

CASE WESTERN RESERVE UNIVERSITY
DEPARTMENT OF ENVIRONMENTAL HEALTH & SAFETY (EHS)
RADIATION SAFETY
ANNUAL REPORT 2015-2016

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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, 2015 through June 30, 2016.

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 2015-2016

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 \$40,004 in 2015-2016 through its services to the research community at Case Western Reserve University.
- For selection of vendor for radioactive bid, waste review team visited vendors at locations before making the selection.
- Dosimetry, amount of unreturned badges did go down due to the pro-active e-mails and phone calls to the individuals and PIs.
- X-Ray Program, to better educate Authorized Possessors (AP) regarding reporting of the new units. This is up to date, there were no new unreported units found during Semi-annual inventory audit and during annual X-Ray inspection.
- Waste Program, to select the best available waste broker during the bidding process.
- Training Program, amount of late retraining for the RAD users went down significantly, but still remains rather high for the ANR users, mostly the ones who have a group annual re-trainings.
- Sealed Source Program, to identify and dispose of any unneeded/unwanted sources.
- RAM Package Program, to continue timely check in for packages.
- Irradiator Program, to provide guidance to those interested in becoming irradiator users.
- Clearances Program, submitted form which is currently in use.

- Meter Calibration Program, improved turnaround time for meter calibration
- Further developed its partnership with the Department of Energy (DOE) through The Pacific National Laboratory (PNNL) to implement security systems and develop programs to ensure that high radiation sources are secure at the University. This program made available substantial funding to harden our high activity radiation sources and to put them behind highly effective security barriers on our Campus. Program development, from this security effort on the Campus, was also aimed at tightly coordinating the Radiation Safety, Dispatch, the Police and Security personnel to respond as a coordinated body to any activities or breakdowns that threaten the security of our irradiator sources. Members of each of the above units completed special training in emergency response to situations that might threaten the security of our radiation sources. Training and automated equipment installation began in 2014 and extended into 2015. Participation in the training and security effort has provided an excellent understanding of how to implement coordinated emergency response to not only irradiator material but to any highly hazardous materials that may threaten the personnel on our camps and in our community. Capitalizing on “lessons learned” helps us to provide a highly functioning coordinated task force that can respond to radiation emergencies and that is primed for further training to handle a variety of other hazardous situations that could arise on the CWRU Campus.

RADIATION SAFETY GOALS FOR 2016-2017

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:

- Implement recommendations from Broadscope Inspection.
- Continued improvements in all radiation safety programs.
- Sealed Source Program, to reduce the amount of unneeded sources on campus.
- RAM Package Program, to timely check in packages.
- Irradiator Program, to reduce the amount of room alarms.
- Dosimetry, to reduce the amount of unreturned badges to as low as possible. We do have some users who are constantly late or do not respond to the multiple request. All of them are Ancillary RAD workers from Plant and Maintenance.
- X-Ray Program, to assure that all users of the equipment required Quarterly Safety Check do perform it timely; All users required to have Safe Operating Procedure posted do have it on place; All users required to have an annual Site Specific Training do have a record of it separately from Annual Training on their CHP.
- Waste Program, to establish good working relationships with a new waste vendor; Learn, implement and comply with the waste disposal requirements of the new vendor.
- Training, to decrease the number of overdue retraining to the minimum
- Fire drills for Radiation Safety staff each semester

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

DECOMMISSIONING FUNDING PLAN

The Broadscope License and the Decommissioning Funding Plan became effective 2/25/2010. The University is required to maintain a Standby Letter of Credit to cover possible costs if the University's Broadscope License is required to undergo rapid decommissioning. The expiration date for the Standby Letter of Credit is 2/28/2016. Funds required for this letter of credit depend on the kind and amounts of radioactive materials maintained in active use or waste by the University. Experimental procedures using more sensitive methods increasingly require less radioactive materials. 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 an $^{241}\text{Am-Be}$ 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 30 irradiator users. Of these, 3 were new users and 11 had access removed.

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

IRRADIATOR	15/16	14/15	13/14	12/13	11/12	10/11	09/10	08/09	07/08	06/07	05/06	04/05
Total Workers	30	38	36	51	48	47	52	68	55	45	28	10
Total Active Irradiators	2	2	3	3	4	4	4	4	4	4	4	3

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 2015-2016 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 Term Expires: 11/8/2017 Chairperson Term Expires: 11/8/2017	Dr. Jeffery Coller Dept. of RNA Center HG Wood 113 Term Expires: 1/2016
Colleen Croniger Dept. of Nutrition BRB 925 Term Expires: 10/15/2019	Dr. Eckhard Jankowsky Dept. of Biochemistry HG Wood 137 Term Expires: 10/15/2019
Dr. W. David Sedwick Radiation Safety Officer (RSO) Dept. of Medicine EHS - Service Building, 1 st Floor	Dr. Saba Valadkhan Dept. of RNA Center Research Tower 100-8 Term Expires: 10/15/2019
Dr. William Schiemann Dept. of Medicine WRB 2404 Term Expires: 1/10/2018	Donny Licatalosi RNA Center HG Wood 106 Term Expires: 2/3/2019
Tomoaki Ogino Molecular & Microbiology HG Wood 207F Term Expires: 2/3/2019	

EX-OFFICIO MEMBERS

Richard Jamieson Vice President of Campus Svcs. Adelbert Hall 205	Felice T. Porter Asst. Dir./Asst. RSO Quality Assurance Specialist EHS Service Bldg., 1 st Fl.
Bruce DeMeza Asst. RSO University Hospitals Case Medical Center Bolwell 2600 LC - BSH 5056	R. Michael Sramkoski Senior Research Associate & Laser Specialist Comprehensive Cancer Center WRB 3542
Joseph Nikstenas EHS Laser Safety Officer & Safety Specialist Service Bldg. 1 st Fl.	Lucy Kennedy Veterinarian Animal Resource Center

SUPPORT STAFF

Gwendolyn Cox-Johnson
 Department Assistant
 Service Bldg., 1st 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 six occasions during the 2015-2016 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	15/ 16	14/ 15	13/ 14	12/ 13	11/ 12	10/ 11	09/ 10	08/ 09	07/ 08	06/ 07	05/ 06	04/ 05
New AU	1	3	7	2	7	3	9	5	7	14	11	8
Additional Isotopes	2	2	3	1	7	5	5	1	7	7	6	10
Radioisotope use in Animals	4	1	3	1	5	3	5	2	5	6	5	7
Sealed Sources	0	6	6	3	2	1	1	1	1	1	6	1
Sealed Sources Update	0	0	2	0	0	0	0	0	0	0	0	0
AU Reactivation	0	0	0	0	1	0	0	0	0	0	1	0
Possession Limit Increase	0	2	0	0	0	1	0	0	0	1	0	1
AU Protocol Update	2	7	15	14	10	12	0	0	0	0	0	3
TOTAL APPROVALS	9	21	36	21	32	25	20	9	20	29	29	30

Major topics acted upon or discussed by the RSC:

- Annual Report Presentation
- Laser Safety Program Summary
- Lucy Kennedy, Animal Resource Center (ARC) representative introduced as RSC contact regarding animal applications in 9/2015.
- Marc Rubin, EHS Associate Director, introduced as Senior Administration representative in 9/2015.
- Gwen Cox Johnson welcomed back after two month medical leave in 9/2015.
- New caution signs for campus presented and discussed in 9/2015.
- Dispatch renovation completed in 10/2015.
- XRD donation from Atotech (10/2015).
- Standby Letter of Credited no longer needed since determined that CWRU can self-guarantee its decommissioning costs as long as CWRU credit rating remains above 'A' in 10/2015.
- Landauer Social Security number purge. EHS will not provide SSN but substitute employee ID or CWRU ID for clarity of EHS records (10/2015).

- ODH RGE Partial Inspection was canceled and CWRU was not charged for ODH visit (10/2015).
- Recirculating chillers were placed on condensers and laser units to help decrease the number of floods in the Millis building (10/2015).
- Donny Licatalosi welcomed to the RSC as a new member (1/2016).
- Jeffrey Collier thanked and given a service plaque for his years of service on the RSC (1/2016).
- RGE Review of Imaging Study for UH and Dental School. Conditions were met for the RGE units and the application was approved and submitted to the IRB.
- Several phosphor imaging plates were donated to a Radiation researcher in March 2016 at a cost of \$8,300 (3/2016).
- Radiation Safety staff attended WMD seminar in Lake County. EHS reviewed Weapons of Mass Destruction (WMD) video called the "Dirty Bomb" (5/2016).
- ODH Health inspection occurred in 2/2016. A follow-up inspection scheduled for June 2016 was canceled (6/2016).
- Deliveries of cylinders, animals, radioactive materials will be held during the RNC Convention in July 2016 (6/2016).
- Quarterly check of Irradiator rooms was completed (6/2016).

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, 7 were the result of unsecured RAM found during after-hours security checks and routine compliance reviews. Three laboratories were 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	15/16	14/15	13/14	12/13	11/12	10/11	09/10	08/09	07/08	06/07
Minor	78	81	134	93	112	64	53	103	83	57
Moderate	10	13	52	19	22	37	76	27	43	11
Major	0	0	0	0	0	2	0	0	0	1
Total	88	94	178	113	134	103	129	130	106	69

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 2015-2016.

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 for a period of at least six months and no more than two years, 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	15/16	14/15	13/14	12/13	11/12	10/11	09/10	08/09	07/08	06/07	05/06	04/05
RA	54	62	66	78	89	87	87	91	92	112	124	116
SM	20	8	13	15	13	16	3	4	5	6	4	9
RI	5	3	6	6	7	4	13	1	14	8	12	2
D	2	6	0	3	1	2	3	6	8	12	11	12
Total in Program	74	70	79	93	102	103	90	95	97	118	128	125

Over the past 3 years, the RSOF has encouraged AUs with no activity involving radioactive materials to give update their AU status. Therefore, now AUs in the program are active or anticipate being active. This reduction in active AUs reflects success in this effort.

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)	Asst. Director/Asst. RSO/Quality Assurance Specialist (0.5)
Specialist Positions (3.5)	Accountant (0.5)
Department Assistant (1)	
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 2015-2016 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 RADIATION LABORATORY WORKER

Personnel listed under an AU work in RAM laboratories but have only minor incidental contact with radioactive material or have to service radioactive laboratories or classrooms where RAM is used.

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	15/16	14/15	13/14	12/13	11/12	10/11	09/10	08/09	07/08	06/07	05/06	04/05
Radiation	61	92	168	239	279	186	279	223	240	297	284	284
Online Retraining	563	615	652	409	405	311	215	418	430	695	724	775
X-Ray	58	50	48	76	72	86	52	97	96	64	51	74
Ancillary	619	279	685	601	382	146	345	403	382	402	413	356
Laser	46	41	35	71	89	38	48	66	41	56	31	116
Laser Online	67	27	39	16	32	42	35	28	15	10	11	0

Over 1,000 laboratory workers were trained for use of radioactive material in 15/16, 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

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, 2016/17 the MCA was upgraded 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. All waste is transferred to the DOA990 facility for

decay in storage and disposal. 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 but is being considered for re-commissioning in the program.

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. The Packard 1900CA LSC was replaced by a Packard 2100TR in the DOA 990 Office. 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 77 isotope transfers approved this year. This includes 18 internal and 59 external transfers.

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, 193 isotope shipments (totaling 578 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 305 isotope waste pickups by RSOF staff or by 69 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
²⁶ Al	0	0	1	0.00005
⁶⁸ Ge	2	0.617	0	0
¹¹ C	0	0	20	38.9
¹⁴ C	8	1.16	0	0
¹⁸ F	0	0	33	119.91
⁵⁹ Fe	1	1.0	0	0
³ H	14	7.705	0	0
¹²⁴ I	0	0	1	2.118
¹²⁵ I	4	0.020	4	0.514
²² Na	0	0	2	0.0012
³² P	152	502.95	16	11.4
³³ P	2	0.784	0	0
³⁵ S	10	63.446	0	0
Total	193	577.682	77	172.843

RADIOACTIVE MATERIALS	15/16	14/15	13/14	12/13	11/12	10/11	09/10	08/09	07/08	06/07	05/06	04/05
Orders	193	241	261	329	331	358	311	428	832	776	933	1,036
mCi	578	732	634	781	760	662	655	714	1,692	1,212	1,332	1,428
Pickups	306	250	237	64	236	275	417	556	548	506	634	725
Sewer Disposals	69	50	61	41	90	59	89	76	90	98	119	98
Transfers	77	61	72	119	151	119	84	98	33	240	124	66
mCi	173	814	1,261	273	543	802	426	324	40	1234	273	149

SEALED SOURCES

Case Western Reserve University's sealed source inventory contains 93 sealed sources. Of these, 88 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, two (2) 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	15/16	14/15	13/14	12/13	11/12	10/11	09/10	08/09	07/08	06/07	05/06	04/05
Sealed Sources	93	93	94	149	142	147	213	211	213	207	168	204
Exempt	88	88	89	144	134	138	203	201	190	188	154	183
Irradiator	3	3	3	3	4	4	4	5	4	4	4	3
Neutron	1	1	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 \$10,918 in cost saving over the fiscal year in lieu of using outside vendors.

CALIBRATION/ SERVICE	COST PER SERVICE	COST SAVINGS
115 meters	\$80/meter	\$9,200
2 Rad Eye meters	\$200/meter	\$400
1 pumps	\$70/pump	\$70
16 thyroid assays	\$55/assay	\$880
4 pre-filter changes	\$92/ set of 4/quarterly	\$368
	TOTAL COST SAVINGS	\$10,918

The RSOF calibrated 115 survey meters in the last fiscal year. There were 4 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. 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 hood are two double filter units for (located in DOA Radiation Area and are OK due to non-use. The fan for compactor has been repaired. Currently, there are two pre-filters and two HEPA filters that are regularly changed for two units:

- Two single filter units for the chemical hood and decay area (located above the DOA office)

Two pumps for radioactive materials were calibrated for use in an iodination hood and the continuous air monitor (CAM).

CALIBRATION/ SERVICE	15/16	14/15	13/14	12/13	11/12	10/11	09/10	08/09	07/08	06/07	05/06	04/05
Meter Calibration	115	112	109	134	136	121	142	172	170	157	188	233

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

METER CALIBRATION BY MONTH	15/16	14/15	13/14	12/13	11/12
7/2015	18	17	19	22	10
8/2015	12	10	8	6	14
9/2015	8	6	1	2	1
10/2015	7	6	5	4	8
11/2015	6	1	1	21	21

12/2015	8	12	17	13	7
1/2016	7	9	11	7	10
2/2016	12	15	10	8	14
3/2016	10	13	12	16	7
4/2016	8	10	8	9	13
5/2016	7	12	16	15	15
6/2016	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	15/16	14/15	13/14	12/13	11/12	10/11	09/10	08/09	07/08	06/07	05/06	04/05
Violations	7	13	40	7	16	24	71	19	37	54	74	89

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 7/1/2011 to 6/31/2013 with two 1-year renewal options. The contract was extended for another year.

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 woman 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 twenty-five (25) 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	15/16	14/15	13/14	12/13	11/12	10/11	09/10	08/09	07/08	06/07	05/06	04/05
Pregnant Workers	0	0	1	2	2	2	1	1	2	2	6	6
Neutron	2	2	2	4	4	4	4	4	4	0	0	0
RGE/ X-Ray	25	37	33	30	30	28	45	103	70	38	60	201
Dental	37	28	46	36	47	34	28	28	28	28	28	28
General	460	473	552	456	456	448	518	698	665	705	905	1005

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 2015.

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 15 Authorized Users of RGE with equipment in 29 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)	15/16	14/15	13/14	12/13	11/12	10/11	09/10	08/09	07/08	06/07	05/06	04/05
Diagnostic units Disposed	2	0	0	4	4	3	3	3	4	4	7	3
Diagnostic units Purchased	1	3	0	3	4	3	3	3	3	4	11	2

The ODH has changed the Radiation Generating Units classification. Two hand-held Dental units were added and one transferred in June 2016. The table below reflects that change.

RADIATION GENERATING EQUIPMENT (IN USE)	15/16	14/15	13/14	12/13	11/12	10/11	09/10
Closed Beam Analytical	6	6	6	6	6	6	6
Dental Computer Tomography (CT)	2	1	1	1	2	1	1
Photoelectron Spectrometer	16	10	11	11	11	11	11
Fluoroscopy	2	3	3	3	2	3	3
Hand-held Dental	2	3	1	2	2	1	1
Hand-held Dental (Inoperable)	1	0	0	0	0	0	0
Intraoral	28	27	27	27	27	27	27
Panoral (Only)	1	1	1	1	1	1	1
Cabinet System exclude admittance	3	3	3	3	3	3	3
Tube Only (Inoperable)	9	12	12	26	26	26	26
Radiographic (Mobile)	1	1	14	0	0	0	0
TOTAL TUBES	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 2015 was filed by 12/31/2015 and the report for January through June 2016 was filed by 6/30/2016. Twenty-four (24) 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 2015 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 2015-2016, 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	15/16	14/15	13/14	12/13	11/12	10/11	09/10	08/09	07/08	06/07	05/06	04/05
Total	0	0	2	9	0	0	0	0	0	6	6	7

¹²⁵ I BIOASSAYS	15/16	14/15	13/14	12/13	11/12	10/11	09/10	08/09	07/08	06/07	05/06	04/05
RSOF Staff	16	16	16	17	19	24	24	44	44	32	64	67
Additional	0	0	2	9	0	0	0	0	0	0	7	10
Total	16	16	18	26	19	24	24	44	44	32	71	77

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-two (22) minor incidents documented over the past year.

INCIDENTS	15/16	14/15	13/14	12/13	11/12	10/11	09/10	08/09	07/08	06/07	05/06	04/05
Major	0	0	0	2	0	0	0	0	1	2	0	1
Minor	22	30	8	16	7	18	17	20	6	7	0	4
TOTAL	22	30	8	18	7	18	17	20	7	9	0	5

DATE	INCIDENT	CONTAMINATION	ROOT CAUSE	FOLLOW UP
6/23/2016	Minor Incident	Intrusion Alarm	Motion detector alarm accidentally set.	Discussed security procedure with user.
6/15/2016	Minor Incident	Intrusion Alarm	Motion detector alarm accidentally set.	Discussed security procedure with user.
5/16/2016	Minor Incident	Contaminated Pre-filter	Contaminated pre-filter found during exhaust fan maintenance.	Pre-filter determined to be contaminated with 32P and was disposed.
5/25/2016	Minor Incident	Irradiator Alarm	Motion detector alarm accidentally set.	Discussed security procedure with user.
3/7/2016	Minor Incident	Irradiator Alarm	Motion detector alarm accidentally set.	Discussed security procedure with user.
3/3/2016	Minor Incident	Irradiator Alarm	Motion detector alarm	Discussed security

			accidentally set.	procedure with user.
1/7/2016	Minor Incident	Irradiator Alarm	Irradiator Duress light was not reset properly.	Discussed alarm reset procedure with user.
12/18/2015	Minor Incident	Irradiator Alarm	Red Light at Security desk would not turn off after test of Duress signal.	Discussed alarm reset procedure with user.
12/15/2016	Minor Incident	Irradiator Alarm	Motion detector alarm accidentally set.	Discussed security procedure with user.
12/15/2015	Minor Incident	Irradiator Alarm	Dispatch irradiator alarm would not reset properly.	Discussed alarm reset security procedure with user.
12/8/2015	Minor Incident	Irradiator Alarm	Motion detector alarm accidentally set.	Discussed security procedure with user.
12/1/2015	Minor Incident	Irradiator Alarm	Overhead lights in room were not working, Motion detector alarm accidentally set.	Maintenance replaced lights.
11/30/2015	Minor Incident	DOA 990 Door Alarm	Door alarm accidentally set.	Discussed door entry/exit alarm procedures with staff.
11/20/2015	Minor Incident	Unprocessed RAM waste found	3 month old Unprocessed RAM dry and animal waste found in RAM waste cart in waste facility.	Waste was processed and records corrected. Discussed waste procedures with staff.
11/9/2015	Minor Incident	Flood	DOA 990 Garage flood from ceiling.	No Radiation rooms or isotopes were involved. No contamination found. Maintenance will repair pipe.
10/12/2015	Minor Incident	Contamination	Investigated potential contamination and spill in research area.	No contamination or spill substantiated after review.
10/17/2015	Minor Incident	Irradiator Alarm	Motion detector alarm accidentally set.	Discussed security procedure with user.
9/28/2015	Minor Incident	Unattended RAM Package	Unlocked RAM package area on loading dock.	Discussed security procedure with Receiving staff.
9/24/2015	Minor Incident	Irradiator Alarm	Motion detector alarm accidentally set.	Discussed security procedure with user.
9/13/2015	Minor Incident	Water Leak	Water leak from one room entered the Irradiator room.	Water collected.
9/6/2015	Minor Incident	Network Outage	Disrupted network connection between unit and irradiator room.	Network connection restored.
8/17/2015	Minor Incident	Irradiator Alarm	Motion detector alarm accidentally set.	Discussed security procedure with user.

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—How it Affects Life on Earth
EPA Facts About Tritium

LASER SAFETY PROGRAM

There are a total of 176 lasers/laser systems in our database for the campus used by 40 Laser PIs in 14 buildings (33 Active, 7 Inactive). The lasers of greatest concern are those labeled Class 3B and Class 4. There are 61 Class 4, 46 Class 3B lasers, as well as 68 lasers in other classes 1, 2, and 3A/3R.

There are 21 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 1001 pieces of equipment and 250 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 ADCO 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 freezer 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, 2015 - JUNE 30, 2016

	GENERATED 7/1/2015- 6/30/2016	DISPOSED: HAZ. WASTE SVCS.	DISPOSED: SEWER	DISPOSED: CHEMICAL SAFETY	DISPOSED: ADCO	IN STORAGE AS OF 6/30/2016
Short-Lived Dry	11	17*	0	0	0	8
Long-Lived Dry	9	0	0	0	5	4
Scintillation Vials	9	0	0	0	7	2
Animals	0.25	0	0	0	0	0.25
Long-Lived Sewer	23.75	0	23.75	0	0	0
Long-Lived Non-Sewer	2	0	0	0	0	2
Short-Lived Sewer	18	0	18	0	0	0
Short-Lived Non-Sewer	4	0	0	0	0	4

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 7/1/2015, kept for decay in storage, and disposed during the period of 7/1/2015–6/30/2016. During this fiscal year, all long-lived hazardous aqueous waste was disposed.

ADCO animal waste cost = \$22.5/lb. for 10 pound barrel = \$225 per 10 pound barrel
 ADCO dry waste cost = \$500 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 17 drums of dry waste surveyed and disposed during 2015-2016 fiscal year at a cost of \$714. Without the decay in storage program, it would cost \$500 to send one 55-gallon drum of decay in storage (DIS) dry waste and it would cost \$225 per 10 lb. drum of animal waste through ADCO services. Therefore, in the absence of decay in storage, the cost to dispose of the waste drums through ADCO would have been \$8,500. Thus, the indirect savings to researchers due to the decay in storage program was \$7,786.

WASTE GENERATION	15/16	14/15	13/14	12/13	11/12	10/11	09/10	08/09	07/08	06/07	05/06	04/05
Short-Lived Dry	11	10	20	26	25	25	87	95	91	85	72	66
Long-Lived Dry	9	6	10	16	10	11	25	50	35	20	25	28
Scintillation Vials	9	10	5	10	8	7	12	30	25	30	47	44
Animals	0.25	1	0.5	0.5	0.35	0.25	0	1	2	4	3	2
Long-Lived Sewer	23.75	25	20	20	17	11.5	60	50	38	35	46	55
Long-Lived Non-Sewer	2	2	0	0	55	91	120	80	20	5	15	5
Short-Lived Sewer	18	20	15	20	18.5	21.5	65	50	140	135	125	115
Short-Lived Non-Sewer	4	5	0	0	1	3	10	20	25	30	20	35

The contract for radioactive waste disposal has been renewed for 11/1/2010 to 6/30/2013 with two 1-year renewal options with ADCO Services. This contract provides for disposal of all long-lived dry materials, scintillation vials, & animal wastes. The contract was extended for another year.

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. There were 4 large phosphor imager plates and 5 small phosphor imager plates donated for a total of \$8300. 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 \$21,300 during 2015-2016.

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 2015 and between March and June 2016. This effort resulted in the review of more than 170 files, in the program areas listed above.

RSC TRI-ANNUAL AUDITS FOR 2015-2016

RSC AUDIT COMMENT:

In November 2015, the Radiation Safety Committee Members conducted a bi-annual audit of the following components of the Radiation Safety Office:

Support Staff Training
Shipping papers/Direct Package Pickup
Radioisotope possession limits
Room Surveys
Sealed Source Leak Tests
Irradiator Program
AU/Worker 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.

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. Ancillary workers were surveyed on 11/04/2015. Dr. Croniger audited 10 files and was unable to find three (3) files for the ancillary staff. The radiation safety office was alerted to this deficiency and is working to update all the training of ancillary staff.

RSOF RESPONSE

Those in non-compliance were contacted and retraining completed.

SHIPPING PAPERS/DIRECT PACKAGE PICKUP

An audit of shipping papers was performed to verify that paperwork is completed for each transfer of radioactive material on 11/4/2015. Dr. McCormick examined 10 files and found no deficiencies among paperwork verifying pickups.

RSOF RESPONSE

No response required.

RADIOISOTOPE POSSESSION LIMITS

Dr. McCormick surveyed ten (10) files on 11/19/2015 to ensure that the possession of isotopes within each surveyed laboratory was within the labs posted possession limits for each isotope. Dr. McCormick reported no deficiencies.

RSOF RESPONSE

No response required.

ROOM SURVEY

An audit was performed on 11/25/2014 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 two (2) laboratories in the process of decommissioning.

RSOF RESPONSE

Room decommissioning surveys were completed.

SEALED SOURCE LEAK TESTS

Files verifying that sealed sources had been leak tested were audited on 11/19/2015. Ten (10) files were examined by Dr. Croniger who reported no deficiencies for the report period.

RSOF RESPONSE

No response required.

IRRADIATOR PROGRAM

An audit of the Irradiator Information Files was performed by Dr. Jankowsky on 11/09/2015 to verify that the irradiators and irradiator workers were audited by the RSOF within the past six months, and that any compliance issues were appropriately followed up and pending issues corrected. Four Irradiators were active on campus; two were not in use at the time of this audit. One surveyed irradiator worker was overdue for training. The worker was notified to retrain.

RSOF RESPONSE

The worker that was out of compliance was contacted and training completed.

AU/WORKER TRAINING

Dr. Schiemann audited the training records of AU/Workers that are overdue for training (by 30 or 60 days) on 11/09/2015. Dr. Schiemann audited ten (10) files and found that four (4) workers were not in compliance. Dr. Schiemann did note that he was unable to find one (1) file: Cooper, Kevin. The assistant RSO was notified of these absences.

RSOF RESPONSE

Those in non-compliance were contacted and training completed.

VALID RAM APPLICATIONS

RAM applications were audited on 11/4/2015 to verify that the applications were complete and valid. Dr. McCormick audited ten (10) files and reported that five (5) laboratories had workers overdue for training. The assistant RSO was notified of these overdue dates for training and notices were sent to the PI of the laboratory.

RSOF RESPONSE

Those in non-compliance 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 11/22/2015. Dr. Valadkhan inspected the facilities and reported that one (1) record of weekly surveys in Wolstein 1118 from

8/14 was missing; maintenance, housekeeping, records and waste storage and handling were all in compliance.

RSOF RESPONSE

The misfiled surveys were placed in the correct file.

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

- Room Surveys
- Bioassay
- Web Page (Radiation Safety) of EHS Website
- Survey Meters
- Radiation-Generating Equipment (RGE) Inventory and Training
- Radioisotope Security Checks
- Semi-Annual Mailings
- Direct Package Pickup
- Licensing Status
- Dosimetry Program
- Compliance
- Incident Reports
- Laser Program

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 in January 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. Valadkhan examined 10 files and noted no deficiencies.

RSOF RESPONSE:

No response required.

BIOASSAY

The bioassay program was audited by Dr. Licatalosi in January 2016 for accuracy regarding bioassay samples. Ten (10) files were audited. No deficiencies were noted in bioassays.

RSOF RESPONSE:

No response required.

WEB PAGE (RADIATION SAFETY) OF EHS WEBSITE

The "Radiation Safety" link of the EHS website was audited by Dr. Jankowsky on in January 2016. He audited whether or not the links were active and accessible. Dr. Jankowsky audited ten (10) random links and no deficiencies.

RSOF RESPONSE:

No response required.

SURVEY METERS

Dr. Jankowsky examined ten (10) survey meter records in January 2016 to audit the calibration dates and match the dates with the database of survey meter calibration. Dr. Jankowsky reported no deficiencies in the audited meters.

RSOF RESPONSE:

No response required.

RADIATION GENERATING EQUIPMENT (RGE) INVENTORY AND TRAINING

A quarterly audit was conducted in January 2016 to verify the update of inventory and the x-ray training dates for workers. Components of the audit include: X-Ray Training and semi-annual updates of Inventory. Dr. Valadkhan reviewed the RGE Inventory and training and reported no deficiencies.

RSOF RESPONSE:

No response required.

RADIOISOTOPE SECURITY CHECKS

Verification and documentation of radioisotope security checks was audited in January 2016 by Dr. Jankowsky who reports that no security checks were generated during this period.

RSOF RESPONSE:

No response required.

SEMI-ANNUAL MAILINGS

Dr. Schiemann audited the response to semi-annual notification of Authorized Users (AU) in January 2016. Dr. Schiemann inspected 10 records and reported no deficiencies.

RSOF RESPONSE:

No response required.

DIRECT PACKAGE PICKUP

Dr. Schiemann audited the files in January 2016 to verify that ordered radioactive material (RAM) was picked up by the AU (or laboratory) and that all orders placed were in the Helix Database. Dr. Schiemann noted no deficiencies.

RSOF RESPONSE:

No response required.

LICENSING STATUS

An audit was conducted to verify the licensing status of all ODH licenses and registrations in January 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. Licatalosi reviewed all license programs and reported no deficiencies. All licenses are active and accurate.

RSOF RESPONSE:

No response required.

DOSIMETRY PROGRAM

An audit of Current Dose records held by the RSOF was performed in January 2016 to verify that AU laboratory workers were current in dose record and active radiation badges. Dr. McCormick audited ten (10) records and three (3) deficiencies. Workers were contacted and badges were updated.

RSOF RESPONSE:

Those in non-compliance were contacted and badges updated.

COMPLIANCE

Compliance review audits were performed in January 2016 to ensure that any non-compliance issues were appropriately resolved. Upon examination of 10 files Dr. McCormick noted no deficiencies.

RSOF RESPONSE:

No response required.

INCIDENT REPORTS

A review of incident reports was performed in January 2016 by Dr. Croniger for verification and documentation of follow-up by the RSOF. During this quarterly report there were no incidents reported.

RSOF RESPONSE:

No response required.

LASER PROGRAM

The laser program was audited by Dr. Croniger in January 2016 for accuracy regarding laser inspections, inventory and status of personnel training. Ten (10) files were audited. No deficiencies were noted.

RSOF RESPONSE:

No response required.

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

- Irradiation Program
- AU/Worker Training
- Radioisotope Possession Limits
- Waste Disposal Facilities
- Valid RAM Applications
- Direct Package Pickup
- Support Staff Training

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.

IRRADIATOR USER TRAINING/IRRADIATORS

Dr. Jankowsky audited ten (10) user training reports and noted no deficiencies.

RSOF RESPONSE:

No response required.

AU/WORKER TRAINING

Dr. Schiemann audited the training records of AU/Workers that are overdue for training (by 30 or 60 days) on 4/22/2016. Dr. Schiemann audited ten (10) files and found that three (3) workers were not in compliance due to overdue training. The assistant RSO was notified of these deficiencies.

RSOF RESPONSE:

Those in non-compliance were contacted and retraining completed.

RADIOISOTOPE POSSESSION LIMITS

Dr. Croniger surveyed ten (10) files to ensure that the possession of isotopes within each surveyed laboratory was within the labs posted possession limits for each isotope. Dr. Croniger 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 quarterly audit in April 2016. Dr. Valadkhan inspected the facilities and reported that weekly wipe tests (DOA processing area) were not up to date. Two waste barrel logs were also missing (3/18/2016, 4/1/2016). RSOF was notified of this report. Other records of maintenance, housekeeping, records and waste storage and handling were all in compliance.

RSOF RESPONSE:

Misfiled wipe tests were found & placed correct file. Waste logs were placed on the noted barrels.

VALID RAM APPLICATIONS

RAM applications were audited for the quarter on 4/20/2016 to verify that the applications were complete and valid. Dr. McCormick audited 10 files and reported no deficiencies.

RSOF RESPONSE:

No response required.

DIRECT PACKAGE PICKUP

Dr. Licatalosi audited one file on 4/19/2016 to verify that ordered radioactive material (RAM) was picked up by the AU (or laboratory) and that all orders placed were in the OnSite Database. Dr. Licatalosi noted no deficiencies.

RSOF RESPONSE:

No response required.

SUPPORT STAFF TRAINING

Dr. Croniger audited the training records of support staff on 04/18/2016. Dr. Croniger audited ten (10) files and noted five (5) deficiencies. The RSOF was informed of these training requirements.

RSOF RESPONSE:

Those in non-compliance were contacted and retraining completed.

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 2016. 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, 2015-June 30, 2016. Dr. Licatalosi reported 20 of the 50 ancillary workers audited were

overdue for training. In addition, Dr. Licatalosi reported that 4 workers out of the 50 survey were also not ancillary by definition. The radiation safety office notified overdue workers and corrected the ancillary status for those individuals identified as not ancillary.

RSOF RESPONSE:

Those in non-compliance were contacted and training completed.

AU AND WORKER TRAINING

Authorized users and worker training files were audited for a period from J July 1, 2015-June 30, 2016. Dr. Croniger examined 50 records and noted fourteen (14) workers that were overdue for training. Overdue workers were notified of their training status.

RSOF RESPONSE:

Those in non-compliance were contacted and training completed.

BIOASSAYS

An audit was performed to verify completion of bioassays for laboratories using >10mCi of ³H and/or 1mCi ¹²⁵I during the period July 1, 2015-June 30, 2016. Dr. Croniger noted that four (4) bioassays had been performed for this period and all were correct.

RSOF RESPONSE

No response required.

COMPLIANCE REVIEW

Compliance review audits were performed to ensure that any non-compliance issues were appropriately resolved. Upon examination of 50 files Dr. Jankowsky noted that one (1) audit was 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 in non-compliance were contacted and training completed.

ISOTOPE ORDERS, AU POSSESSION LIMITS, AND THE ONSITE DATABASE

Dr. Schiemann audited 50 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. Schiemann noted three (3) orders with incorrect dates. The Assistant RSO was informed of these orders.

RSOF RESPONSE:

The information was added to the database.

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, 2015-June 30, 2016. Dr. Jankowsky audited 50 records and reported 17 individuals without dose records who were notified of the deficiency. One (1) person found in the active personnel files had actually left the University.

RSOF RESPONSE

The information was archived in the database.

INCIDENT REPORTS

A review of monthly incident reports From July 1, 2015-June 30, 2016 was performed by Dr. Ogino for verification and documentation of follow-up by the RSOF. During this period there were a total of nineteen (19) incidents reported. All incidents were effectively resolved in a timely manner.

RSOF RESPONSE

No response required.

IRRADIATOR INFORMATION REVIEW

An audit of the Irradiator Information Files was performed by Dr. McCormick to verify that the irradiators were audited by the RSOF within the past six months between the period of July 1, 2015-June 30, 2016, 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 REVIEW

The Laser program was audited by Dr. Schiemann for accuracy regarding laser inspections, inventory and status of personnel training in the period July 1, 2015-June 30, 2016. Fifty (50) files were audited. No deficiencies were noted for this period in inspection data.

RSOF RESPONSE:

No response required.

LICENSING STATUS

An audit was conducted to verify the licensing status of all ODH licenses and registrations during the period July 1, 2015-June 30, 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. Jankowsky reviewed all license programs and noted that all licenses were current. He notes that the Ohio Department of Health (ODH) and Ohio Environmental Protection Agency (OEPA) need updating.

RSOF RESPONSE

Information for both licenses was updated.

RADIOISOTOPE SECURITY CHECKS

Verification and documentation of radioisotope security checks were performed for the period July 1, 2015- June 30, 2016. Dr.Ogino reports that twenty-four (24) security checks were generated during this period. Two (2) instances of unlocked RAM storage accounted for all of the security checks. All incidents were noted to be resolved in an efficient and timely manner.

RSOF RESPONSE:

No further response required.

RADIATION GENERATING EQUIPMENT INVENTORY AND TRAINING

Quarterly inventory status and equipment surveys were examined by Dr. Schiemann who examined 15 files for the period July 1, 2015-June 30, 2016. 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 July 1, 2015-June 30, 2016. Fifty (50) files were examined by Dr. Schiemann who noted four (4) meters that were due for calibration and one file that could not be located.

RSOF RESPONSE:

The meters were calibrated promptly following the audit. The misplaced file was found.

EHS WEBPAGE (RADIATION SAFETY)

The website for the RSOF was audited to ensure proper operation, access and current links were operational for the period July 1, 2015-June 30, 2016. Dr. Croniger reports that all systems within the Radiation Website are functional.

RSOF RESPONSE

No response required.

ROOM SURVEYS (ACTIVE/DECOMMISSION)

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, 2015-June 30, 2016. Dr. McCormick examined 35 files and noted one (1) deficiency, an overdue survey for BRB 1003.

RSOF RESPONSE

The survey was completed, entered in database, and filed.

SEALED SOURCE LEAK TEST

Files verifying that sealed sources had been leak tested were audited for the period of July 1, 2015-June 30, 2016. Fifty (50) files were examined by Dr. Valadkhan who reported one (1) source was overdue for leak testing. The RSOF was notified of this report.

RSOF RESPONSE:

The sources were leak tested and database updated.

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, 2015-June 30, 2016. Dr. Valadkhan examined 6 files and found two deficiencies among paperwork verifying package receipts.

RSOF RESPONSE:

The deficiencies in paperwork were verified and did not need correction.

SEMI-ANNUAL MAILINGS (AIR/ SEWER INVENTORY)

An annual audit of the air/sewer disposal inventory was performed for the period July 1, 2015- June 30, 2016. Fifty (50) files were reviewed by Dr. Valadkhan who noted five (5) questionable status updates. The Assistant RSO was notified of these questions.

RSOF RESPONSE:

Two forms were processed and placed in the file, two forms were for sealed source only users, and one misfiled form was refiled.

VALID RAM APPLICATION

RAM applications were audited for the period July 1, 2015- June 30, 2016 to verify that the applications were complete and valid. Dr. McCormick audited fifty (50) files and reported no deficiencies.

RSOF RESPONSE:

No response required.

WASTE DISPOSAL FACILITIES (DOA990/WOLSTEIN) & RSOF LABORATORY

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, 2015-June 30, 2016. Dr. Licatalosi 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.

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 Radiation Safety Committee, 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	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 7/22/2016 and reviewed by Dr. David Sedwick. It covers fiscal years 7/1/2015-6/30/2016.

APPENDIX

AUTHORIZED USERS WITH STATUS CHANGE DURING FISCAL 2015-2016

RADIATION ACTIVE

Michael Jon Hore (9/24/2015)
Faramarz Ismail Beigi (10/2/2015)
David Danielpour (5/24/2016)

STORAGE MODE

Danny Manor (12/8/2015)
Mukesh Jain (2/19/2016)
David Wald (6/1/2016)
John Letterio (6/4/2016)

RADIATION INACTIVE

Eben Alsberg (9/11/2015)
Brian Cobb (9/11/2015)
Joseph Lamanna (4/1/2016)
James McGuffin Cawley (6/1/2016)
William Schiemann (6/6/2016)

DEPARTED

Yong Gao (8/5/2015)
Michael Maguire (5/30/2016)

X-RAY AUTHORIZED POSSESSOR LIST

<u>AP NAME</u>	<u>CONTACT PERSON</u>	<u>UNITS</u>
Amir Avishai	Amir Avishai	3
Arthur Heuer	Wayne Jennings	7
Chris Dealwis	Lucas Hoffman	1
Gary Chottiner	Gary Chottiner	1
Jean Iannandrea	Susan Opsitnick	33
Edward Greenfield	Teresa Pizzuto	1
Mukesh Jain	Steve Schomisch	2
Lashandra Korley	Bill Lenart	7
Zhenghong Lee	Chris Flask	3
Anna Samia	Anna Samia	1
Liming Dai	Liming Dai	1
Gerald Matisoff	Gerald Matisoff	1
Daniel Scherson	Nikola Matic	1
Kenneth Singer	Ina Martin	1
Derek Taylor	Derek Taylor	3

LASER USERS

Rigoberto Advincula (4)	Mary Barkley (Inactive) (5)	James Basillion (2)
Jesse Berezovsky (14)	Clemens Burda (3)	Paul Carey (4)
Patty Conrad (1)	Carlos Crespo (5)	Liming Dai (2)
Diana Driscoll (17)	Jeffrey Duerk (Inactive) (1)	Dominique Durand (Inactive) (1)
Steven Eppell (5)	Philip Feng (3)	Jeffrey Garvin (1)
Alex Huang (2)	Yoshikazu Imanishi (1)	Hatsuo Ishida (4)
Eckhard Jankowsky(Inactive)(1)	Jaikrishnan R. Kadambi (9)	Kathleen Kash (Inactive) (12)
Robert Kirsch (4)	LaShanda Korley (1)	Michael Martens (Inactive) (1)
Heidi Martin (Inactive) (1)	Minh Lam (1)	Edward Medof (Inactive) (1)
Claudia Mizutani (1)	Wyatt Newman (1)	Rajesh Ramachandran (1)
Andrew Rollins (12)	Charles Rosenblatt (11)	Shasta Sabo (1)
Daniel Scherson (15)	David Schwam (1)	Kenneth D. Singer (16)
Giuseppe Strangi (4)	Benjamin Strowbridge (3)	Lei Zhu (1)
Christian Zorman (1)		