individuals carrying out experiments and procedures involving the use of RGEX-ray (X-ray), such as fluoroscopy and X-ray diffractometers. The four fluoroscopy users had collar badges. This fiscal year, we issued 251 visitor badges to fluoro observers.

Although only 20 percent of the workers currently monitored are required to wear dosimeters to comply with the terms of the CWRU's Broad Scope license or RGE programs, the use of dosimeters is encouraged as it provides an excellent method for early detection of activities that might be dangerous to individual workers.

PERSONNEL MONITORING	17/18	16/17	15/16	14/15	13/14	12/13	11/12	10/11	09/10	08/09	07/08
Pregnant Workers	1	0	0	0	1	2	2	2	1	1	2
Neutron	2	2	2	2	2	4	4	4	4	4	4
RGE/ X-ray	251	32	25	37	33	30	30	28	45	103	70
Dental	41	27	37	28	46	36	47	34	28	28	28
General	347	485	460	473	552	456	456	448	518	698	665

CWRU uses Luxel badges, which are considered to be state-of-the-art detection technology for personnel dosimetry. Luxel badges can measure minimum detectable limits of 1.0 mRem.

ODH regulations require that all monitored workers be advised annually of their occupational dose exposure. All workers were sent a copy of their prior calendar year's dose report in 2017.

RADIATION GENERATING EQUIPMENT

Machines that produce ionizing radiation (RGE) require safety labeling using appropriate warning indicator systems augmented by testing for radiation leakage during operation. Analytical research units include X-ray diffraction. As of 8/2015, X-ray registration is no longer required for electron microscopes. There are also X-ray units in use for health care and diagnostic research. There are currently 11 AUs of RGE with equipment in 19 laboratories. RGE is inventoried semi-annually and surveyed annually for leakage. Investigators in charge of RGE, *not the RSOF*, are required to provide site-specific training programs for workers using this equipment. The EHS provides general safety classes for individuals using RGE.

RADIATION-GENERATING UNITS (Not In Use)	**17/18**	**16/17**	**15/16**	**14/15**	**13/14**	**12/13**	**11/12**	**10/11**	**09/10**	**08/09**	**07/08**
Diagnostic units Disposed	0	0	2	0	0	4	4	3	3	3	4
Diagnostic units Purchased	0	0	1	3	0	3	4	3	3	3	3

The ODH has changed the Radiation Generating Units classification. There were no units purchased or disposed of for 2017-2018. The table below reflects that change.

RADIATION GENERATING EQUIPMENT (IN USE)	**17/18**	**16/17**	**15/16**	**14/15**	**13/14**	**12/13**	**11/12**	**10/11**	**09/10**
Closed Beam Analytical	6	6	6	6	6	6	6	6	6
Dental Computer Tomography (CT)	2	2	2	1	1	1	2	1	1
Photoelectron Spectrometer (No longer under ODH)	0	16	16	10	11	11	11	11	11
Fluoroscopy	2	2	2	3	3	3	2	3	3
Hand-held Dental	4	3	2	3	1	2	2	1	1
Hand-held Dental (Inoperable)	0	1	1	0	0	0	0	0	0
Intraoral	30	30	28	27	27	27	27	27	27
Panoral (Only)	1	1	1	1	1	1	1	1	1
Cabinet System exclude admittance	3	3	3	3	3	3	3	3	3
Tube Only (Inoperable)	0	9	9	12	12	26	26	26	26
Radiographic (Mobile)	1	1	1	1	14	0	0	0	0
TOTAL TUBES	**49**	**71**	**71**	**74**	**73**	**74**	**88**	**87**	**87**

RADIOACTIVE MATERIAL RELEASES

SEWER EXPOSURE CONTROL and MONITORING

State and federal regulations permit CWRU to dispose of low levels of RAM into the sanitary sewers. The Northeast Ohio Regional Sewer District requires semiannual reports on RAM that is discharged into the sanitary sewer system. CWRU's sewer releases were in compliance with both federal and state regulations. The report for July through December 2017 was filed by 12/31/2017 and the report for January through June 2018 was filed by 6/30/2018. Twenty AUs in storage mode or using only sealed sources were exempt from completing this form. One hundred percent compliance with sewer disposal regulations was achieved for both reporting periods.

AIR EXPOSURE CONTROL & MONITORING

During the 2017 calendar year, RAM released into the air were less than 10 percent of the maximum levels set by the EPA. Therefore, CWRU had no reports to file and the University was in compliance with the air effluent releases stipulated by the EPA Clean Air Act, the NRC and the ODH.

With regard to airborne exposure control, the primary concern is to safeguard against exposure to airborne radioactive iodine that is used for protein iodination experiments. To control exposures, the RSOF requires that reactions involving use of volatile radioactive iodine isotopes be performed in an iodination hood that is housed in a chemical hood. The charcoal-filtered exhaust from the iodination hoods typically reduce radioactive material emissions by approximately 90 percent. Experiments requiring use of large amounts of iodine in especially volatile form are routinely carried out in closed systems to prevent airborne release of radioactive iodine. There were no experiments requiring the use of volatile iodine conducted this fiscal year. This program has been inactive since 2014.

BIOASSAY PROGRAM

Bioassays are required for employees who may receive an internal, measurable radiation dose. Bioassay procedures include, but are not limited to, thyroid screening and urinalysis. The RSOF can perform bioassays for radioactive iodine (thyroid scan) and tritium uptake (urinalysis). Bioassay records are retained in the RSOF and are available for review by the assayed individuals.

RADIOACTIVE IODINE

During 2017-2018, there were no active iodination laboratories. The RSO maintains an inventory of four iodination hoods to be deployed when needed. A bioassay is required when more than 1 mCi of radioactive iodine is used in volatile form. The RSOF must be notified prior to:

- Handling more than 1.0mCi of volatile radioactive iodine.
- The following must be completed prior to the procedure:
    - Performance of a baseline bioassay for anyone involved in the procedure that does not have a baseline radioactive iodine bioassay on file
    - Arrangements for monitoring of effluent releases to the atmosphere during the first iodination procedure using a new protocol to measure and mitigate any release to the environment

After an iodination procedure, individuals involved in the procedure must contact the RSOF and arrange for a bioassay to be completed by the end of the next business day. Bioassays were completed for the RSOF staff involved in radioactive waste handling. There were no iodination procedures performed this fiscal year. No workers exceeded 10 percent of the ODH limits.

IODINATION PROCEDURES	17/18	16/17	15/16	14/15	13/14	12/13	11/12	10/11	09/10	08/09	07/08
Total	0	0	0	0	2	9	0	0	0	0	0

^{125}I BIOASSAYS	17/18	16/17	15/16	14/15	13/14	12/13	11/12	10/11	09/10	08/09	07/08
RSOF Staff	16	16	16	16	16	17	19	24	24	44	44
Additional	0	0	0	0	2	9	0	0	0	0	0
Total	16	16	16	16	18	26	19	24	24	44	44

TRITIUM

Urine bioassays must be carried out for individuals using more than 10mCi of tritium, with a baseline bioassay required prior to experiment. There were no urine bioassays required during this fiscal year.

RADIOACTIVE MATERIALS INCIDENTS

EMERGENCY RESPONSE

Emergency response procedures have been developed and approved by the RSOF and RSC for spills, releases or loss of RAM, small fires, large fires, internalized contamination and medical emergencies. The goal during any emergency response is to protect people first and property second. The RSO or designee provides instruction, assistance and supervision of clean up as required. The RSO is authorized to act independently and take prompt remedial action in situations involving RAM that present imminent danger or threat to personnel, property, or the community at large.

INCIDENT/ SPILL RESPONSE

MAJOR INCIDENT/ SPILL

This is a spill that involves personnel contamination or results in contamination outside of the intended work area that cannot be easily and effectively contained and cleaned up.

MINOR INCIDENT/ SPILL

This is a spill that does not involve personnel contamination and that remains inside the intended work area; one that can be easily and effectively contained and cleaned up without assistance from the RSOF. It also includes events that trigger irradiator alarms, most of which are caused by mechanical failures and installation of new high security equipment.

There were no major incidents and twenty minor incidents documented over the past year.

INCIDENTS	17/18	16/17	15/16	14/15	13/14	12/13	11/12	10/11	09/10	08/09	07/08
Major	0	0	0	0	0	2	0	0	0	0	1
Minor	20	21	22	30	8	16	7	18	17	20	6
TOTAL	20	21	22	30	8	18	7	18	17	20	7

DATE	INCIDENT	CONTAMINATION	ROOT CAUSE	FOLLOW UP
8/14/2017	Minor Incident	RFID Alarm	Problem with RMS/ Linel connection	Contractor called to troubleshoot
8/9/2017	Minor Incident	IRR Alert	Loss of connection from cameras due to Contractor work.	Connection back once Contractor done
8/30/2017	Minor Incident	Power Outage	IRR alarm caused by power outage	Contractor called to troubleshoot.
9/7/2017	Minor Incident	Intrusion Alarm	IRR door left ajar.	Door oiled so that it closes.
10/18/2017	Minor Incident	Unauthorized Relocation	AU -80 freezer moved to non-radiation room.	Radiation Safety cleared equipment and decommissioned freezer.
10/23/2017	Minor Incident	Package mix up	Accidently gave wrong package to each laboratory.	Both packages were given to the proper laboratories.
10/31/2017	Minor Incident	Irradiator Alarm	Maglock on door not closing properly causing alarm. Room locked until maglock replaced.	New maglock ordered and installed.
12/4/2017	Minor Incident	Inquiry about proper RAM waste container	Custodial reported that RAM waste was in regular container with RAM label.	Explained that properly RAM labeled container with a RAM waste log is acceptable.
12/8/2017	Minor Incident	Unknown Device Found	Staff concerned about unknown blue light coming from device.	IT Service confirmed that the device was installed in room to enhance WIFI communication.
2/23/2018	Minor Incident	Irradiator Alarm	Laboratory waste not logged. Staff too close to proximity reader when entering room and set off alarm.	Discussed security procedure with staff.
3/19/2018	Minor Incident	Motion Alarm	Staff did not leave room quickly causing alarm.	Discussed security procedure with staff.
4/9/2018	Minor Incident	Unauthorized Relocation	RAM freezer moved to RAM room.	EHS notified after move and area checked.
3/16/2018	Minor Incident	Short-lived Isotope Inquiry	AU inquired whether another AU isotope usage was done properly.	All transfer paperwork was approved and properly documented.
5/7/2018	Minor Incident	Flood in waste rooms	Water from 2nd floor flood came down to the 1st floor near waste rooms.	Water samples were collected and no contamination was found.
3/17/2018	Minor Incident	UH/CWRU Inquiry	Meeting to discuss about isotope transfers between UH and CWRU.	Potential concerns were addressed by both UH and CWRU Radiation Safety Officers.
4/19/2018	Minor Incident	Unknown Radiation Source	Laboratory Inquiry about whether Old unknown source was disposed.	Determined that unknown source had been disposed.
6/14/2018	Minor Incident	Intrusion Alarm	Person accidentally entered intrusion code and alarm went off.	Alarm was reset properly.
6/22/2018	Minor Incident	Irradiator Alert	Power outage campus wide caused loss of communication.	Alarm was reset properly.
6/2/2018	Minor Incident	Sealed Source	Staff reported potential source found.	No source found in area.
5/1/2018	Minor Incident	Old X-ray control Panel Inquiry	Staff reported equipment with RAM label.	Old RAM labeled behind construction materials in storage room. Staff will

				notify Radiation Safety before disposal of equipment.

EHS WEBSITE & NEWSLETTER

The EHS home website(https://case.edu/ehs/) provides integrated web-based access to EHS services. Information on training classes, online retraining and safety manuals is available at this site. All information is updated on a regular basis.

The EHS newsletter is filled with articles that are designed to keep the campus community abreast of safety issues and concerns. It covers the latest government regulations, addresses various concerns that are found during laboratory inspections and provides answers to questions frequently asked by laboratory personnel. Articles that were submitted during this year included:

1. Radiation Risks Associated with Medical Events
2. Environmental Monitoring at Nuclear Power Plants
3. Uses of Radiation (Part 2)
4. Uses of Radiation (Part 1)

LASER SAFETY PROGRAM

There are a total of 216 lasers/laser systems in our database for the campus used by 38 laser PIs in 16 buildings (29 Active, nine Inactive). The lasers of greatest concern are those labeled Class 3B and Class 4. There are 25 3B/4 PIs with a total of 124 Class 3B/4 lasers, as well as 13 1-3R PIs with a total of 76 lasers in other classes 1, 2, and 3A/3R.

There are 29 class 3B/4 enclosed laser systems that are considered eye-safe under normal use that decrease the hazard to the user. Thirty-four audits of laser systems were performed during this fiscal year. There were no laser incidents reported this year.

ULTRA VIOLET (UV) SAFETY PROGRAM

As noted by an Occupational Safety and Health Administration (OSHA)director, “OSHA has written two standards that cover employee exposure to radiation: Nonionizing Radiation (29 CFR 1910.97) and Ionizing Radiation (29 CFR 1910.1096). The non-ionizing radiation standard only covers the radio frequency region, including microwaves. The ionizing radiation standard covers alpha, beta, gamma, and X-rays; neutrons; high-speed electrons and protons; and other atomic particles; but does not include sound or radio waves, or visible, infrared, or ultraviolet light. Therefore, there are no OSHA-mandated employee exposure limits for ultraviolet radiation.”

CLEARANCES/ RELOCATION PROGRAM

The RSOF requires at least three weeks’ notice to decommission laboratories. An orchestrated effort between the RSOF, the Safety Services division of EHS, facilities services and AUs facilitates these operations. There were 1125 pieces of equipment and 35 rooms that were cleared in this reporting period.

WASTE MANAGEMENT

RADIOACTIVE WASTE FACILITY

Our radiation waste facility decay-in-storage licensing with the ODH specifies that we must dispose of any interim generated waste as soon as practical when a waste site is open. The CWRU Radioactive Waste Facility (RWF) is used to segregate waste streams and prepare the waste for disposal. The different waste streams include aqueous waste, sharps, animals, scintillation vials, beta plates and dry solid waste.

^{32}P solid waste is held for decay (for at least 10 half-lives) in the radioactive waste facility. The waste is surveyed and subsequently sent to Stericycle (formally BFI), a commercial disposal facility for incineration. Currently, only the outside of waste bags are surveyed (with approval from ODH) followed by immediate placement into a burn box. This simplifies handling by staff and provides for compliant and economical disposal of these materials. This procedure has greatly decreased hazard exposures to RSOF personnel handling radioactive waste at CWRU. Reducing the volume of waste to be disposed remains a continuing aim of the waste program. As part of the waste minimization program, isotope users are encouraged to reduce the volume of waste generated in the laboratory by minimizing the use of extraneous paper products. Short-lived, non-sewer (hazardous waste) is held for decay, resurveyed after ten half-lives and disposed by Chemical Analytics, a commercial hazardous waste disposal company. ^{35}S and ^{125}I are no longer held for decay, but are shipped along with the long-lived solid waste. Long-lived solid waste (greater than 60-day half-life) and scintillation vials are disposed by Ecology Services, a commercial radioactive waste hauler.

Non-hazardous aqueous waste is no longer held for decay. This waste is picked up from laboratories by the RSOF staff and immediate sewer disposal and is carried out in the radioactive waste facility since the isotope activities are significantly below our established regulatory limits as per OAC 3701:1-38-12 Appendix C. A sewer disposal log is kept in the EHS offices. Total sewer disposals are reported semi-annually to the Northeast Ohio Regional Sewer District.

COLLECTION AND DISPOSAL OF ANIMAL REMAINS AND BIOHAZARDOUS WASTE

The RSOF maintains two -20°C freezers for storage of radioactive animal remains and waste. One is located at the ARC and the other in Wolstein 1118. Radioactive wastes are bagged and labeled in yellow bags in the same manner as dry solid waste. All waste placed in the freezer must be logged on the animal disposal sheet on the cold room door. A log sheet of animals disposed in this manner is also kept for inventory purposes by the laboratories generating the waste.

Any item that has come in contact with an etiologic agent is considered biohazardous. Etiologic agents include bacteria, viruses and parasites and must be disinfected or decayed to background before disposal. Infected animal waste is placed in the ARC (BRB B05A) for disposal by the RSOF. Radioactive animal waste includes cage bedding, carcasses, viscera, excrement, serum, blood or other animal tissue containing radioactive materials. All waste is tagged. Additional information regarding etiological agents is placed on the tag. All animal waste is disposed of by the RSOF.

WASTE GENERATED IN JULY 1, 2017 - JUNE 30, 2018

	GENERATED 7/1/2017-6/30/2018	DISPOSED: HAZ. WASTE SVCS.	DISPOSED: SEWER	DISPOSED: CHEMICAL SAFETY	DISPOSED: Ecology Services	IN STORAGE AS OF 6/30/2018
Short-Lived Dry	18	5*	0	0	10	3
Long-Lived Dry	6	0	0	0	6	0
Scintillation Vials	6	0	0	0	6	0
Animals	0	0	0	0	0	0
Long-Lived Sewer	28	0	28	0	0	0
Long-Lived Non-Sewer	2	0	0	0	0	2
Short-Lived Sewer	25	0	25	0	0	0
Short-Lived Non-Sewer	2	0	0	0	0	2

All values in the dry waste, vial and animal categories denote the number of 55-gallon drums. All values for the liquid waste categories are in gallons. The single asterisk (*) demarcates the number of drums generated prior to 7/1/2017, kept for decay in storage and disposed during the period of 7/1/2017—6/30/2018. During this fiscal year, all long-lived hazardous aqueous waste was disposed.

Ecology Services animal waste cost = $22/lb. for 10-pound barrel = $220 per 10-pound barrel
Ecology Services dry waste cost = $470 per 55-gallon drum

We did not hold short-lived waste for decay this fiscal year since we needed to get rid of the metal drums completely and switch to poly drums per our new vendor. We sent all short-lived drums to Ecology Services. We did start to decay short-lived isotopes again and now have about six drums ready to be re-surveyed and disposed as regular waste.

The cost of disposal for one box of biomedical waste at Hazardous Waste Services (Stericycle) is $21 per box (average of two boxes per 55-gallon drum). There were no drums of dry waste surveyed and disposed of during 2017-2018. Without the decay in storage program, it would cost $470 to send one 55-gallon drum of decay in storage (DIS) dry waste and it would cost $220 per 10 lb. drum of animal waste through Ecology Services. Therefore, in the absence of decay in storage, the cost to dispose of the waste drums through Ecology Services would have been $690. Thus, the indirect savings to researchers due to the decay in storage program was $690.

WASTE GENERATION	17/18	16/17	15/16	14/15	13/14	12/13	11/12	10/11	09/10	08/09	07/08
Short-Lived Dry	18	9	11	10	20	26	25	25	87	95	91
Long-Lived Dry	6	5	9	6	10	16	10	11	25	50	35
Scintillation Vials	6	12	9	10	5	10	8	7	12	30	25
Animals	0	1	0.25	1	0.5	0.5	0.35	0.25	0	1	2
Long-Lived Sewer	28	30	23.75	25	20	20	17	11.5	60	50	38
Long-Lived Non-Sewer	2	2	2	2	0	0	55	91	120	80	20
Short-Lived Sewer	25	21	18	20	15	20	18.5	21.5	65	50	140
Short-Lived Non-Sewer	2	0	4	5	0	0	1	3	10	20	25

The contract for radioactive waste disposal has been renewed for 6/2016 to 6/2019 with two one-year renewal options with Ecology Services. This contract provides for disposal of all long-lived dry materials, scintillation vials and animal wastes.

RECYCLING PROGRAM

The RSOF occasionally obtains laboratory equipment in very good condition from AUS who have either left the University or ceased to use RAM. The equipment includes radioactive waste containers (lead and Lucite), shielding (lead and Lucite) and survey meters. This equipment is offered to the AUs' conserve funds otherwise needed to buy new RAM handling equipment. This cost saving from these recycling efforts resulted in re-use of equipment that saved AUs and EHS more than $8,930 during 2017-2018.

RADIATION SAFETY COMMITTEE AUDITS

The RSC audits are carried out in two different ways:

- Performance audits are conducted on-site at the RSOF by individual RSC members at various times throughout the year.
- A compliance inspection of RSOF records is conducted shortly after the end of each fiscal year by a team of RSC Members.

Performance audits of RSOF activities included the following areas:

AREA AUDITED	# OF INDIVIDUAL FILES EXAMINED
RAM Applications	10
Isotope Orders/ AU Possession Limits	10
RGE inventory/ training	10
Ancillary staff training	10
AU/ worker training	10
Radiation survey meters	10
Waste disposal facility	2
Shipping papers	10
RAM security checks	10
Bioassays	10
Semi-Annual mailings	10
Sealed sources	10
EHS Radiation Webpage	1
Irradiators	5
Room Surveys (Active/Decommissioned)	10
Compliance Reviews	10
Lasers	10
Licensing	10
Dosimetry	10
Incidents	10

These audits were conducted between October and December 2017 and between March and June 2018. This effort resulted in the review of more than 170 files in the program areas listed above.

RSC TRI-ANNUAL AUDITS FOR 2017-2018

RSC AUDIT COMMENT:

In October 2017, the RSC members conducted a bi-annual audit of the following components of the RSOF:

Active/Decommissioning Room Surveys
AU/Worker Training
Bioassays
Compliance Reviews
Dosimetry Program

Incident Reports
Irradiator Program
Isotope Possession Limit
Laser Program
Licensing Status
Radiation Generating Equipment (RGE) Inventory & Training
Sealed Source Leak Tests
Radioisotope Security Checks
Support Staff Training
Valid RAM Applications
Waste Facility

Each audit consisted of randomly selecting five to twenty files from the past year to ensure its contents were up-to-date, accurate and consistent with the database.

Active/Decommissioning Room Surveys

An audit was performed on October 31, 2017 to validate active RAM use files and decommissioned room files to verify that the laboratory was surveyed within the last six months as well as verification for any follow-up on non-compliance issues. Dr. Schiemann examined ten files and noted two deficiencies. The RSOF was informed of these and the deficiencies were corrected.

RSOF RESPONSE

Both rooms have been decommissioned and are no longer considered active RAM rooms.

AU and Worker Training

Authorized users and worker training files were audited on October 18, 2017 by Dr. Licatalosi, who examined 10 records and noted nine workers that were overdue for training. Overdue workers were notified of their training status.

RSOF RESPONSE

Those that were deficient in training were notified and once training was completed, the records were updated.

Bioassays

An audit was performed to verify completion of bioassays for laboratories using >10mCi of ^{3}H and/or 1mCi ^{125}I on November 2, 2017. Dr. Croniger noted that five bioassays had been performed for this period with no deficiencies.

RSOF RESPONSE

No response required.

Compliance

Compliance review audits were performed by Dr. Ogino on October 20, 2017 to ensure that any non-compliance issues were appropriately resolved. Upon examination of ten files, Dr. Ogino noted no deficiencies of a file not in the database.

RSOF RESPONSE

No response required.

Dosimetry Program

An audit of current dose records held by the RSOF was performed on October 17, 2017 to verify that AUs' laboratory workers were current in dose record and active radiation badges. Dr. Croniger audited 10 records and reported no deficiencies.

RSOF RESPONSE

No response required.

Incident Reports

A review of incident reports performed on October 31, 2017 by Dr. Schiemann was performed for verification and documentation of follow-up by the RSOF. During this period no deficiencies were reported.

RSOF RESPONSE

No response required.

Irradiator User Training/Irradiators

An audit of the irradiator information files was performed by Dr. Jankowsky to verify that the irradiators were audited by the RSOF within the past six months. The audit was performed on October 18, 2017. Four irradiators were active on campus and each file was up-to-date and compliant.

RSOF RESPONSE

No response required.

Isotope Possession Limits

Dr. McCormick audited 10 files on October 19, 2017 to verify that the amount of RAM ordered was within the possession limits of the AUs and that all orders placed were in the Onsite Database. Dr. McCormick noted no deficiencies in the audited records.

RSOF RESPONSE

No response required.

Laser Program

The laser program was audited by Dr. Schiemann for accuracy regarding laser inspections, inventory and status of personnel training on October 31, 2017. Five files were audited. Two deficiencies in inspection were noted and the RSOF was notified of the responsible PI to contact.

RSOF RESPONSE

The laser users were contacted and the inventory and training were updated.

Licensing Status

An audit was conducted to verify the licensing status of all ODH licenses and registrations on October 18, 2017. Components of the audit include: Broad Scope license, RGE license, waste license, radiation manual, X-ray manual, laser manual, radiation training, X-ray Training, radiation online training, UV online training and RSC guidelines. Dr. Valadkhan reviewed all licensed programs and noted that all licenses were current.

RSOF RESPONSE

No response required.

Radiation Generating Equipment Inventory and Training

Quarterly inventory status and equipment surveys were examined by Dr. Jankowsky who examined 10 files on October 18, 2017. Dr. Jankowsky noted seven deficiencies in training records. All records were updated successfully upon notification of the RSOF.

RSOF RESPONSE

Inventory and training were done during inspection. One X-ray user only has an electron microscope, therefore, no inventory was required.

Sealed Source Leak Tests

Files verifying that sealed sources had been leak tested were audited on October 20, 2017. Ten files were examined by Dr. Ogino who found three deficiencies. The missing files were reported and the situation corrected by the RSOF.

RSOF RESPONSE

Two misplaced files were found and categorized correctly. The database was also updated.

Radioisotope security checks

Verification and documentation of radioisotope security checks were performed on October 17, 2017. Dr. Croniger reports that all security checks during this period showed no deficiencies.

RSOF RESPONSE

No response required.

Support Staff Training

An audit was conducted to verify the training status of personnel encompassing ancillary segments of the Radiation Safety Program including: ARC, shipping and receiving, custodial, security and plant security on October 18, 2017. Dr. Licatalosi reported eight deficiencies upon examination of 10 records. The RSOF was notified of the overdue workers and the workers were sent notices.

RSOF RESPONSE

Those that were deficient in training were notified and once training was completed, the records were updated.

Valid Ram Applications

RAM applications were audited on October 18, 2017 to verify that the applications were complete and valid. Dr. Valadkhan audited 10 files and reported two deficiencies where files needed updating. The RSOF was notified of these files and the files were subsequently updated to be in compliance.

RSOF RESPONSE

Inventory and personnel corrections were updated in the database and current reports were placed in the database.

Waste Disposal Facilities

The waste disposal facilities (DOA990/Wolstein) and RSOF laboratory were inspected to ensure safe operation and maintenance as required by RSOF on October 19, 2017. Dr. McCormick inspected the facilities and reported that all records of maintenance, housekeeping, records and waste storage and handling were all in compliance. Two barrels of waste were found without inventory sheets. RSOF was notified and the updated inventory sheets were provided.

RSOF RESPONSE

No response required.

In January/February 2018**,** the RSC members conducted a tri-annual audit of the following components of the RSOF:

Active/Decommissioning Room Surveys
AU & Worker Training
Bioassays
Direct Package Pickup
Irradiator Program
Isotope Possession Limits
Laser Program
Radiation Generating Equipment Inventory & Training
Sealed Sources
Radioisotope Security Checks
Semiannual Mailings
Support Staff Training
Survey Meters
EHS Radiation Webpage

Each audit consisted of randomly selecting 5 to 20 files from the past year to ensure its contents were up-to-date, accurate and consistent with the database.

Active/Decommissioning Room Surveys

An audit was performed on 2/5/2018 to validate active RAM use files and decommissioned room files to verify that the laboratory was surveyed within the last six months as well as verification for any follow-up on non-compliance issues. Dr. Schiemann examined 10 files and noted no deficiencies.

RSOF RESPONSE:

No response required.

AU and Worker Training

Authorized users and worker training files were audited on 1/31/2018 by Dr. Licatalosi, who examined 10 records and noted seven workers that were overdue for training. Overdue workers were notified of their training status.

RSOF RESPONSE:

Those that were deficient in training were notified and once training was completed, the records were updated.

Bioassays

An audit was performed to verify completion of bioassays for laboratories using >10mCi of ^{3}H and/or 1mCi ^{125}I on 1/24/2018. Dr. Croniger noted that five bioassays had been performed for this period with one noted deficiency, which was flagged from an employee that was terminated and therefore not out of compliance.

RSOF RESPONSE:

The old file was archived.

Direct Package Pickup

Isotope orders received within the last three months, destined for direct pickup, were reviewed by Dr. Jankowsky. Dr. Jankowsky audited three files to ensure that direct pickup was denoted in the files. Dr. Jankowsky noted no deficiencies.

RSOF RESPONSE:

No response required.

Irradiator User Training/Irradiators

An audit of the irradiator information files was performed by Dr. Jankowsky to verify that the irradiators were audited by the RSOF within the past six months. The audit was performed on 1/31/2018. Four Irradiators were active on campus and each file was up-to-date and compliant.

RSOF RESPONSE:

No response required.

Isotope Possession Limits

Dr. McCormick audited 10 files on 1/26/2018 to verify that the amount of RAM ordered was within the possession limits of the AUs and that all orders placed were in the Helix Database. Dr. McCormick noted no deficiencies in the audited records.

RSOF RESPONSE:

No response required.

Laser Program

The laser program was audited by Dr. McCormick for accuracy regarding laser inspections, inventory and status of personnel training on 1/26/2018. Seven files were audited. One deficiency in inspection was noted and the RSOF was notified of the responsible PI to contact.

RSOF RESPONSE:

The inspection for the laser PI was completed.

Radiation Generating Equipment Inventory and Training

Quarterly inventory status and equipment surveys were examined by Dr. Valadkhan who examined five files on 2/8/2018. Dr. Valadkhan noted no deficiencies in training records.

RSOF RESPONSE:

No response required.

Sealed Source Leak Tests

Files verifying that sealed sources had been leak tested were audited on 1/25/2018. Ten files were examined by Dr. Ogino who reported three missing inventory files. The RSOF was notified of this report and the files were corrected.

RSOF RESPONSE:

The three sealed source files were corrected in the database.

Radioisotope security checks

Verification and documentation of radioisotope security checks were performed on 1/24/2018. Dr. Croniger reported that all security checks during this period showed no deficiencies.

RSOF RESPONSE:

No response required.

Semi-Annual Mailings (Air/Sewer Inventory)

An audit of the air/sewer disposal inventory was conducted on 1/31/2018 by Dr. Fisher. Five files were reviewed by Dr. Fisher who noted five questionable status updates. The assistant RSO was notified of these missing surveys.

RSOF RESPONSE:

The five inventories were received and the database updated.

Support Staff Training

An audit was conducted to verify the training status of personnel encompassing ancillary segments of the Radiation Safety Program including; ARC, shipping and receiving, custodial, security and plant security on 1/25/2018. Dr. Ogino reported four deficiencies upon examination of 10. The RSOF was notified of the overdue workers.

RSOF RESPONSE:

The four workers were contacted and their training was updated.

Radiation Survey Meters

Compliant calibration of survey meters was audited on 2/8/2018. Ten files were examined by Dr. Valadkhan who noted no meters that were due for calibration.

RSOF RESPONSE:

No response required.

EHS Radiation Webpage

The EHS Radiation webpage for the RSOF was audited to ensure that proper operation, access and current links were operational on 2/5/2018. Dr. Schiemann reported that no systems within the EHS radiation webpage were dysfunctional.

RSOF RESPONSE:

No response required.

In April 2017**,** the RSC members conducted a tri-annual audit of the following components of the RSOF:

Bioassays
Compliance Reviews
Dosimetry
Direct Package Pickup
Incidents
Lasers
Licensing
Semi-Annual Mailings
Survey Meters
Valid RAM Applications
Waste Facility
EHS Radiation Webpage

Each audit consisted of randomly selecting 5 to 20 files from the past year to ensure its contents were up-to-date, accurate and consistent with the database.

Bioassays

Dr. Jankowsky audited four reports and noted that no orders of ^{125}I or ^{3}H>10mCi were placed within the last six months. He reported no deficiencies in bioassays in this audit.

RSOF RESPONSE:

No response required.

Compliance

Compliance review audits were performed by Dr. McCormick on 4/18/2018 to ensure that any non-compliance issues were appropriately resolved. Upon examination of 10 files, Dr. McCormick noted four deficiencies of a file not in the database or with a late entry. The RSOF was notified of these occurrences and the files were corrected.

RSOF RESPONSE:

The misplaced files were found and the database updated.

Dosimetry Program

An audit of current dose records held by the RSOF was performed on 4/18/2018 to verify that AUs' laboratory workers were current in dose record and active radiation badges. Dr. Croniger audited 10 records and reported no deficiencies.

RSOF RESPONSE:

No response required.

Direct Package Pickup

Dr. Jankowsky audited direct package pickup receipts on 4/18/2018. Dr. Jankowsky audited three files and found no deficiencies.
RSOF RESPONSE:

No response required.

Incident Reports

A review of incident reports on 4/18/2018 by Dr. Ogino was performed for verification and documentation of follow-up by the RSOF. During this period no deficiencies were reported.

RSOF RESPONSE:

No response required.

Laser Program

The laser program was audited by Dr. Licatalosi for accuracy regarding laser inspections, inventory and status of personnel training on 4/23/2018. Five files were audited. Four deficiencies in inspection were noted and the RSOF was notified of the responsible PI to contact. The laser program manager notified the principal investigators regarding these deficiencies.

RSOF RESPONSE:

The four laser PIs were notified and the laser inventories were updated in the database.

Licensing Status

An audit was conducted to verify the licensing status of all ODH licenses and registrations on 4/20/2018. Components of the audit include: Broad Scope license, RGE license, waste license, radiation manual, X-ray manual, laser manual, radiation training, X-ray training, radiation online training, UV online training and RSC guidelines. Dr. Schiemann reviewed all license programs and noted that all licenses were current.

RSOF RESPONSE:

No response required.

Semi-annual Mailings

Dr. Fisher surveyed 10 files 4/18/2018 to ensure that responses to the latest semi-annual mailing were in order. Dr. Fisher reported two deficiencies. The RSOF was informed of these deficiencies and the hard copies of the reports were placed into the files.

RSOF RESPONSE:

The AUs were contacted and the reports were received.

Survey Meters

Dr. Ogino inspected 10 meters to ensure that meter inspections and calibration were up-to-date. He reported no deficiencies on 4/18/2018.

RSOF RESPONSE:

No response required.

Valid Ram Applications

RAM applications were audited on 4/18/2018 to verify that the applications were complete and valid. Dr. McCormick audited 10 files and reported four deficiencies where files needed updating. The RSOF was notified of these files and the files were subsequently updated to be in compliance.

RSOF RESPONSE:

The four files were updated in the database.

Waste Disposal Facilities

The waste disposal facilities (DOA990/Wolstein) and the RSOF laboratory were inspected to ensure safe operation and maintenance as required by RSOF on 4/20/2018. Dr. Valadkhan inspected the facilities and reported that all records of maintenance, housekeeping, records and waste storage and handling were in compliance.

RSOF RESPONSE:

No response required.

EHS Radiation Webpage

Dr. Donny Licatalosi inspected the operation of the EHS Radiation webpages for the radiation safety section. Dr. Licatalosi examined 10 random sites on 4/25/2018 within the webpages and associated links and reported no deficiencies.

RSOF RESPONSE:

No response required.

Overall, this bi-annual part of the audit process was successful. Records were easily accessed and reviewed. The program was found to be efficient. Productive interaction among committee members and the RSOF staff during the audit process helped expedite the procedure. All corrections to the files and the OnSite database were made following each trimester audit.

ANNUAL RADIATION SAFETY PROGRAM AUDIT REPORT

The RSC conducted its annual audit of the RSOF the first week in June 2018. The committee reviewed the performance of 20 components of the RSOF. The areas were:

- Active/Decommissioning Room Surveys

- Ancillary Staff Training
- AU and Worker Training
- Bioassays
- Compliance Review
- Isotope Orders, AU Possession Limits and the database
- Dosimetry Program
- Incident Reports
- Irradiator Program Review
- Laser Program Review
- Licensing Status
- Radioisotope Security Checks
- Radiation Generating Equipment Inventory and Training
- Radiation Survey Meters
- EHS Radiation Webpage
- Seal Sources
- Direct Pickup & Package Receipt
- Semi-Annual Mailings (air/sewer inventory)
- Valid RAM Application
- Waste Disposal Facilities (DOA990, Wolstein) & RSOF Laboratory

The Results of this audit are summarized in this report as follows:

Active/Decommissioning Room Surveys

The audit verified that RAM active and decommissioned laboratories were surveyed within six months and that non-compliances issues were corrected. Dr. Schiemann examined rooms for the period: 7/1/2017 –6/30/2018. Fifty files were examined and six deficiencies were noted. The RSOF was informed of these and the deficiencies were corrected.

RSOF RESPONSE:

The six rooms have been decommissioned and the files were moved to the decommissioned room area.

Ancillary Staff Training

An annual audit was conducted to verify the training status of personnel encompassing ancillary segments of the Radiation Safety Program including; ARC, shipping and receiving, custodial security and plant security. Ancillary workers were surveyed from 7/1/2017 – 6/30/2018. Dr. Licatalosi reported that 28/50 of the ancillary workers audited were overdue for training. The radiation safety office notified overdue workers.

RSOF RESPONSE:

Those that were deficient in training were notified and once training was completed, the records were updated.

AU and Worker Training

AUs and worker training files were audited for a period from Dr. Licatalosi examined 50 records and noted 10 workers were overdue for training. Overdue workers were notified of their training status.

RSOF RESPONSE:

Those that were deficient in training were notified and once training was completed, the records were updated.

Bioassays

An audit was performed to verify completion of bioassays for laboratories using >10mCi of ^{3}H and/or 1mCi ^{125}I between 7/1/2017 – 6/30/2018. Dr. Croniger noted that four bioassays had been performed for this period, with no deficiencies.

RSOF RESPONSE:

No response required.

Compliance

Compliance review audits were reviewed for the period 7/1/2017 – 6/30/2018 to ensure that any non-compliance issues were appropriately resolved. Upon examination of 50 files, Dr. Croniger noted no deficiencies.

RSOF RESPONSE:

No response required

Isotope Orders, AU Possession limits and the Helix Database

Dr. McCormick audited 22 files to verify that the amount of RAM ordered was within the possession limits of the AU and that all orders placed were in the Helix Database covering the period 7/1/2017 – 6/30/2018. Dr. McCormick noted no deficiencies in the audited records.

RSOF RESPONSE:

No response required.

Dosimetry Program

An audit of current dose records held by the RSOF was performed to verify that AU laboratory workers were current in dose record and active radiation badges for the period 7/1/2017– 6/30/2018. Dr. Valadkhan audited 50 records and reported eight individuals without dose records who were notified of the deficiency. The RSOF was notified of these individuals.

RSOF RESPONSE:

The eight dose records were requested from Landauer and placed in the individual files.

Incident Reports

A review of monthly incident reports from 7/1/2017 – 6/30/2018 was performed by Dr. Ogino for verification and documentation of follow-up by the RSOF. During this period, there were a total of eighteen incidents reported. All incidents were effectively resolved in a timely manner.

RSOF RESPONSE:

No response required.

Irradiator Information

An audit of the irradiator information files was performed by Dr. Jankowsky to verify that the irradiators were audited by the RSOF within the past six months between the period of 7/1/2017 – 6/30/2018 and that any compliance issues were appropriately followed up and pending issues corrected. Four Irradiators were active on campus and each file was up-to-date and compliant.

RSOF RESPONSE:

No response required.

Laser Program

The laser program was audited by Dr. Jankowsky for accuracy regarding laser inspections, inventory and status of personnel training in the period 7/1/2017 – 6/30/2018. Thirty-four files were audited. Numerous (overdue) deficiencies were noted and the RSOF was notified of the responsible PI to contact.

RSOF RESPONSE:

Those that were deficient in training were notified and once training was completed, the records were updated.

Licensing Status

An audit was conducted to verify the licensing status of all ODH licenses and registrations during the period 7/1/2017 – 6/30/2018. Components of the audit include: Broad Scope license, RGE license, waste license, radiation manual, X-ray manual, laser manual, radiation training, X-ray training, radiation online training, UV online training and RSC guidelines. Dr. Schiemann reviewed all license programs and noted that all licenses were current. He noted that all website links corresponding to training and manuals regarding X-ray, laser and radiation retraining are functional.

RSOF RESPONSE:

No response required.

Radioisotope Security Checks

Verification and documentation of radioisotope security checks were performed for the period 7/1/2017 – 6/30/2018. Dr. Fisher audited fifty security checks generated during this period. One instance of an unattended isotope was reported. All incidents were noted to be resolved in an efficient and timely manner.

RSOF RESPONSE:

No response required.

Radiation Generating Equipment Inventory and Training

RGE inventory status and equipment surveys were examined by Dr. Schiemann who examined 50 files for the period 7/1/2017 – 6/30/2018. Dr. Schiemann noted no deficiencies in inventory reports and equipment surveys.

RSOF RESPONSE:

No response required.

Radiation Survey Meters

Compliant calibration of survey meters was audited for the period 7/1/2017 – 6/30/2018. Fifty files were examined by Dr. McCormick who noted 12 meters that were due for calibration. The RSOF was notified of these calibration needs and the proper PIs were contacted.

RSOF RESPONSE:

The AUs for the 12 meter calibrations that were deficient were notified and the meters were calibrated and records were updated.

EHS Radiation Website

The website for the RSOF was audited to ensure proper operation, access and current links were operational for the period 7/1/2017 – 6/30/2018. Dr. Licatalosi reports no dysfunctional pages for this period.

RSOF RESPONSE:

No response required.

Sealed Source Leak Tests

Files verifying that sealed sources had been leak tested were audited for the period of 7/1/2017 – 6/30/2018. Seventy files were examined by Dr. Ogino who reported no deficiencies.

RSOF RESPONSE:

No response required.

Shipping Papers Direct Pickup and Package Receipt

An annual audit of shipping papers was performed to verify that paperwork was completed for each transfer of radioactive material for the period 7/1/2017 – 6/30/2018. Dr. Fisher examined 12 files and found no deficiencies in the paperwork verifying package receipts.

RSOF RESPONSE:

No response required.

Semi-Annual Mailings (Air/Sewer Inventory)

An annual audit of the air/sewer disposal inventory was performed for the period 7/1/2017 – 6/30/2018. Fifty files were reviewed by Dr. Valadkhan who noted 11 questionable status updates. The assistant RSO was notified of these questions. The RSOF notified the PIs for updated status reports.

RSOF RESPONSE:

Those that were deficient were notified and the records were updated.

Valid Ram Applications

RAM applications were audited for the period 7/1/2017 – 6/30/2018. to verify that the applications were complete and valid. Dr. McCormick audited 36 files and reported no deficiencies.

RSOF RESPONSE:

No response required.

Waste Disposal Facilities

The waste disposal facilities (DOA990/Wolstein) and RSOF Laboratory were inspected to ensure safe operation and maintenance as required by RSOF for the period 7/1/2017 – 6/30/2018. Dr. Valadkhan inspected the facilities and reported one missing waste log, but all other records of maintenance, housekeeping, records and waste storage and handling were all in compliance. RSOF was notified and identified the missing log.

RSOF RESPONSE:

The missing log was found.

SUMMARY

No major problems exist in the RSOF program and the RSOF staff is functioning on a very competent level.

RSOF RESPONSE:

The RSOF thanks the RSC for its careful audit of safety activities over the past year. Deficiencies uncovered during the audit were referred to the RSOF auditor for increased scrutiny during the coming year.

EHS INTERNAL AUDITS

Three layers of audits are utilized by the RSOF on an ongoing basis to ensure that the radiation safety programs and procedures are working smoothly. In addition to audits conducted by the RSOF Staff and RSC, the assistant RSO conducts quality control reviews of all programs and records and assists with resolution. Full audit results of the program are available in the EHS office.

Sealed Source	RAM Security Checks	Bioassays
Shipping Papers	Semi-Annual Mailings	Dosimetry
Valid RAM Applications	RGE Inventory/ Training	Survey Meters
Isotope Orders/ AU Possession Limits	Ancillary Training	Compliances
AU/ Worker Training	Licensing	EHS Radiation Webpage
Waste Disposal Facility	Incidents	Liaison Program
Active/Decommissioned Room Surveys	Irradiator	Laser Program

Corrections to the files were made promptly. In response to internal audit findings, radiation safety continues to improve its procedures and programs.

This report was prepared by Felice T. Porter on 9/8/2018 and reviewed by Dr. David Sedwick. It covers fiscal years 7/1/2017-6/30/2018.

APPENDIX

AUTHORIZED USERS WITH STATUS CHANGE DURING FISCAL 2017-2018

RADIATION ACTIVE

Zhenghe John Wang (9/2017) Nelson Phillips (4/2018) Kristian Baker (6/2018)

STORAGE MODE

Peter McCall (8/23/2017) Xingjun Fan (8/30/2017) Vincent Monnier (9/1/2017)
David Danielpour (10/13/2017) Colleen Croniger (1/23/2018) Michael Hore (2/20/2018)

RADIATION INACTIVE

Amy Wilson Delfosse (7/26/2017) John Mieyal (7/26/2017) John Letterio (10/16/2017)
Peter Harte (1/19/2018) Mary Barkley (1/1/2018) Ruth Keri (5/2/2018)
Faramarz Ismail Beigi (5/15/2018)

DEPARTED

Gerald Matisoff (7/5/2017) Scott Welford (7/6/2017) Mark Jackson (7/18/2018)
Donald Anthony Sr (12/6/2017) Junran Zhang (2/16/2018)

X-RAY AUTHORIZED POSSESSOR LIST

AP NAME	CONTACT PERSON	UNITS
Amir Avishai	Amir Avishai	5
Chris Dealwis	Lucas Hoffman	1
Gary Chottiner	Gary Chottiner	1
Fady Faddoul	Susan Opsitnick	31
Edward Greenfield	Teresa Pizzuto	1
Mukesh Jain	Steve Schomisch	2
Lei Zhu	Lei Zhu	4
Zhenghong Lee	Chris Flask	3
Suparna Mahalaha	Angel Henderson	
Anna Samia	Anna Samia	1
Daniel Scherson	Daniel Scherson	1
Rigoberto Advincula (Inactive)		
Eben Alsberg (Inactive)		
Derek Taylor (Inactive)		
Peter McCall (Inactive)		

LASER USERS

Rigoberto Advincula (5) Ozan Akkus (1) James Basilion (2) Jesse Berezovsky (14)
Clemens Burda (3) Paul Carey (4) Hillel Chiel (1) Carlos Crespo (8)
Liming Dai (2) Diana Driscoll (16) Steven Eppell (8) Philip Feng (5)
Roger French (1) Jeffrey Garvin (1) Brian Grimberg (10) Alex Huang (2)
Yoshikazu Imanishi (4) Hatsuo Ishida (5) Michael Jenkins (9) Chirag Kharangate (11)
LaShanda Korley (2) Soumyajit Mandal (1) Michael Martens (13) Minh Lam (1)
Claudia Mizutani (1) Andre Paes (1) Krzysztof Palczewski (1) John Protasiewicz (4)
Rajesh Ramachandran (1) Andrew Rollins (12) Charles Rosenblatt (14) Daniel Scherson (15)
Alp Sehirlioglu (1) Kenneth D. Singer (18) Giuseppe Strangi (4) Nicole Ward (1)
Christian Zorman (4)

Dominique Durand (Storage) (1) Heidi Martin (Storage) (1) Mary Barkley (Inactive) (5)
Agata Exner (Storage) (1) Edward Medof (Storage) (1) Jeffrey Duerk (Inactive) (1)
Eckhard Jankowsky (Storage) (1) Wyatt Newman (Storage) (1) David Schwam (Inactive) (1)
Kathleen Kash (Storage) (13) Lei Zhu (Storage) (1) Ben Strowbridge (Inactive) (1)