

CASE WESTERN RESERVE UNIVERSITY
DEPARTMENT OF ENVIRONMENTAL HEALTH & SAFETY (EHS)
RADIATION SAFETY
ANNUAL REPORT 2016-2017

W. David Sedwick, Director/ RSO
Felice T. Porter, Assistant Director/Assistant RSO
Report Editor and Departmental Auditor

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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) Broadscope 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. Its contents cover the period from July 1, 2016 through June 30, 2017.

SUMMARY

DEPARTMENT STRENGTHS

The RSOF has a staff with broad and diverse backgrounds that can address and resolve a wide range of issues faced in Radiation Safety at Case Western Reserve University (CASE). The RSOF has developed programs that meet or exceed regulatory requirements. This program proactively anticipates new safety requirements by promulgation of new programs. Success of these programs 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 2016-2017

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 \$19,568 in 2016-2017 through its services to the research community at Case Western Reserve University.
- Renewed Landauer contact for another 5 years.
- Completed 5-year contract with new waste disposal, Ecology Services.
- Successfully passed ODH inspection of Radiation Broadscope License & Irradiator Program
- Successfully passed ODH inspection of Radiation Generating Equipment License
- Completed a more comprehensive Irradiator Security Plan for ODH
- A new Security Plan for irradiator use was generated by the RSOF that was given a positive review by the Ohio Department of Health during the CWRU Radiation Safety Program's most recent State inspection. Augmented emphasis of a number of sections of the Security Plan for irradiators necessitated a complete comprehensive rewrite of the existing Security Plan from 2015/2016 that included detailed discussion of all procedures used to establish the trustworthiness and qualifications of all personnel and supervisors of the Irradiator Safety Program.
- Waste Facility clean-up and consolidation of storage locations for more efficient utilization in the Radiation Waste Storage Facilities was accomplished.

- All shielding materials were examined for condition and utility for redistribution to new Authorized Users who joined the Radiation Safety Programs or for current AUs who started new experiments requiring shielding.

RADIATION SAFETY GOALS FOR 2017-2018

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 Case Western Reserve University Safety Programs on the surrounding community through educational and programmatic interaction with local partners and emergency responders. Specific efforts currently address:

- Dosimetry: to reduce the amount of unreturned badges to as low as possible.
- X-Ray Program: ensure that all AP timely report inventory and personnel changes.
- Waste Program: visit waste disposal sites which were not visited during the bid process.
- Training: to decrease the number of overdue retraining to the minimum and ensure timely entry of Hazard Communication classes into RAD database.
- Sealed Source Program: to find a cheaper alternative to disposing of unwanted sources.
- Packages: to establish a better relationship with Purchasing.
- Irradiators: to reduce the number of alarms due to user mistakes.
- Clearances: facilitate by keeping all reports in a shared file for easy access.
- Meter Calibrations: decrease turn over time to no more than one week after receipt.
- Add CCF member to RSC
- Add electronic RSC audit process
- Seamlessly change website interface from Blackboard to Canvas
- Develop necessary radiation safety and radiation generating equipment programs and evaluate their impact for the Dental School in its new location in the new dental campus.
- Develop radioactive materials programs for any classroom experiments in the New medical school.
- Meet with Cleveland Clinic radioactive materials 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.
- Determine whether new technology to replace the RMS units can be installed on an accelerated schedule in the CWRU irradiator locations.
- Examine and test an on-line system for training tests and results provision for radiation tests for all radioactivity trained personnel.
- Examine and evaluate current status of joint program relationships with University Hospitals 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 (ODH) LICENSE

Case Western Reserve University has one Ohio Department of Health (ODH) Broadscope license. The license covers possession and use of both nuclear accelerator-produced radioactive material (NARM) and naturally occurring radioactive material (NORM) for experimental purposes. It also provides for the licensed use of four (4) irradiators. A Broadscope License site visit was last conducted by ODH on January 11-12, 2016.

The University has one ODH Radiation Generating Equipment (RGE) registration. The registration covers the receipt, possession, use, storage, and disposal of all radiation-generating sources including dental x-ray machines, x-ray diffraction units, fluoroscopy units, and electron microscopes. The last ODH Radiation-Generating Equipment (RGE) Inspection was conducted on July 19, 2014.

ODH LICENSE	EXPIRATION DATE	PURPOSE
011-011800-11	January 1, 2020	Broadscope License
09-M-06944-12	May 31, 2018	Radiation-Generating Equipment Registration (All)
06-E-06944-020	May 31, 2018	Radiation-Generating Equipment Registration (Mobile Units)

DECOMMISSIONING FUNDING PLAN

The Broadscope License and the Decommissioning Funding Plan became effective 2/25/2010. Funds required for this funding plan depend on the kind and amounts of radioactive materials maintained in active use or waste by the University. The University now operates under an agreement with ODH and requires no letter of credit. This agreement covers all possible decommissioning costs for radioactive materials located at the University as long as the University's credit rating is maintained.

RADIOACTIVE MATERIAL USE AND STORAGE LOCATIONS

Radioactive material is located at the following facilities:

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

Radioactive material is received and/or stored at the following sites:

- Shipping and Receiving, 2232 Circle Drive, Cleveland, OH
- Wolstein Research Building, 2103 Cornell Road, Cleveland, OH

PURPOSE FOR RADIOACTIVE MATERIAL (RAM) USE

The majority of isotope use at the University is for biomedical research. The most typical isotopes used are ^{14}C , ^3H , ^{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 . Six (6) 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), 3 high dose irradiators that contain ^{137}Cs sources, and 2 low dose irradiators charged with ^{192}Ir and ^{60}Co (out of service). Currently, 2 high dose irradiators are in use and the third is out of service. The ^{60}Co irradiator is considered low dose. There were 34 irradiator users. Of these, 11 were new users and 12 had access removed.

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

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

RADIATION SAFETY PROGRAM - RESPONSIBLE PARTIES

RADIATION SAFETY COMMITTEE (RSC)

The Radiation Safety Committee sets policy for use of radioactive materials for the University Community. 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) Broadscope License. Radiation Safety Committee members are chosen from diverse disciplines to provide comprehensive expertise. The Committee reviews all applications for use of radioactive materials.

The 2016-2017 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: 11/8/2017 Chairperson Term Expires: 11/8/2017	Dr. W. David Sedwick Radiation Safety Officer (RSO) Dept. of Medicine EHS - Service Building, 1 st 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: 1/10/2018	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

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., 1 st Fl. LC - 7227
Bruce DeMeza University Hospitals Asst. RSO Bishop S621 LC - BSH 5056	R. Michael Sramkoski Senior Research Associate & Laser Specialist Dept. of Comprehensive Cancer Ctr WRB 3405 LC - 7285
Joseph Nikstenas EHS Laser Safety Officer & Safety Specialist Service Bldg. 1 st Fl. LC - 7227	Marc Rubin EHS Senior Director Service Bldg. 1 st Floor LC - 7227

SUPPORT STAFF

Gwendolyn Cox-Johnson Department Assistant Service Bldg., 1 st Floor

The Radiation Safety Committee acts as an advisory and enforcement body to ensure that radioactive materials are safely used in accordance with ALARA (As Low As Reasonably Achievable) 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 Case Western Reserve University 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 seven occasions during the 2016-2017 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 Administration.

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

Major topics acted upon or discussed by the RSC:

- Quorum RSC Meeting (7/2017).
- Laser Summary Report was presented by Joseph Nikstenas (6/2017).
- ODH Re-inspection went well. No violations were found (6/2017).
- Staff from EHS, Security, Police, and Dispatch will attend the Alarm Response Training in TN from 7/10-14/2017 (6/2017).
- Richard Jamieson reports that the Greenway Project is going well. The EPA inspection of waste in the laboratories found several violations that must be corrected. The Fire Safety position has been filled (6/2017).
- Laser Summary Report was presented by Joseph Nikstenas (4/2017).
- High Security detectors training occurred 4/4-5/2017 and it went well (4/2017).
- EHS is approved for re-visit to High Security training in July 2017 for 12 staff along with Dispatch, Security, & Police (4/2017).
- Smoke detectors are being scheduled for its annual check in high security rooms (4/2017).

- Bid request are being submitted for High Security equipment (4/2017).
- Richard Jamieson reported that the Health Education Campus Facility is ongoing (4/2017).
- Quarterly audits were conducted this month (4/2017).
- Laser Summary Report was presented by Felice Porter in Joseph Nikstenas' absence (2/2017).
- Laser inventory, training, and personnel training notices were sent (2/2017).
- Joseph Nikstenas is attending Radiation Officer and DOT training (2/2017).
- EHS Renovation is now complete (2/2017).
- EHS has had two waste pickups with new vendor, Ecology Services, and it's going well 2/2017).
- RSC Quarterly Audits are due (2/2017).
- Power outage and slow internet has added to high security incidents (2/2017).
- Annual High Security Training will be scheduled (2/2017).
- Fire drill planning in the works for EHS and Security (2/2017).
- Richard Jamieson reports that the Operations Committee is working with the CCF/CWRU on their newest project of a Health Educational Campus slated for 2019 (2/2017).
- Quarterly audits are scheduled (2/2017).
- Laser Summary Report was presented by Felice Porter in Joseph Nikstenas' absence (12/2016).
- Laser inventory, training, and personnel training notice were sent (12/2016).
- EHS renovation is underway (12/2016).
- Ecology Services, Radiation waste handler, will have first waste pickup in November (12/2016).
- All Radiation manuals, forms, and quizzes will be reviewed and revised for 2017 as well as EHS website (12/2016).
- Annual reports for Radiation Safety and Safety Services have been submitted to President Barbara Snyder (12/2016).
- RSC Quarterly Audits are complete (12/2016).
- Timothy Nilsen is Emeritus and retired. He is now classified as an Inactive Radiation User effective 11/11/2016. Jeffrey Coller is now the new Director and Chair for RNA Center (12/2016).
- ODH Inspection Follow-up Report was accepted and now deemed complete. They will revisit CWRU with a year (12/2016).
- Annual Report Presentation by W. David Sedwick (RSO, Radiation Safety Director). Goals and Accomplishment highlighted (10/2016).
- Reappointment to the RSC: Colleen Croniger, Saba Valadkhan, and Eckhard Jankowsky for 3 years (10/2016).
- RSC Quarterly Audit conducted (10/2016).
- Quarterly Irradiator Audit conducted (10/2016).
- There were 3 inspections (ODH X-Ray Program, CWRU Internal Audit, & ODH Broadscope License) in 2 months (10/2016).
- Ecology Services is chosen as the vendor for Radioactive Materials disposal (10/2016).
- Multi-Channel Analyzer updated with a new hand held meter (10/2016).
- Felice Porter thanked Richard Jamieson for allowing Gwendolyn Cox Johnson, who is having difficulty using her walker, to move from Parking Lot 53 to Health Service Garage during the construction of the sidewalks to the Service Building (10/2016).
- Tom McCormick thanked the RSC for conducting the quarterly audit timely (10/2016).
- Laser Safety Program Summary including Training and Audits by Joseph Nikstenas (LSO).
- Joe Nikstenas added Interim EHS Fire Safety Specialist to his duties with the departure of Roy Evans to The Ohio State University Fire Safety Department. A new Fire Safety Specialist will be hired (7/2016).
- CWRU was closed for the week of the Republic National Conference and there were no incidents (7/2016).
- Medical School Facility Management disposed of a large amount of old equipment (7/2016).
- ODH plans to re-inspect the Radiation Program (7/2016).
- Felice, Yelena, and Joe went to Tennessee to check out vendors for the bid for the waste contract (7/2016).
- Richard Jamieson reported that during the RNC all went well with the Residence halls and the Police Officers that were housed there (7/2016).
- Tom McCormick thanked the RSC for completing their annual audits timely (7/2016).

SENIOR MANAGEMENT

The Radiation Safety Program monitors, inspects, and audits radiation materials, radiation generating equipment and source use by AUs and their personnel. Senior management

oversight and support of radiation safety-related activities is ensured by attendance of the Vice President for Campus Services at all RSC meetings. The RSC conducts independent audits of the Radiation Safety Program. Radiation Safety Office (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 safe use of radioactive materials 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 Case Western Reserve University's License. The audit program includes routine unannounced inspections of each AU's laboratory.

ADMINISTRATIVE CONTROLS

Administrative controls are established and approved by the Radiation Safety Committee for laboratories where radioactive material (RAM) 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 Ohio Department of Health. 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 radioactive materials
- Unapproved transfer of radioactive materials

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. One laboratory was assessed that had three or more minor violations during one compliance review by Radiation Safety during routine audits. Documented follow up and resolutions were completed for all major & moderate violations.

VIOLATIONS	16/17	15/16	14/15	13/14	12/13	11/12	10/11	09/10	08/09	07/08
Minor	70	78	81	134	93	112	64	53	103	83
Moderate	11	10	13	52	19	22	37	76	27	43
Major	0	0	0	0	0	0	2	0	0	0
Total	81	88	94	178	113	134	103	129	130	106

The Assistant RSO, the RSOF staff, and RSO have updated and revised most of the Departments manuals, training, licenses, certificates, and standard operating procedures in 2016-2017.

AU CATEGORIES:

RADIATION ACTIVE (RA)

AUs who actively use RAM are “Radiation Active”. 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 radioactive materials can be found in the Appendix.

RADIATION INACTIVE (RI)

These AUs do not currently use RAM and do not possess radioactive materials.

RADIATION ACTIVE (STORAGE MODE) – RA (SM)

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

DEPARTED (D)

AUs who no longer carry out research at Case Western Reserve University and whose laboratories have been decommissioned for radioactive material use are placed in the Departed category this fiscal year.

AUs	16/17	15/16	14/15	13/14	12/13	11/12	10/11	09/10	08/09	07/08
RA	50	54	62	66	78	89	87	87	91	92
SM	15	20	8	13	15	13	16	3	4	5
RI	5	5	3	6	6	7	4	13	1	14
D	5	2	6	0	3	1	2	3	6	8
Total in Program	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 AU Possession Limits, relative to NRC/ODH Registration Limit.

AU RADIOISOTOPE INVENTORY

The Radioisotope Inventory Report (see APPENDIX) lists researchers along with the amount of radioactive material each is authorized to use, each AU’s 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)	Specialist Positions (3.5)
Department Assistant (1)	Asst. Director/Asst. RSO/Quality Assurance Specialist (0.5)
Student (1)	

Training and education are central to our Department's aim to develop diverse skills among our personnel that are required for response 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 2016-2017 included Radiological Instrument Training, RCRA Selected Hazardous Waste Training, 8-Hour HAZWOPER Refresher Training, & Hazardous Materials Transportation Security Awareness.

One member of the EHS Staff is responsible for maintaining the EHS website that houses all on-line departmental training programs and schedules, safety manuals, safety newsletters, MSDSs, and safety information resources. The website is an essential resource for the campus community that requires continuous updating. This individual also monitors and backs up all departmental databases.

EHS EMAIL

Since implementing the EHS Email (does@case.edu), the number of inquiries and safety concerns raised by Case Western Reserve University personnel has averaged fifteen (15) 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 "*As Low As Reasonably Achievable*" (ALARA). The RSOF provides training for all personnel that use RAM or Radiation Generating Equipment (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 Authorized User 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, Animal Resource Center, 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 that has met the requirements for unescorted room access, including background & fingerprint check and radiation safety, site-specific, & laboratory safety training.

TRAINING

The RSOF documents 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 Case Western Reserve University'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 University Hospitals CASE Medical Center) in addition to the general X-Ray and site-specific trainings. Right-To-Know Fluoroscopy 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 on-line.

All non-laboratory personnel are required to attend Hazard Communication & 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 radioactive materials are used.

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

Over 1,313 laboratory workers were trained through the Radiation Safety Program in 2016-2017, which is a high point over the last 10 years. This increase reflects an effort on the part of the RSO to provide full training instead of Ancillary training to all workers in laboratories where isotope is in active use.

FACILITIES AND EQUIPMENT

Case Western Reserve University 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 Case Western Reserve University 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 190 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	126
X-Ray	18
Laser	46

Radiation Safety Office (RSOF)

Facilities and equipment used by the RSOF to support laboratory inspection or isotope storage are located in the Service Building (1st Floor), Medical School (DOA990), and the Wolstein Building (1118, 1119, & 1120).

RSOF Laboratory:

The RSOF is located in the Service Building on the 1st Floor at 2220 Circle Drive. The laboratory in the RSOF is equipped with a Packard Model 2900TR Liquid Scintillation Counter (additional machines are located in both Radioactive Waste Facilities), and a Packard 5000 Gamma Counter. The RSOF maintains bioassay equipment consisting of a single-channel analyzer and a detector for monitoring thyroid uptake of ¹²⁵I. 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 EPA audits, as well as for identification of unknown isotopes found during radiation inspections. The RSOF laboratory also houses a chemical hood, survey meters, the MCA 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 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 5-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.

Wolstein Building Waste Facility:

This facility has a counting room (Rm. 1120) that contains a chemical hood, a liquid process/storage area (Rm. 1119) that contains a walk-in chemical hood, and solid process/storage area (Rm. 1118) 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.

One room (1120) in this Facility has been developed as a combined Chemical and Radioactive Materials Emergency Response Center. It contains spill supplies, a liquid scintillation counter, survey meters for both count and dose rates, and a computer that provides access to our Onsite web database and Safety Data Sheets (SDS) in the event of radioactive/ chemical spills.

IODINATION EQUIPMENT

Special hoods, air pumps and activated charcoal-filter exhaust are placed in laboratories that conduct iodinations. Four (4) iodination hoods are in storage. One iodination hood was loaned to associate facility for use in 2014 & donated to the Scripps Research Institute in 2016. Their locations are as follows:

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

ANIMAL RESOURCE CENTER (ARC)

Conventional animal care/use facilities are located in the Robbins Building, Wearn Building, Metrohealth Hospital, 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 & large animals such as sheep, dogs, and pigs) are housed in the Robbins facility 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 facility during in 2009 which added an Ultra Barrier Facility. One irradiator behind the Ultra Barrier is not in current 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 AU's laboratory. Instruments requiring simple repairs are repaired in-house.

The Packard Auto Gamma 5000 Counter in the Service Building Radiation Laboratory was replaced by a Packard Cobra II Auto Gamma Counter in 2016. The Packard 1900CA LSC was replaced by a Packard 2100TR in the DOA 990 Office in 2016. The Gamma counter calibrations are conducted monthly for the EHS Radiation Laboratory and as needed for the LSCs in 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 the Purchasing Department.

AUs must be approved for the isotope and the quantity of isotope ordered. The activity, when added to the AU's existing inventory, cannot exceed the AU's 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 Area for RSOF inspection and clearance before delivery to the AUs' laboratories.

TRANSFER OF RADIOACTIVE MATERIALS

The RSOF reviews and approves the transfer of all radioactive material 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 123 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 placed on the package confirm that inspection has been completed by the RSOF. The Campus mail group delivers packages to most laboratories. Laboratories located across Adelbert Rd or Cornell Rd 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 Broadscope License requires that shipments be surveyed within three hours of arrival. In the past year, 164 isotope shipments (totaling 383 mCi) were inspected and approved by the RSOF after 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 236 isotope waste pickups by RSOF staff or by 30 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
¹¹ C	0	0	20	51.600
¹⁴ C	8	1.400	7	2.090
¹³⁷ Cs	2	0.035	1	0.030
⁶⁴ Cu	0	0	2	17.500
¹⁸ F	0	0	65	369.966
⁶⁸ Ga	0	0	8	16.200
³ H	8	4.760	6	0.458
¹²⁴ I	1	1.100	0	0
¹²⁵ I	11	0.060	5	0.474
¹²⁹ I	0	0	1	0.0001
³² P	127	352.007	5	0.631
³³ P	3	0.923	0	0
³⁵ S	4	22.702	0	0
^{99m} Tc	0	0	3	3.510
Total	164	382.988	123	462.458

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

SEALED SOURCES

Case Western Reserve University's sealed source inventory contains 94 sealed sources. Of these, 89 sealed sources are required to be inventoried every six months. Five (5) sealed sources require six-month leak tests, as stated in our ODH license. This includes 4 gamma sources and 1 neutron source.

There are three (3) high-dose irradiators and two (2) 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 (2) 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, one (1) sealed sources were returned to the manufacturer and two (2) new sources were received. The RSOF has actively encouraged AUs to dispose of sealed sources for which there were no anticipated use.

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

RADIATION SURVEY METER CALIBRATIONS

Case Western Reserve University's ODH Broadscope 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 \$8,928 in cost saving over the fiscal year in lieu of using outside vendors.

CALIBRATION/ SERVICE	COST PER SERVICE	COST SAVINGS
91 meters	\$80/meter	\$7,280
2 Rad Eye meters	\$200/meter	\$400
0 pumps	\$70/pump	\$0
16 thyroid assays	\$55/assay	\$880
4 pre-filter changes	\$92/ set of 4/quarterly	\$368
	TOTAL COST SAVINGS	\$8,928

The RSOF calibrated 91 survey meters in the last fiscal year. There were 3 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 changes 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. 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 continuous air monitor (CAM). The CAM system and air pumps are not in service and have not been calibration since there were no iodinations.

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

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

METER CALIBRATION BY MONTH	16/17	15/16	14/15	13/14	12/13	11/12
7/2016	12	18	17	19	22	10

8/2016	8	12	10	8	6	14
9/2016	7	8	6	1	2	1
10/2016	5	7	6	5	4	8
11/2016	4	6	1	1	21	21
12/2016	8	8	12	17	13	7
1/2017	0	7	9	11	7	10
2/2017	0	12	15	10	8	14
3/2017	8	10	13	12	16	7
4/2017	17	8	10	8	9	13
5/2017	9	7	12	16	15	15
6/2017	7	12	1	1	11	16

RAM SECURITY

Radioactive materials 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	16/17	15/16	14/15	13/14	12/13	11/12	10/11	09/10	08/09	07/08
Violations	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 1-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/](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. No women declared their pregnancy. During 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 radiation generating (x-ray) equipment, such as fluoroscopy and X-Ray Diffractometers. The four (4) Fluoroscopy users had collar badges.

Although only 20% of the workers currently monitored are required to wear dosimeters to comply with the terms of the Case Western Reserve University Broadscope License or Radiation generating equipment programs, the use of dosimeters is encouraged because it provides an excellent method for early detection of activities that might be dangerous to individual workers.

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

Case Western Reserve University 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 2016.

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 electron microscopes, X-Ray diffraction and particle

accelerators. 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 & diagnostic research. There are currently 10 Authorized Users of RGE with equipment in 25 laboratories. Radiation-generating equipment 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)	16/17	15/16	14/15	13/14	12/13	11/12	10/11	09/10	08/09	07/08
Diagnostic units Disposed	0	2	0	0	4	4	3	3	3	4
Diagnostic units Purchased	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 for 2016-2017. The table below reflects that change.

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

RADIOACTIVE MATERIAL RELEASES

SEWER EXPOSURE CONTROL & MONITORING

State and Federal regulations permit Case Western Reserve University to dispose of low levels of radioactive materials into the sanitary sewers. The Northeast Ohio Regional Sewer District (NEORS) requires semiannual reports on radioactive material discharged to the sanitary sewer system. Case Western Reserve University's sewer releases were in compliance with both Federal and State regulations. The report for July through December 2016 was filed by 12/31/2016 and the report for January through June 2017 was filed by 6/30/2017. Twenty (20) 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 2016 calendar year, radioactive material releases to the air were less than 10% of the maximum levels set by the EPA. Therefore, Case Western Reserve University 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%. 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 2016-2017, 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 1.0 mCi 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% of the ODH limits.

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

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

TRITIUM

Urine bioassays must be carried out for individuals using more than 10 mCi 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 and twenty-one (21) minor incidents documented over the past year.

INCIDENTS	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	2	0	0	0	0	1
Minor	21	22	30	8	16	7	18	17	20	6
TOTAL	21	22	30	8	18	7	18	17	20	7

DATE	INCIDENT	CONTAMINATION	ROOT CAUSE	FOLLOW UP
6/2/2017	Minor Incident	Duress Alarm	Staff entry showed mismatch	Discussed security procedure with user

5/23/2017	Minor Incident	Irradiator door did not open	Unable to open Irradiator door	Door was oiled and works fine
5/18/2017	Minor Incident	RAM package delivery	RAM package delivered directory to laboratory	Staff bought package to Shipping/Receiving
4/21/2017	Minor Incident	Irradiator Alarm	Accidentally double scanned card while exiting	Reminded new user of procedure
4/18/2017	Minor Incident	DOA Alarm	Staff forgot to disable alarm	Discussed procedure with staff
4/3/2017	Minor Incident	Irradiator Alert	Lost internet connection	Internet connection restored to building
3/31/2017	Minor Incident	Irradiator Alarm	Duress alarm from improper entry	Discussed security procedure with user
3/20/2017	Minor Incident	Computer Failure	Dispatch computer not functional	Installed new hard drive and software
2/23/2017	Minor Incident	DOA 990 Alarm	DOA 990 waste room alarm not working	Keypad replaced
2/21/2017	Minor Incident	Unlabeled Waste	Laboratory waste not logged	Laboratory properly disposed of waste
2/13/2017	Minor Incident	Irradiator Alert	Lost internet connection	Internet access restored in building
2/9/2017	Minor Incident	Irradiator Alert	Power outage in building	Power restored in building
1/30/2017	Minor Incident	Irradiator Alert	Power outage in building	Power restored in building
1/18/2017	Minor Incident	Irradiator Alert	Lost internet connection	Internet access restored in building
12/12/2016	Minor Incident	Door Alarm	Entered and left the room too quickly causing alarm	Must allow door alarm to reset
12/21/2016	Minor Incident	DOA Security Alarm	Forgot to turn alarm off before entry	Reminded to make sure alarm is off before entry
10/20/2016	Minor Incident	Motion Alarm	Person left in room	Discussed the exit procedure
10/7/2016	Minor Incident	Unsecured package	RAD package delivered to office	Package bought to Shipping/Receiving. Discussed security procedure with staff.
9/17/2016	Minor Incident	Irradiator Alert	Alert button was red, possible after power surge	All signals normal.
9/6/2016	Minor Incident	DOA 990 Alarm	DOA 990 Alarm set while person in room	Better communication between EHS and Security
8/5/2016	Minor Incident	Irradiator Alarm	Silent Alarm from building test	Facilities will notify before test.

EHS WEB SITE & NEWSLETTER

The EHS home web site (<https://case.edu/ehs/>) provides integrated web-based access to EHS services. Information on training classes, on-line 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 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:

- Ultraviolet Radiation (Part V)
- Ultraviolet Radiation (Part IV)
- Ultraviolet Radiation (Part III)—Earth's Surface
- Ultraviolet Radiation (Part II)—Effects on The Biosphere
- Ultraviolet Radiation: How It Affects Life on Earth

LASER SAFETY PROGRAM

There are a total of 181 lasers/laser systems in our database for the campus used by 38 Laser PIs in 14 buildings (38 Active, 8 Inactive). The lasers of greatest concern are those labeled Class 3B and Class 4. There are 16 3B/4 PIs with a total of 111 Class 3B/4 lasers, as well as 14 1-3R PIs with a total of 70 lasers in other classes 1, 2, and 3A/3R.

There are 26 class 3B/4 enclosed laser systems that are considered eye-safe under normal use that decrease the hazard to the user. Thirty-one (31) 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 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 to 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 the AU facilitates these operations. There were 1076 pieces of equipment and 23 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 Case Western Reserve University 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.

³²P 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 Case Western Reserve University. 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. ³⁵S and ¹²⁵I 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 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 & 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 Animal Resource Center (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 by the RSOF.

WASTE GENERATED IN JULY 1, 2016 - JUNE 30, 2017

	GENERATED 7/1/2016- 6/30/2017	DISPOSED: HAZ. WASTE SVCS.	DISPOSED: SEWER	DISPOSED: CHEMICAL SAFETY	DISPOSED: Ecology Services	IN STORAGE AS OF 6/30/2017
Short-Lived Dry	9	11*	0	0	0	6
Long-Lived Dry	5	0	0	0	5	2
Scintillation Vials	12	0	0	0	12	2
Animals	1	1	0	0	0	1
Long-Lived Sewer	30	0	30	0	0	0
Long-Lived Non-Sewer	2	0	0	0	0	2
Short-Lived Sewer	21	0	21	0	0	0
Short-Lived Non-Sewer	0	0	0	0	0	0

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 7/1/2016, kept for decay in storage, and disposed during the period of 7/1/2016–6/30/2017. 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

The cost of disposal for one box of biomedical waste at Hazardous Waste Services (Stericycle) is \$21 per box (average of 2 boxes per 55 gal drum). There were 6 drums of dry waste surveyed and disposed during 2016-2017 fiscal year at a cost of \$252. 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 \$2,820. Thus, the indirect savings to researchers due to the decay in storage program was \$2,820.

WASTE GENERATION	16/17	15/16	14/15	13/14	12/13	11/12	10/11	09/10	08/09	07/08
Short-Lived Dry	9	11	10	20	26	25	25	87	95	91
Long-Lived Dry	5	9	6	10	16	10	11	25	50	35
Scintillation Vials	12	9	10	5	10	8	7	12	30	25
Animals	1	0.25	1	0.5	0.5	0.35	0.25	0	1	2
Long-Lived Sewer	30	23.75	25	20	20	17	11.5	60	50	38
Long-Lived Non-Sewer	2	2	2	0	0	55	91	120	80	20
Short-Lived Sewer	21	18	20	15	20	18.5	21.5	65	50	140
Short-Lived Non-Sewer	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 1-year renewal options with Ecology Services. This contract provides for disposal of all long-lived dry materials, scintillation vials, & animal wastes.

RECYCLING PROGRAM

The RSOF occasionally obtains laboratory equipment, in very good condition, from AU's 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 AU's to conserve funds otherwise needed to buy new radioactive materials handling equipment. This cost-saving from these recycling efforts resulted in re-use of equipment that saved AUs & EHS more than \$7,820 during 2016-2017.

RADIATION SAFETY COMMITTEE AUDITS

Radiation Safety Committee (RSC) audits are carried out in two different ways:

- Performance audits are conducted on-site at the Radiation Safety Office (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:

<u>AREA AUDITED</u>	<u># OF INDIVIDUAL FILES EXAMINED</u>
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
Web site Accuracy	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 2016 and between March and June 2017. This effort resulted in the review of more than 170 files, in the program areas listed above.

RSC TRI-ANNUAL AUDITS FOR 2016-2017

RSC AUDIT COMMENT:

In October 2016, the Radiation Safety Committee Members conducted a bi-annual audit of the following components of the Radiation Safety Office:

Active/Decommissioning Room Surveys
Bioassays
Compliance
Dosimetry Program
Incident Reports

Laser Program
Licensing Status
Radiation Generating Equipment (RGE) Inventory & Training
Sealed Source Leak Tests
Radioisotope Security Checks
Semi-Annual Mailings (Air/Sewer Inventory)
Survey Meters
Website

Each audit consisted of randomly selecting five (5) to twenty (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 October 13, 2016 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 (10) files and noted 4 deficiencies. Dr. Schiemann noted that the decommissioned database did not correspond to files present in the RAM File Room decommissioned file cabinet. The RSOF was informed of these discrepancies.

RSOF RESPONSE

The surveys were found in the cabinet for active surveys and placed in the decommissioned file.

Bioassays

An audit was performed to verify completion of bioassays for laboratories using >10mCi of ³H and/or 1mCi ¹²⁵I on October 24, 2016. Dr. Jankowsky noted no deficiencies. Dr. Jankowsky also noted that no orders were placed in the last six months that exceeded the stated limits.

RSOF RESPONSE

No response required.

Compliance

Compliance review audits were performed by Dr. Croniger to ensure that any non-compliance issues were appropriately resolved. Upon examination of ten (10) files Dr. Croniger noted one (1) deficiency of a file not in the database. The RSOF was informed and these files were updated.

RSOF RESPONSE

The file was updated during the audit.

Dosimetry Program

An audit of Current Dose records held by the RSOF was performed on October 20, 2016 to verify that AU laboratory workers were current in dose record and active radiation badges. Dr. Valadkhan audited ten (10) records and reported four (4) deficiencies for late reports. The RSOF was informed of this report and updated the reports.

RSOF RESPONSE

The deficiency was corrected during the audit.

Incident Reports

A review of incident reports on October 12, 2016 by Dr. Licatalosi was performed for verification and documentation of follow-up by the RSOF. During this period one deficiency was reported for no incident summary. The RSOF office updated this record.

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 on October 24, 2016. 5 (5) files were audited. Deficiencies were noted for this period in inventory and training. The RSOF and laser specialist were notified of these deficiencies.

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 12, 2016. Components of the audit include: Broadscope 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. Ogino reviewed all license programs and noted that all licenses were current.

RSOF RESPONSE

No response required.

Radiation generating equipment (RGE) inventory and training

Quarterly inventory status and equipment surveys were examined by Dr. Schiemann who examined 10 files on October 13, 2016. Dr. Schiemann noted no deficiencies in training records.

RSOF RESPONSE

No response required.

Radiation generating equipment (RGE) inventory and training

Quarterly inventory status and equipment surveys were examined by Dr. Schiemann who examined 10 files on October 13, 2016. Dr. Schiemann noted no deficiencies in training records.

RSOF RESPONSE

No response required.

Radioisotope security checks

Verification and documentation of radioisotope security checks were performed on October 12, 2016. Dr. Licatalosi reports 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 performed on October 20, 2016. Ten (10) files were reviewed by Dr. Valadkhan who noted no deficiencies.

RSOF RESPONSE

No response required.

Survey Meters

Compliant calibration of survey meters was audited on October 12, 2016. Ten (10) files were examined by Dr. McCormick who noted no deficiencies.

RSOF RESPONSE

No response required.

Website

The website for the RSOF was audited to ensure proper operation, access and current links on October 12, 2016. Dr. Ogino reports that all systems within the Radiation Website are functional.

RSOF RESPONSE

No response required.

In February 2017, the Radiation Safety Committee Members conducted a tri-annual audit of the following components of the Radiation Safety Office:

- Active/Decommissioning Room Surveys
- AU & Worker Training
- Compliance
- Dosimetry Program
- Incident Reports
- Isotope Possession Limits
- Laser Program
- Licensing Status
- Radiation Generating Equipment (RGE) Inventory & Training
- Sealed Source Leak Tests
- Radioisotope Security Checks
- Support Staff Training
- Valid RAM Applications
- Waste Disposal Facilities

Each audit consisted of randomly selecting five (5) to twenty (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 February 16, 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 10 files and noted no deficiencies.

RSOF RESPONSE:

No response required.

AU and Worker Training

Authorized users and worker training files were audited on February 16, 2017 by Dr. Licatalosi, who examined ten (10) records and noted seven (7) workers that were overdue for training.

RSOF RESPONSE:

Overdue workers were notified of their training status.

Compliance

Compliance review audits were performed by Dr. McCormick to ensure that any non-compliance issues were appropriately resolved. Upon examination of ten (10) files Dr. McCormick noted no deficiencies.

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. Dr. Valadkhan audited ten (10) records and reported no deficiencies.

RSOF RESPONSE:

No response required.

Incident Reports

A review of incident reports on February 16, 2017 by Dr. Ogino was performed for verification and documentation of follow-up by the RSOF. During this period there were no deficiencies reported.

RSOF RESPONSE:

No response required.

Isotope Possession limits

A review of possession limits was conducted by Dr. Licatalosi who examined ten (10) files and noted no deficiencies.

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 February 16, 2017. 5 (5) files were audited. One deficiency was noted for this period in inspection data. The RSOF was notified of this occurrence.

RSOF RESPONSE:

The user was notified and the deficiency corrected.

Licensing Status

An audit was conducted to verify the licensing status of all ODH licenses and registrations on February 16, 2017. Components of the audit include: Broadscope 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.

Radiation generating equipment (RGE) inventory and training

Quarterly inventory status and equipment surveys were examined by Dr. Jankowsky who examined 10 files on February 22, 2017. Dr. Jankowsky noted deficiencies in training records for 4 individuals. The RSOF was notified and these individuals were contacted to update their training.

RSOF RESPONSE:

Those that were contacted have updated their training.

Sealed Source Leak Tests

Files verifying that sealed sources had been leak tested were audited on February 16, 2017. Ten (10) files were examined by Dr. Ogino who reported one (1) missing inventory file. The RSOF was notified of this report.

RSOF RESPONSE:

The misplaced file was located.

Radioisotope security checks

Verification and documentation of radioisotope security checks were performed on February 16, 2017. Dr. Croniger reports that all security checks during this period showed any 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; Animal Resource Center (ARC), Shipping & Receiving, Custodial, Security and Plant Security on February 16, 2017. Dr. Croniger reported no deficiencies upon examination of ten (10) records.

RSOF RESPONSE:

No response required.

Valid Ram Applications

RAM applications were audited on February 16, 2017 to verify that the applications were complete and valid. Dr. McCormick audited ten (10) files and reported five (5) deficiencies noted for workers that required updated training. The RSOF was notified and these workers were contacted to update their training.

RSOF RESPONSE:

The persons were contacted and training completed.

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 February 16, 2017. Dr. Valadkhan inspected the facilities and reported that two (2) records were deficient for radiation surveys.

RSOF RESPONSE:

The RSOF was notified of these deficiencies and the surveys were performed.

In April 2017, the Radiation Safety Committee Members conducted a tri-annual audit of the following components of the Radiation Safety Office:

Bioassays
Direct Package Pickup

Semi-Annual Mailings
Survey Meters
Webpage

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

Bioassays

Dr. Croniger audited ten (10) reports and noted that no orders of ^{125}I or ^3H >10mCi were placed within the last 6 months. She reported no deficiencies in Bioassays in this audit.

RSOF RESPONSE:

No response required.

Direct Package Pickup

Dr. Jankowsky audited direct package pickup receipts on 4/12/2017. Dr. Jankowsky audited ten (10) files and found no deficiencies.

RSOF RESPONSE:

No response required.

Semi-annual Mailings

Dr. Licatalosi surveyed ten (10) files to ensure that responses to the latest semi-annual mailing were in order. Dr. Licatalosi reported one deficiency. The RSOF was informed of this deficiency.

RSOF RESPONSE:

The AU was contacted and the report was received.

Survey Meters

Dr. Saba Valadkhan inspected ten (10) meters to ensure that meter inspections and calibration were up to date. She reported no deficiencies on 4/19/2017.

RSOF RESPONSE:

No response required.

Webpage

Dr. William Schiemann inspected the operation of the EHS web pages for the radiation safety section. Dr. Schiemann examined 10 random sites within the web pages 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 RSOF staff during the audit process helped expedite the process. All corrections to the files and OnSite database were made following each trimester audit.

ANNUAL RADIATION SAFETY PROGRAM AUDIT REPORT

The Radiation Safety Committee conducted its annual audit of the Radiation Safety Office the first week in June 2017. Members of the RSC conducted the audit. The committee reviewed the performance of 20 components of the RSOF. The areas were:

- 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
- Radiation Website
- Room Surveys
- Seal Source /Leak Test
- Shipping Papers
- 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.

Ancillary Staff Training

An annual audit was conducted to verify the training status of personnel encompassing ancillary segments of the radiation safety program including; Animal Resource Center (ARC), Shipping & Receiving, Custodial, Security and Plant Security. Ancillary workers were surveyed from July 1, 2016-June 30, 2017. Dr. Croniger reported that 23/50 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

Authorized users and worker training files were audited for a period from July 1, 2016-June 30, 2017. Dr. Licatalosi examined 50 records and noted fifteen (15) workers that were overdue for training. Overdue workers were notified of their training status. Special attention will be given to late training responses among AUs and Workers to improve compliance in this area.

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 ^3H and/or 1mCi ^{125}I during the period July 1, 2016-June 30, 2017. Dr. Croniger noted that four (4) bioassays had been performed for this period and all were correct.

RSOF RESPONSE:

No response required.

Compliance

Compliance review audits were performed to ensure that any non-compliance issues were appropriately resolved. Upon examination of 50 files Dr. McCormick noted that six (6) were overdue. Several instances of follow up from previous compliance audits were noted. Follow up compliance issues were addressed by the Radiation Safety Office.

RSOF RESPONSE:

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

Isotope Orders, AU possession limits and the Helix Database

Dr. Licatalosi audited 45 files to verify that the amount of radioactive material (RAM) ordered was within the possession limits of the AU and that all orders placed were in the Onsite Database. Dr. Licatalosi 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 July 1, 2016-June 30, 2017. Dr. Valadkhan audited 50 records and reported 30 individuals without dose records who were notified of the deficiency. The RSOF was notified of these individuals.

RSOF RESPONSE:

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

Incident Reports

A review of monthly incident reports From July 1, 2016-June 30, 2017 was performed by Dr. Ogino for verification and documentation of follow-up by the RSOF. During this period there were a total of fourteen (14) incidents reported. One incident had a document missing in the report. All other 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. Croniger to verify that the irradiators were audited by the RSOF within the past six months between the period of July 1, 2016-June 30, 2017, 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. McCormick for accuracy regarding laser inspections, inventory and status of personnel training in the period July 1, 2016-June 30, 2017. Thirty-four (34) files were audited. Eight (8) deficiencies in training (overdue) 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 July 1, 2016-June 30, 2017. Components of the audit include: Broadscope 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 notes 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 July 1, 2016- June 30, 2017. Dr. Croniger audited fifty (50) security checks generated during this period. One (1) instance of unlocked magnet on security door was reported. All incidents were noted to be resolved in an efficient and timely manner.

RSOF RESPONSE:

No response required.

Radiation generating equipment (RGE) inventory and training

Quarterly inventory status and equipment surveys were examined by Dr. Croniger who examined 11 files for the period July 1, 2016-June 30, 2017. Dr. Croniger 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 July 1, 2016-June 30, 2017. Fifty (50) files were examined by Dr. Valadkhan who noted eight (8) meters that were due for calibration.

RSOF RESPONSE:

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

Radiation Website

The website for the RSOF was audited to ensure proper operation, access and current links were operational for the period July 1, 2016-June 30, 2017. Dr. Schiemann reports 2 systems within the Radiation Website that were dysfunctional. Corrections were made to the Training Manual link (old manual) and the isotope data sheet discussing cesium sources.

RSOF RESPONSE:

No response required.

Room Surveys

An audit was performed 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 for the period July 1, 2016-June 30, 2017. Dr. Schiemann examined 44 files and noted one (1) deficiency, an overdue survey for HG Wood 450. Dr. Schiemann further notes that the decommissioned room list needs to be updated and cross-referenced to the database.

RSOF RESPONSE:

Those that were deficient were filed correctly and the records were updated.

Sealed Source Leak Tests

Files verifying that sealed sources had been leak tested were audited for the period of July 1, 2016-June 30, 2017. Ten (10) files were examined by Dr. Ogino who reported no deficiencies.

RSOF RESPONSE:

No response required.

Shipping Papers

An annual audit of shipping papers was performed to verify that paperwork is completed for each transfer of radioactive material for the period July 1, 2016-June 30, 2017. Dr. McCormick examined 9 files and found no deficiencies among 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 July 1, 2016-June 30, 2017. Fifty (50) files were reviewed by Dr. Licatalosi who noted five (5) questionable status updates. The Assistant RSO was notified of these questions.

RSOF RESPONSE:

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

Valid Ram Applications

RAM applications were audited for the period July 1, 2016- June 30, 2017 to verify that the applications were complete and valid. Dr. McCormick audited fifty (50) files and reported four (4) deficiencies where files needed updating. The RSOF was notified of these files.

RSOF RESPONSE:

Those that were deficient, the records were updated.

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 July 1, 2016 - June 30, 2017. Dr. Valadkhan inspected the facilities and reported that all records of maintenance, housekeeping, records and waste storage and handling were all in compliance.

RSOF RESPONSE:

No response required.

SUMMARY

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

RSOE RESPONSE:

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

EHS INTERNAL AUDITS

Three layers of audits are utilized by the RSOE on an ongoing basis to ensure that the Radiation Safety programs and procedures are working smoothly. In addition to audits conducted by the RSOE Staff and Radiation Safety Committee, the Assistant RSOE 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	Website Accuracy
Waste Disposal Facility	Incidents	Liaison Program
Room Surveys (Active/ Decommissioned)	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 Thornton-Porter on 9/8/2017 and reviewed by Dr. David Sedwick. It covers fiscal years 7/1/2016-6/30/2017.

APPENDIX

AUTHORIZED USERS WITH STATUS CHANGE DURING FISCAL 2016-2017

RADIATION ACTIVE

Walter Boron (11/22/2016)
Shu Guang Chen (3/15/2017)

STORAGE MODE

Jennifer Dorth (10/18/2016)

RADIATION INACTIVE

David Wald (11/22/2016)
Nancy Oleinick (12/22/2016)
Charles Hoppel (2/27/2017)
Nathan Berger (6/8/2017)
Mary Barkley (6/8/2017)

DEPARTED

Michael Maguire (8/9/2016)
Roxana Rojas (9/14/2016)
Timothy Nilsen (12/8/2016)
Michael Harris (12/31/2016)
Robert Petersen (2/27/2017)

X-RAY AUTHORIZED POSSESSOR LIST

<u>AP NAME</u>	<u>CONTACT PERSON</u>	<u>UNITS</u>
Amir Avishai	Wayne Jennings	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
Lashandra Korley	Bill Lenart	4
Zhenghong Lee	Chris Flask	3
Anna Samia	Anna Samia	1
Peter McCall	Peter McCall	1
Daniel Scherson	Nikola Matic	1

LASER USERS

Rigoberto Advincula (5)	Mary Barkley (Inactive) (5)	James Basillion (2)
Jesse Berezovsky (14)	Clemens Burda (3)	Paul Carey (4)
Carlos Crespo (5)	Liming Dai (2)	Diana Driscoll (17)
Dominique Durand (Inactive) (1)	Steven Eppell (5)	Philip Feng (4)
Jeffrey Garvin (1)	Alex Huang (2)	Yoshikazu Imanishi (4)
Hatsuo Ishida (4)	Eckhard Jankowsky (Inactive) (1)	Jaikrishnan R. Kadambi (8)
Kathleen Kash (Inactive) (10)	LaShanda Korley (2)	Michael Martens (8)
Heidi Martin (Inactive) (1)	Minh Lam (1)	Edward Medof (Inactive) (1)
Claudia Mizutani (1)	Wyatt Newman (Inactive) (1)	Rajesh Ramachandran (1)
Andrew Rollins (9)	Charles Rosenblatt (13)	Daniel Scherson (15)
David Schwam (1)	Kenneth D. Singer (19)	Giuseppe Strangi (4)
Lei Zhu (Inactive) (1)	Christian Zorman (4)	James Jacobberger (5)
Krzysztof Palczewski (1)	Agata Exner (Inactive) (1)	