

CASE WESTERN RESERVE UNIVERSITY
DEPARTMENT OF ENVIRONMENTAL HEALTH & SAFETY
RADIATION SAFETY
ANNUAL REPORT 2020-2021

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TABLE OF CONTENTS

INTRODUCTION	3
SUMMARY	3
RADIATION SAFETY ACCOMPLISHMENTS FOR 2020-2021	3
RADIATION SAFETY GOALS FOR 2021-2022	4
OHIO DEPARTMENT OF HEALTH LICENSE	4
RADIATION SAFETY PROGRAM-RESPONSIBLE PARTIES	6
ADMINISTRATIVE CONTROLS	9
RADIATION SAFETY OFFICE	11
RADIATION SAFETY PROGRAM	16
RADIATION SAFETY COMMITTEE AUDITS	29
APPENDIX	48
• Authorized User Inventory List	I
• Sealed Sources	II
• X-ray Devices	III
• Lasers	IV
• Organizational Chart	V

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's (RSC) operating guidelines and Case Western Reserve University's State of Ohio (Nuclear Regulatory Commission Agreement State) Broad Scope License. The report summarizes the activities of the Radiation Safety Office (RSOF) of the Department of Environmental Health & Safety (EHS) at Case Western Reserve University (CWRU). Its contents cover the period from 7/1/2020 – 6/30/2021.

SUMMARY

DEPARTMENT STRENGTHS

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

DEPARTMENT OPPORTUNITIES

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

RADIATION SAFETY ACCOMPLISHMENTS FOR 2020-2021

Over the past year, the radiation safety division of EHS continued to improve the effectiveness of the radiation safety Program. Notable new accomplishments include:

- COVID-19 Pandemic Impact:
 - Reduced radioactive waste collection
 - Maintained Training which was moved to virtual via Zoom and Canvas format
 - Reduced Laser research and training
 - Cancelled Summer Student Program
 - Performed Compliance Reviews by appointment since fewer research staff in laboratories
 - Onsite database support less responsive since their staff was not in the office
 - Maintained EHS equipment (meter calibrations, LSCs, Gamma Counters) on monthly basis
 - Maintained EHS website due to remote Drupal access
 - Reduced Radiation Badge exchange & pickup with 2/3 of all badges being exchanged during the period
 - Maintained Xray equipment, training, & inspection across campus, except Dental Bus was not in use
 - Maintained Environmental Release Summaries, but there were reduced sewer disposals
 - Increased Clearance of laboratories for CWRU departures, relocations, repairs, and disposals
 - Maintained Orientation for CWRU Faculty, Staff, & Students which was moved to virtual via Zoom
 - Reduced Staff Advisory Council (SAC) Meetings since fewer staff on campus
 - Reduced isotope orders, isotope transfers, radiation use on campus
 - Reduced sealed sources that were unneeded, and none were ordered
 - Reduced irradiator use and fewer requesting access
- X-ray: Complete disposal of and archiving in the EHS database of all old dental school X-ray units

- Recording and archiving in the EHS database all radiation detection equipment in the new dental school located at the Health Education Campus (HEC) Dental Clinic, 9601 Chester Ave., Cleveland, OH 44106.
- Development of a radiation generating equipment inspection program for the new dental school location
- Examined and evaluated the status of joint program relationships with University Hospitals (UH) radiation safety with special emphasis on dual user relationships and responsibilities. Arranged meetings with UH radiation safety personnel to review these issues.
- Purged CWRU radiation waste facility of all stored liquid waste that could not be deposited through the sewer system as decayed radioactive waste but was stored to accumulate amounts of material that could be economically transferred to our waste vendor.
- Generated in-house savings accrued from meter calibration, recycling and decay-in-storage programs amounting to more than **\$14,060 in 2020-2021** through its services to the research community at CWRU.

RADIATION SAFETY GOALS FOR 2021-2022

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

- Dosimetry: Reduce quantity of unreturned badges
- Organize virtual tour of Landauer Facilities& Waste program
- Organize virtual tour of Ecology Service facilities
- Training: Implement live Zoom recordings of in-person trainings to allow at home/quarantined individuals to participate
- Laser: Implement a permit application system to help distinguish between eye-safe laser instrument use (training not required) and actual open-beam laser use
- Meet with Cleveland Clinic radioactive materials (RAM) program leaders to examine new joint program interfaces that arise in the new medical school
- Jointly consider including a Cleveland Clinic program representative on the CWRU RSC to coincide with opening of new Facilities at Cleveland Clinic location

OHIO DEPARTMENT OF HEALTH LICENSE

CWRU has one Ohio Department of Health (ODH) broad scope license. The license covers possession and use of both nuclear accelerator-produced RAM and naturally occurring RAM for experimental purposes. It also allows for the licensed use of four irradiators. The ODH broad scope license site visit was last conducted on 10/16/2019.

The University has two ODH radiation-generating equipment (RGE) registrations. The registrations cover the receipt, possession, use, storage, and disposal of radiation generating equipment including dental X-ray machines, X-ray diffraction units, and fluoroscopy units. The ODH RGE (X-ray) inspection for the dental bus mobile units was conducted on 7/16/2019. The ODH RGE (X-ray) general inspection was conducted on 7/21-22/2020.

ODH LICENSE	EXPIRATION DATE	PURPOSE
011-011800-11	January 1, 2025	Broad Scope License
09-M-06944-12	May 31, 2022	Radiation-Generating Equipment Registration (All)
06-E-06944-020	March 31, 2023	Radiation-Generating Equipment Registration (Mobile Units)

DECOMMISSIONING FUNDING PLAN

The CWRU broad scope license and the decommissioning funding plan became effective 10/2019. Until that time, the University was required to maintain a standby letter of credit to cover possible costs if the University's broad scope license was required to cover costs of rapid decommissioning. The funds required for this letter of credit depended on the kind and amounts of RAM maintained in active use or waste by the University. The University now operates under an agreement with ODH that requires no letter of credit but is dependent on the University's good financial standing. This agreement covers all possible decommissioning costs for RAM located at the University as long as the University's credit rating is maintained.

RADIOACTIVE MATERIAL USE AND STORAGE LOCATIONS

RAM and/or RGE are located at the following facilities:

- Main campus of Case Western Reserve University, 10900 Euclid Avenue, Cleveland, Ohio 44106
- University Hospitals (UH), 2065 Adelbert Road, Cleveland, Ohio 44106
- Wolstein Research Building (WRB), 2103 Cornell Road, Cleveland, Ohio 44106
- Health Education Campus (HEC) Dental Clinic, 9601 Chester Avenue., Cleveland, Ohio 44106 (no RAM)
- Health Education Campus (HEC) Main Building, 9501 Euclid Avenue., Cleveland, Ohio 44106

RAM and/or RGE are received and/or stored at the following sites:

- Shipping and receiving, 2232 Circle Drive, Cleveland, Ohio 44106
- Wolstein Research Building, 2103 Cornell Road, Cleveland, Ohio 44106
- Health Education Campus (HEC) Dental Clinic, 9601 Chester Avenue, Cleveland, Ohio 44106 (no RAM)
- Health Education Campus (HEC) Main Building, 9501 Euclid Avenue, Cleveland, Ohio 44106 (no RAM)

PURPOSE FOR RAM USE

The majority of isotope used 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 .

RADIATION SAFETY PROGRAM – RESPONSIBLE PARTIES

RADIATION SAFETY COMMITTEE

The RSC sets policy for the use of RAM for the University's committee. Members of this committee are appointed by the president of the University and has responsibility for monitoring and enforcing compliance with the University's radiation safety program as outlined in the University's ODH broad scope license. RSC members are chosen from diverse disciplines to provide comprehensive expertise. The committee reviews all applications for use of RAM.

The 2020-2021 RSC membership and their affiliations are listed below. The ODH is informed of committee membership changes. The committee is also aided by input from ex-officio (non-voting) and visiting members (non-voting).

VOTING MEMBERS

Dr. Thomas McCormick Dept. of Dermatology BRB 530 LC - 4926 Term Expires: 10/15/2023 Chairperson Term Expires: 10/15/2023	Dr. W. David Sedwick Radiation Safety Officer (RSO) Dept. of Medicine (Emeritus) EHS - Service Building, First Floor LC - 7227 Term Expires:	Dr. Saba Valadkhan Dept. of Molecular & Microbiology HG Wood 210A LC - 4960 Term Expires: 10/1/2022
Dr. Colleen Croniger Dept. of Nutrition BRB 925 LC - 4954 Term Expires: 10/1/2022	Dr. Suhrim Fisher Animal Resource Center BRB RB5P LC - 4925 Term Expires: 10/15/2020	Dr. Donny Licatalosi Dept. of RNA Center HG Wood 106 LC - 4973 Term Expires: 10/17/2021
Dr. Zhenghong Lee Dept. of Radiology Bolwell Building S107 LC - 1714 Term Expires: 9/1/2023		Dr. Christine Duval Dept. of Chemical Engineering AW Smith Building 147 LC - 7217 Term Expires: 9/1/2023

EX-OFFICIO MEMBERS

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

SUPPORT STAFF

Naomi Boles Department Assistant Service Bldg., First Floor
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The RSC acts as an advisory and enforcement body to ensure that all RAM are safely used in accordance with the 'As Low As Reasonably Achievable' (ALARA) principles. The committee conducts audits each trimester, which address programmatic compliance. The RSC also conducts an annual audit in which the entire program is reviewed.

The audits ensure that:

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

The RSC met via Zoom on five occasions during the 2020-2021 fiscal years to review applications for radioisotope use and action on other business. Two were quorum meetings. Eight RSC meetings were cancelled because agenda items did not require immediate address. The minutes of the RSC meetings and executive committee actions are available in the RSOF, through the RSC or through the University's administration. Laboratory occupation during the Covid-19 pandemic was reduced significantly along with the number of safety topics requiring address by the RSC. However, the presence of radioactive materials and use of irradiators over this period required continuing audit activities over this period by both the RSOF staff and the RSC members.

APPLICATIONS	20/ 21	19/ 20	18/ 19	17/ 18	16/ 17	15/ 16	14/ 15
New AU	1	0	2	3	3	1	3
Additional Isotopes	3	2	1	2	0	2	2
Radioisotope use in Animals	1	1	0	2	2	4	1
Sealed Sources	3	0	0	1	5	0	6
Sealed Sources Update	1	2	2	1	0	0	0
AU Reactivation	0	0	0	0	0	0	0
Possession Limit Increase	0	0	0	0	0	0	2
AU Protocol Update	4	3	16	4	7	2	7
TOTAL APPROVALS	13	8	21	13	17	9	21

Important topics acted upon or discussed by the RSC:

- Backup generator for the waste room suppression system is needed. (3/2021)
- Planning for CWRU scheduled complete reopening 7/2021. (3/2021)
- Discussion of CWRU's approval as a Covid-19 vaccine center was deliberated (2/2021)
- ODH contacted Beckman LSC concerning users having issues with radiation source activity-dependent clock malfunctions that can be addressed by Tritech. (2/2021)
- HEC dental school administration is in transition. Old dental equipment is now registered under RSOF. (2/2021)
- Radiation contract renewals were extended during the Covid-19 pandemic to 6/2021. (2/2021)
- The SAIRC? external transfer form for short-lived isotope between PETNET and CWRU was updated. (2/2021)
- Consideration of a memorandum of understanding between UH and CWRU was initiated. (10/2020)
- Dual-user status between UH and CWRU for four authorized users was terminated and the dual-user status was eliminated. (10/2020)
- Presentation of RSC Annual Report. (10/2020)

- 2020 U.S. presidential debate activities were hosted at the HEC Building. (9/2020)
- ODH accepted a shared resource application for high security equipment. (9/2020)
- Engineering found laser equipment in storage. EHS donated this laser equipment to several departments who expressed interest. (9/2020)
- Two new RSC committee members, Duval and Z. Lee (full names should be use) were added to the RSC. (9/2020)
- Emphasis of the irradiator program under the UH license (clinical) and the CWRU license (non-clinical) were contrasted for their different requirements. The Irradiators regulated by these programs are completely independent. (8/2020)
- New director of high security irradiator program was appointed. (8/2020)
- There will be a new protocol for research when staff returns is to campus. (7/2020)
- Committee Updates: Collier and Ogino left CWRU, Schiemann rotated off RSC. We need to replace three RSC members. (7/2020)
- Quarterly irradiator checks completed. (7/2020)
- HEC dental testing completed. (7/2020)
- ODH X-ray inspection completed. (7/2020)
- LSC/gamma counter preventative maintenance completed. (7/2020)
- No fetal badges and no high doses were found during 6/2020 to 7/2021 academic years. (7/2020)
- Contacted all radiation, laser, and X-ray authorized users before Covid-19 shut down & ramp up (3/18-6/30) informing them of RSOF staggered shifts if needed for research concerns. EHS staff back on campus July 2020. (7/2020)
- Note: Updated broad scope license was received. (3/2020)

SENIOR MANAGEMENT

The Radiation Safety Program monitors, inspects and audits RGE and source used by AUs and their personnel. Senior management oversight and support of radiation safety-related activities is guaranteed by attendance of the vice president for campus security, or an appointed representative, at all RSC meetings. The RSC conducts independent audits of the Radiation Safety Program. The RSOF staff immediately responds to audit findings. Audit findings and responses are reported to senior management and the Committee. Richard Jamieson, vice president of campus services, continues to provide direct administrative representation for the Radiation Safety Program. In the absence of Richard Jamieson, Marc Rubin, EHS senior director, provides administrative representation.

RSOF AND AUTHORIZED USERS (AUs)

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

ADMINISTRATIVE CONTROLS

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

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

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

Minor severity violations are listed under the following categories:

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

Moderate severity violations include the following:

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

Major severity violations include the following:

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

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

VIOLATIONS	20/21	19/20	18/19	17/18	16/17	15/16	14/15
Minor	24	19	38	43	70	78	81
Moderate	0	2	17	13	11	10	13
Major	0	0	0	0	0	0	0
Total	24	21	55	56	81	88	94

The assistant RSO, the RSOF staff and the RSO have updated and revised most of the department manuals, training, licenses, certificates, and standard operating procedures in 2020-2021.

AU CATEGORIES:

RADIATION ACTIVE

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

RADIATION INACTIVE

These AUs do not currently use or possess RAM.

RADIATION ACTIVE STORAGE MODE

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

DEPARTED (D)

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

AUs	20/21	19/20	18/19	17/18	16/17	15/16	14/15
RA	35	44	47	49	50	54	62
SM	18	16	18	20	15	20	8
RI	5	2	2	7	5	5	3
D	1	2	3	5	5	2	6
Total in Program	53	64	70	69	65	74	70

MASTER ISOTOPE LIST

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

AU RADIOISOTOPE INVENTORY

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

RADIATION SAFETY OFFICE (RSOF)

STAFFING

The RSOF operated under University approval with the following positions:

RSO (1)	specialist positions (4)
Department assistant (1)	Asst. director/asst. RSO/quality assurance specialist (1)
student (1)	

Training and education are central to our department's goal in developing diversified skills among our personnel who are required to respond to safety incidents and for maintenance of regulatory mandates. Specialists are encouraged to attend training and continuing education. Seminars, training, and conferences attended or completed during 2020-2021 included radiological instrument training, RCRA selected hazardous waste training, 8-hour HAZWOPER refresher training and hazardous materials transportation security awareness. Training was provided by Zoom courses during the past year.

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

EHS EMAIL

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

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

TRAINING SESSIONS

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

AU

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

RADIATION WORKER

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

ANCILLARY WORKER

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

RADIATION GENERATING EQUIPMENT (RGE) WORKER

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

IRRADIATOR USERS

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

TRAINING

The RSOF keeps a record of all dates of training, attendees and content of training. Records of refresher trainings offered online are also maintained. Classes and online sessions attended are essential components of CWRU's safety philosophy. Training is audited on a monthly basis by the assistant RSO to ensure compliance. The RSOF maintains both a program description and other pertinent safety training materials for this purpose. It also monitors on-site training for irradiator use.

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

All non-laboratory personnel are required to attend hazard communication and ancillary radiation training. Groups trained now include custodial, plant, ARC, shipping, security

departments, and contractor workers. Employees who do not complete training are restricted from working in areas where RAM are used.

TRAINING	20/21	19/20	18/19	17/18	16/17	15/16	14/15
Radiation	69	108	143	133	118	61	92
Online Retraining	258	298	398	342	349	563	615
X-ray	15	12	32	22	43	58	50
Ancillary	1651	725	1561	710	741	619	279
Laser	30	58	66	59	40	46	41
Laser Online	42	48	40	68	22	67	27

Over 2,065 laboratory workers were trained through the Radiation Safety Program in 2020-2021, which is a high point over the last five years. This increase reflects an effort on the part of the RSO to provide full training instead of ancillary training to all workers for laboratories where isotope is in active use.

FACILITIES AND EQUIPMENT

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

AW Smith	Bingham	Biomedical Research
Bishop	Bolwell	DeGrace
Old 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
HEC Main	HEC Dental	

LABORATORIES

There are 305 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	121
X-ray	61
Laser	123

Radiation Safety Office (RSOF):

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

RSOF Laboratory:

The RSOF is in the service building on the first floor, 2220 Circle Drive. The laboratory in the RSOF is equipped with a Perkin Elmer Tricarb 4910 liquid scintillation counter (additional machines are in both radioactive waste facilities) and a Packard Cobra II Auto gamma counter. The RSOF maintains bioassay equipment consisting of a single-channel analyzer and a detector for monitoring thyroid uptake of ^{125}I . The department also has a multi-channel analyzer with a sodium iodide detector. These instruments are used for bioassays and the quantification of air samples for the Environmental Protective Agency (EPA) audits as well as for identification of unknown isotopes found during radiation inspections. The RSOF laboratory also houses a chemical hood, survey meters, an MCA that was upgraded (2016) to a USB version, new software & computer, decontamination supplies and essential analytical and calibration equipment. Perkin Elmer 2470 automatic gamma counter (Wallac Wizard 2) acquired and in process of getting set up.

Radioactive Waste Facilities:

Medical School Waste Facility (DOA990):

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

The storage area contains racks for the proper storage of solid and liquid waste. Waste streams consist of dry solid, bulk liquid and liquid scintillation vials. Dry solid waste and the liquid scintillation vials are packed in standard 55-gallon drums. Liquid waste is stored in five-gallon carboys and placed in spill trays to contain leakage. The floor of the waste facility was repaired for cracks and resurfaced in 2/2016. Radioactive animal carcasses are kept in a designated freezer in the ARC until they are disposed. More than half of the racks, which were not being used, were disassembled in 2017. In addition, old, broken, and unwanted equipment and materials were disposed.

Wolstein Building Waste Facility:

Room 1120, in this facility, is a counting room that also contains a chemical hood. Room 1119 contains a walk-in chemical hood and a liquid process/storage area, and Room 1118 is used for solid process/storage activities. The liquid process/storage area and solid process/storage areas are used for short-term storage only.

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

IODINATION EQUIPMENT

Special hoods, air pumps and activated charcoal-filter exhausts are placed in laboratories that conduct iodinations. Four iodination hoods are in storage. Their locations are as follows:

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

ANIMAL RESOURCE CENTERS

Conventional animal care facilities are in the Robbins building, Wearn building, Wickenden building, Metro Health Hospital, the Small Animal Imaging Research Center, and the Wolstein Research Building. These facilities are used by AUs to conduct animal studies with radioactive, chemical, and biological materials. A variety of animals (mice, rats, hamsters, rabbits, groundhogs, ferrets, and large animals such as sheep, dogs, and pigs) are housed in the Robbins building as needed. The Wearn, Wickenden, 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. Robbins houses one irradiator behind the ultra-barrier that is currently not in use.

EQUIPMENT CALIBRATION

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

The Packard Cobra II auto gamma counter is in the service building's radiation laboratory. The new Perkin Elmer Tricarb 4910 is in the radiation laboratory. The old LSC was moved to the WRB laboratory, while the WRB LSC was moved to the DOA990 office.

Quality control checks are conducted monthly for the EHS liquid scintillation and gamma counters in the radiation laboratory, DOA 990 and WRB 1119. The continuous air monitor (CAM) in DOA 990 is out of service until further need arises. All iodination air pumps are out of service. Air flow meters are annually calibrated, so calibration of iodination pumps can be done when needed. The LSCs in the radiation safety laboratory, WRB 1120 and in DOA 990 are on service contracts and maintained.

RADIATION SAFETY PROGRAM

PURCHASE OF RADIOACTIVE MATERIALS

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

TRANSFER OF RADIOACTIVE MATERIALS

The RSOF reviews and approves the transfer of all RAM internally (on campus) and externally (off campus) to, or from, an AU. Before initiating a transfer, either the internal or external transfer form must be completed and forwarded to the RSOF for approval. There were 28 isotope transfers approved this year.

ISOTOPE	ORDERS		TRANSFERS	
	#	mCi	#	mCi
¹³³ Ba	0	0	0	0
¹¹ C	0	0	0	0
¹⁴ C	3	0.75	0	0
⁶⁴ Cu	0	0	1	7.18
¹⁸ F	0	0	24	212.9
³ H	8	3.89	0	0
²² Na	0	0	1	0.02
³² P	26	147.3	2	0.25
³³ P	0	0	0	0
³⁵ S	6	55.01	0	0
Total	43	206.9	27	220.3

RADIOACTIVE MATERIALS	20/21	19/20	18/19	17/18	16/17	15/16	14/15
Orders	43	86	131	137	164	193	241
mCi	206	335	444	363	383	578	732
Pickups	53	100	106	44	176	306	250
Sewer Disposals	14	35	37	21	53	69	50
Transfers	27	63	110	85	123	77	61
mCi	220	471	227	641	462	173	814

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 one meter or 200 mR/hr at the surface, the package is held by the RSOF, and the laboratory is contacted. An inspection sticker and the RAM package receipt form is placed on the package to confirm that inspection has been completed by the RSOF. The campus mail

group delivers packages to most laboratories. Laboratories located across Adelbert Road or Cornell Road use direct pickup. Direct pickup by a laboratory designee alleviates the need to complete the bill of lading since the package is carried to the laboratory and not transported in a vehicle. The AU or designee is required to survey all radioactive material packages upon receipt for contamination and evidence of damage or breakage.

Radioisotope use, for biomedical research, results in frequent movement of radioactive materials to and from the campus. The broad scope license requires that shipments be surveyed within three hours of arrival. In the past year, 43 isotope shipments were inspected and approved by the RSOF upon receipt on the campus. A few shipments/transfers off campus were also made by laboratories. The RSOF assisted these laboratories by making sure that paperwork was properly prepared and proper labeling was used on the packages.

DISPOSAL OF RADIOACTIVE MATERIALS

Exclusive of decay of isotope in laboratories and minor inventory changes, isotopes were removed from laboratories by either 53 isotope waste pickups by the RSOF staff, or by 14 AU-directed disposals into the sanitary sewers. The following table presents a breakdown by isotope of radioactive materials entering and leaving laboratories.

SEALED SOURCES

CWRU's sealed source inventory contains 78 sealed sources. Of these, 73 sealed sources are required to be inventoried every six months. Five sealed sources require six-month leak tests as stated in our ODH license. This includes five gamma sources.

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

See the APPENDIX for a list of sealed sources on campus. These sources are not included in the general summary reports for radioactive materials. This fiscal year, one liquid source was opened for an experiment, six sources were disposed by Ecology Services, and zero new sources were received. The RSOF has actively encouraged AUs to dispose of sealed sources for which there is no anticipated use.

INVENTORY	20/21	19/20	18/19	17/18	16/17	15/16	14/15
Sealed Sources	78	84	82	86	94	93	93
Exempt	73	78	76	79	89	88	88
Irradiator	3	3	3	3	3	3	3
Neutron	0	0	0	1	1	1	1

IRRADIATORS

Five licensed low-to-high activity radiation sources are possessed for biomedical and other research. These include three high dose irradiators that contain ^{137}Cs sources, and two low dose irradiators when charged with ^{192}Ir and ^{60}Co (out of service). Currently, two high dose

irradiators are in use and the third is out of service. The ^{60}Co irradiator is now considered low dose. There were 22 irradiator users.

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

IRRADIATOR	20/21	19/20	18/19	17/18	16/17	15/16	14/15
Total Workers	22	19	20	26	34	30	38
Total Active Irradiators	2	2	2	2	2	2	2

RADIATION SURVEY METER CALIBRATIONS

CWRU's ODH Broad Scope license requires annual calibration of portable survey meters. Properly calibrated meters are necessary for laboratories to perform accurate radiation surveys. AUs are responsible for the annual calibration, maintenance, and repair of their survey instruments. Count rate calibrations on survey instruments and minor repairs are provided by the RSOF as a free service. The EHS provided in-house services that generated \$9,700 in cost savings over the fiscal year in lieu of using outside vendors.

CALIBRATION/ SERVICE	COST PER SERVICE	COST SAVINGS
52 meters	\$100/meter	\$5,200
12 Rad Eye meters	\$200/meter	\$2,400
1 pump	\$100/pump	\$100
16 thyroid assays	\$100/assay	\$1,600
4 pre-filter changes	\$100/ set of 4/quarterly	\$400
	TOTAL COST SAVINGS	\$9,700

The RSOF calibrated 81 survey meters in the last fiscal year. There were eight meters added to 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. There are two single filter units for the chemical hood and decay area (located above the DOA office). The fan for the compactor has been repaired. Currently, there are two pre-filters and two HEPA filters that are regularly changed for two units.

This year, one pump for radioactive materials was calibrated for use in an iodination hood. The CAM system is not in service and has not been calibrated.

CALIBRATION/ SERVICE	20/21	19/20	18/19	17/18	16/17	15/16	14/15
Meter Calibration	81	73	88	95	91	115	112

METERS IN USE	20/21	19/20	18/19	17/18	16/17	15/16	14/15
Hi-Q	1	1	1	1	2	2	1
Inovision	0	1	1	1	2	1	1
Ludlum	52	45	58	63	61	81	87
RPI Mini Monitor	4	2	4	6	10	13	8
Technical	1	1	1	1	1	1	1

Victoreen	4	2	3	2	4	6	4
WB Johnson	7	6	6	6	7	10	10
Fluke Biomedical	0	1	1	1	1	1	1
Research Product	1	2	1	1	1	1	1
Rad Eye	11	12	12	12	2	2	0

METER CALIBRATION BY MONTH	20/21	19/20	18/19	17/18	16/17	15/16	14/15
7/2020	16	10	13	24	12	18	17
8/2020	17	20	17	12	8	12	10
9/2020	13	9	15	9	7	8	6
10/2020	11	10	2	4	5	7	6
11/2020	3	0	5	4	4	6	1
12/2020	8	10	5	6	8	8	12
1/2021	5	1	0	1	0	7	9
2/2021	5	5	8	0	0	12	15
3/2021	1	1	1	23	8	10	13
4/2021	2	2	13	4	17	8	10
5/2021	1	2	8	7	9	7	12
6/2021	1	2	1	1	7	12	1

RAM SECURITY

RAM and potentially hazardous chemicals must be secured against unauthorized access or removal when unattended. All refrigerators, freezers or other storage units with RAM labels that are 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	20/21	19/20	18/19	17/18	16/17	15/16	14/15
Violations	7	2	15	10	10	7	13

PERSONNEL MONITORING

Personal radiation dosimeters are issued through the RSOF to radiation workers and personnel who have the potential to receive a measurable radiation dose while working at the University. All laboratory workers, visitors to the laboratory, maintenance workers and contractors working in a laboratory are candidates for inclusion in the dosimetry program. Other personnel may request dosimeters, which are provided by the RSOF. Radiation workers who are issued dosimeters must complete the new radiation worker training class and fill out an occupational exposure history form. Dosimeters are to be returned promptly at the end of each cycle of use so that the RSOF can take timely action consistent with implementation of ALARA in the event any significant exposure to radiation is detected by the dosimeter.

The contract for dosimetry was renewed with Landauer, Inc., which provides radiation monitoring services. The dates of the contract are for 7/1/2015 to 6/31/2018 with two one-year renewal options. We are on renewal option as of 7/1/2018. The contract was extended to 6/2021 due to Covid-19.

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 confirmed pregnancy.

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 RGE/X-ray (X-ray), such as fluoroscopy and X-ray diffractometers. The four fluoroscopy users had collar badges. This fiscal year, we issued 38 visitor badges to fluoroscopy observers.

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

PERSONNEL MONITORING	20/21	19/20	18/19	17/18	16/17	15/16	14/15
Pregnant Workers	0	1	1	1	0	0	0
Neutron	2	2	2	2	2	2	2
RGE/ X-ray	25	175	76	251	32	25	37
Dental	51	38	35	41	27	37	28
General	399	325	284	347	485	460	473

CWRU uses Luxel badges, which are 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 2020.

RADIATION GENERATING EQUIPMENT

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

RADIATION-GENERATING UNITS (Not In Use)	20/21	19/20	18/19	17/18	16/17	15/16	14/15
Diagnostic units Disposed	25	0	0	0	0	2	0
Diagnostic units Purchased	0	0	0	0	0	1	3

The ODH has changed the radiation generating units' classification. There were no units purchased and 25 units disposed of for 2020-2021. The table below reflects that change.

RADIATION GENERATING EQUIPMENT (IN USE)	20/21	19/20	18/19	17/18	16/17	15/16	14/15
Closed Beam Analytical	5	5	6	6	6	6	6
Dental Computer Tomography (CT)	2	5	5	2	2	2	1
Photoelectron Spectrometer (No longer under ODH)	1	4	0	0	16	16	10
Fluoroscopy	1	2	2	2	2	2	3
Hand-held Dental	8	8	13	4	3	2	3
Hand-held Dental (Inoperable)	1	1	1	0	1	1	0
Intraoral	55	73	72	30	30	28	27
Panoral (Only)	1	1	1	1	1	1	1
Cabinet System exclude admittance	2	3	3	3	3	3	3
Tube Only (Inoperable)	11	9	0	0	9	9	12
TOTAL TUBES	87	112	103	49	71	71	74

RADIOACTIVE MATERIAL RELEASES

SEWER EXPOSURE CONTROL and MONITORING

State and federal regulations permit CWRU to dispose of low levels of RAM into the sanitary sewers. CWRU RSOF requires semiannual reports on RAM that is discharged into the sanitary sewer system. CWRU's sewer releases were in compliance with both federal and state regulations. The report for July through December 2020 was filed by 12/31/2020 and the report for January through June 2021 was filed by 6/30/2021. Eighteen 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 2019 calendar year, RAM released into the air were less than 10 percent of the maximum levels set by the EPA. Therefore, CWRU had no reports to file and the University was in compliance with the air effluent releases stipulated by the EPA Clean Air Act, the NRC and the ODH.

Regarding 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 reduces radioactive material emissions by approximately 90 percent. Experiments requiring use of large amounts of iodine in especially volatile form are routinely carried out in closed systems to prevent airborne release of radioactive iodine. There was one experiment requiring the use of volatile iodine conducted this fiscal year. This program had 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 2020-2021, 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 one mCi of radioactive iodine is used in volatile form. The RSOF must be notified prior to:

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

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

IODINATION PROCEDURES	20/21	19/20	18/19	17/18	16/17	15/16	14/15
Total	0	0	1	0	0	0	0

¹²⁵ I BIOASSAYS	20/21	19/20	18/19	17/18	16/17	15/16	14/15
RSOF Staff	16	16	16	16	16	16	16
Additional	0	0	2	0	0	0	0
Total	16	16	18	16	16	16	16

TRITIUM

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

RADIOACTIVE MATERIALS INCIDENTS

EMERGENCY RESPONSE

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

INCIDENT/ SPILL RESPONSE

MAJOR INCIDENT/ SPILL

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

MINOR INCIDENT/ SPILL

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

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

INCIDENTS	20/21	19/20	18/19	17/18	16/17	15/16	14/15
Major	0	0	0	0	0	0	0
Minor	19	7	11	20	21	22	30
TOTAL	19	7	11	20	21	22	30

DATE	INCIDENT	CONTAMINATION	ROOT CAUSE	FOLLOW UP
6/25/2021	Minor Incident	DOA Door Alarm	Alarm accidentally set while staff in the room.	Reviewed proper procedure with staff.
6/24/2021	Minor Incident	Communication Loss	Contractor requested access and was denied. Proper notification channels were not used.	Reviewed proper procedure with staff.
6/23/2021	Minor Incident	Accidental Disposal	Stock vials stored in freezer were accidentally disposed with other legacy waste.	RSOF personnel must contact Researcher before stored inventory is disposed.
6/5/2021	Minor Incident	Ceiling Water Leak	Sink left on and water leaked through the ceiling. Area surveyed to ensure no contamination.	No contamination found. Custodial cleaned up water/tiles. Reviewed proper procedure with personnel.
6/2/2021	Minor Incident	IRR Alarm	ID scanned twice causing alarm	Reviewed proper procedure with staff.
4/8/2021	Minor Incident	IRR Alarm	Communication loss/network alert	Computer glitch resolved.
3/5/2021	Minor Incident	DOA Waste Room	After preventative maintenance and a power surge, DOA Suppression system panel was disconnected.	Facilities will add new transformer and then energize the suppression system panel,
3/4/2021	Minor Incident	IRR Alarm	Piezo Alarm triggered during generator test.	Reviewed proper procedure with staff.
3/3/2021	Minor Incident	IRR Alarm	Duress Alarm triggered during training	Reviewed proper procedure with staff.
3/2/2021	Minor Incident	IRR Alert	Power outage	Battery checked to resolve outage.
2/24/2021	Minor Incident	IRR Alert	Frequent communication loss/network alerts	Software update, data issue fixed, cleared backlog of alarms that resolved alerts.
1/28/2021	Minor Incident	IRR Alert	Communication loss	Communication restored.
1/26/2021	Minor Incident	IRR Alarm	Early room exit causing alarm	Reviewed proper procedure with staff.
1/5/2021	Minor Incident	IRR Alarm	ID scanned twice causing alarm	Reviewed proper procedure with staff.
12/20/2020	Minor Incident	Yellow Alert	WRB Security Computer had yellow alert.	Rebooted computer.
11/5/2020	Minor Incident	IRR Alarm	IRR Alarm & Comm Loss.	Rebooted computer.
11/5/2020	Minor Incident	IRR Camera	Generator test caused camera loss.	Rebooted computer.
9/10/2020	Minor Incident	Motion Alarm	Researcher swiped card but did not leave the room.	Reviewed proper procedure with staff.
7/20/2020	Minor Incident	Security Alarm	DOA 990 Chem waste room door opened without turning off the alarm.	Reviewed proper procedure with staff.

EHS WEBSITE & NEWSLETTER

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

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

- Radiation Safety
- Polymer Radiation Shield May Replace Lead

LASER SAFETY PROGRAM

There are 243 lasers/laser systems in our database for the campus used by 44 laser PIs in 16 buildings (42 Active, two Storage). The lasers of greatest concern are those labeled Class 3B and Class 4. There are 27 3B/4 PIs with a total of 145 Class 3B/4 lasers, as well as 17 1-3R PIs with a total of 91 lasers in other classes 1, 2, and 3A/3R.

There are 36 class 3B/4 enclosed laser systems that are considered eye-safe under normal use that decrease the hazard to the user. Thirty-one audits of laser systems were performed during this fiscal year. There were no laser incidents reported this year.

ULTRAVIOLET (UV) SAFETY PROGRAM

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

CLEARANCES/ RELOCATION PROGRAM

The RSOF requires at least three weeks' notice to decommission laboratories. An orchestrated effort between the RSOF, the safety services division of EHS, facilities services and AUs facilitates these operations. There were 978 pieces of equipment and 25 rooms that were cleared in this reporting period.

WASTE MANAGEMENT

RADIOACTIVE WASTE FACILITY

Our radiation waste facility decay-in-storage licensing with the ODH specifies that we must dispose of any interim generated waste as soon as practical when a waste site is open. The CWRU Radioactive Waste Facility (RWF) is used to segregate waste streams and prepare the waste for disposal. The different waste streams include aqueous waste, sharps, animals, scintillation vials, 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 Medwaste Ohio, a commercial disposal facility for incineration. Currently, only the outside of waste bags is surveyed (with approval from ODH) followed by immediate placement into a burn box. This simplifies handling by staff and provides for compliant and economical disposal of these materials. This procedure has greatly decreased hazard exposures to RSOF personnel handling radioactive waste at CWRU. Reducing the volume of waste to be disposed remains a continuing aim of the waste program. As part of the waste minimization program, isotope users are encouraged to reduce the volume of waste generated in the laboratory by minimizing the use of extraneous paper products. Short-lived, non-sewer (hazardous waste) is held for decay, resurveyed after ten half-lives, and disposed by Chemtron, 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. Ecology Services, a commercial radioactive materials waste hauler, dispose of long-lived solid waste (greater than 60-day half-life) and scintillation vials.

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

COLLECTION AND DISPOSAL OF ANIMAL REMAINS AND BIOHAZARDOUS WASTE

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

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. All animal waste is disposed of by the RSOF.

WASTE GENERATED IN JULY 1, 2020 - JUNE 30, 2021

	GENERATED 7/1/2020- 6/30/2021	DISPOSED: MEDWASTE OHIO	DISPOSED: SEWER	DISPOSED: CHEMICAL SAFETY	DISPOSED: Ecology Services	IN STORAGE AS OF 6/30/2021
Short-Lived Dry	5	0	5	0	0	0
Long-Lived Dry	2	0	2	0	2	0
Scintillation Vials	2	0	2	0	2	0
Animals	0	0	0	0	0	0
Long-Lived Sewer	35	0	35	0	0	0
Long-Lived Non-Sewer	0	0	0	1	0	0
Short-Lived Sewer	10	0	10	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 7/1/2020, kept for decay in storage and disposed during the period of 7/1/2020—6/30/2021. 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 Medwaste Ohio is \$25 per container (average of 2 containers per 55-gallon drum). There were eight drums of decay-in-storage dry waste surveyed and disposed of during 2020-2021. Thus, the indirect savings to researchers due to the decay in storage program was \$3,360.

WASTE GENERATION	20/21	19/20	18/19	17/18	16/17	15/16	14/15
Short-Lived Dry	5	4	6	18	9	11	10
Long-Lived Dry	2	6	8	6	5	9	6
Scintillation Vials	2	6	6	6	12	9	10
Animals	0	0	0	0	1	0.25	1
Long-Lived Sewer	35	25	35	28	30	23.75	25
Long-Lived Non-Sewer	0	1	5	2	2	2	2
Short-Lived Sewer	10	20	30	25	21	18	20
Short-Lived Non-Sewer	0	1	1	2	0	4	5

The contract for radioactive waste disposal has been extended for 6/2016 to 6/2019 with two one-year renewal options with Ecology Services. This contract provides for disposal of all long-lived dry materials, scintillation vials and animal wastes. The contract was extended to 6/2021 due to COVID-19.

RECYCLING PROGRAM

The RSOF occasionally obtains laboratory equipment in very good condition from AUs who have either left the University or ceased to use RAM. The equipment includes radioactive waste containers (lead and Lucite), shielding (lead and Lucite) and survey meters. This equipment is offered to the AUs to conserve funds otherwise needed to buy new RAM handling equipment. This cost saving from these recycling efforts resulted in re-use of equipment that saved AUs and EHS more than \$1,000 during 2020-2021.

RADIATION SAFETY COMMITTEE AUDITS

The RSC audits are carried out in two different ways:

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

Performance audits of RSOF activities included the following areas:

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

These audits were conducted between October and December 2020 and between March and June 2021. This effort resulted in the review of more than 170 files in the program areas listed above.

RSC TRI-ANNUAL AUDITS FOR 2020-2021

RSC AUDIT COMMENT:

In October 2020, the RSC members conducted a trimester audit of the following components of the RSOF:

Active/Decommissioning Room Surveys
AU and Worker Training
Dosimetry Program
Irradiator User Training/Irradiators
Laser Program

Licensing Status
Radiation Generating Equipment (RGE) inventory and training
Sealed Source Leak Tests
Security Checks
Semi-Annual Mailings (Air/Sewer Inventory)
Survey Meters
Valid RAM Applications
Waste Disposal Facilities

Each audit consisted of randomly selecting five to twenty files from the past year to ensure its contents were up-to-date, accurate and consistent with the database. Note that Dr. Valadkhan performed many audits for this reporting period due to COVID restrictions. Dr. Valadkhan preferred to perform more audits in this period to accommodate her work schedule and COVID quarantine regulations, thus her participation was especially heavy for this period. The committee thanks Dr. Valadkhan for her extraordinary service.

Active/Decommissioning Room Surveys

An audit was performed on October 28, 2020, 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 ten (10) files and noted that three (3) surveys were not on file. The RSOF was notified of the missing paperwork.

RSOF RESPONSE:

Three surveys were found to be misfiled and were filed correctly.

AU/Worker Training

Authorized users and worker training files were audited on October 28, 2020, by Dr. Valadkhan. He examined ten (10) records and noted no workers that were overdue for training.

RSOF RESPONSE:

No response required.

Dosimetry Program

An audit of current dose records held by the RSOF was performed on October 28, 2020, to verify that AU laboratory workers were current in dose record and active radiation badges. Dr. Valadkhan audited the record and identified ten (10) individuals (authorized users) who did not pick up their badges, likely due to the COVID work schedule alterations.

RSOF RESPONSE:

Researchers collected the few leftover badges within the week.

Irradiator User Training/Irradiators

An audit of the irradiator information files was performed by Dr. Valadkhan to verify that the irradiators were audited by the RSOF within the past six months. The audit was performed on October 28, 2020. Four Irradiators were active on campus and each file was up-to-date and compliant. Dr. Valadkhan noted no deficiencies.

RSOF RESPONSE:

No response required.

Laser Program

The laser program was audited by Dr. Valadkhan for accuracy regarding laser inspections, inventory, and status of personnel training on October 28, 2020. Ten (10) files were audited. Eight (8) incidents were noted and the RSOF was notified of the responsible PIs to contact for follow up on worker training and audit scheduling.

RSOF RESPONSE:

Emails were sent to the delinquent laser users concerning training and inspection issues. The database was updated as responses were received.

Licensing Status

An audit was conducted to verify the licensing status of all ODH licenses and registrations on October 29, 2020. Components of the audit include broad scope license, RGE license, waste license, radiation manual, X-ray manual, laser manual, radiation training, X-ray training, radiation online training, UV online training and RSC guidelines. Dr. Zhenghong Lee reviewed all license programs and noted that all licenses were current (no deficiencies).

RSOF RESPONSE:

No response required.

Radiation Generating Equipment (RGE) inventory and training

Quarterly inventory status and equipment surveys were examined by Dr. Valadkhan who examined nine (9) files on October 28, 2020. Dr. Valadkhan noted no deficiencies and one change of responsible PI for a staff member (move from Dr. Greenfield to Dr. Jain).

RSOF RESPONSE:

The X-ray unit of the retired researcher was transferred from CWRU to UH and is no longer on the CWRU RGE license.

Sealed Source Leak Tests

Files verifying that sealed sources that had been leak tested were audited on October 22, 2020. Ten (10) files were examined by Dr. Fisher who reported no deficiencies.

RSOF RESPONSE:

No response required.

Security Checks

Verification and documentation of radioisotope security checks were performed on October 22, 2020. Dr. Duval audited ten (10) records and reported that all were in order. Dr. Duval noted that Dr. Sankaran, in the AW Smith building, left the University and the space is now occupied with a new PI. The change in PI was noted by the RSOF.

RSOF RESPONSE:

No response required.

Survey Meters

Compliant calibration of survey meters was audited on October 22, 2020. Ten (10) files were examined by Dr. Fisher who noted one (1) meter that was overdue for calibration. The RSOF was notified of this calibration need.

RSOF RESPONSE:

The one survey meter was collected and calibrated.

Semi-Annual Mailings (Air/Sewer Inventory)

An audit of the air/sewer disposal inventory was performed on October 29, 2020, by Dr. Lee. Dr. Lee noted that the standard operating procedure was readily available, and any issues were resolved.

RSOF RESPONSE:

No response required.

Valid RAM Applications

RAM applications were audited on October 27, 2020, to verify that the applications were complete and valid. Dr. Licatalosi audited ten (10) files and reported four (4) deficiencies where training was overdue. The RSOF was notified to contact individuals in need of retraining.

RSOF RESPONSE:

Emails were sent to researchers that needed training and training was 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 on October 22, 2020. Dr. Duval inspected the facilities and reported that all records of maintenance, housekeeping, records and waste storage and handling were in compliance.

RSOF RESPONSE:

No response required.

In January/February 2021, the RSC members conducted a tri-annual audit of the following components of the RSOF:

Active/Decommissioning Room Surveys
Bioassays
Compliance Reviews
Direct Package Pickup
Dosimetry Program
EHS Webpage
Incident Reports
Isotope Possession Limits
Licensing Status
Sealed Sources Leak Tests
Security Checks
Semi-Annual Mailings (Air/Sewer Inventory)
Support Staff Training
Waste Disposal Facilities

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

Active/Decommissioning Room Surveys

An audit was performed on January 13, 2021, 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. Zhenghong Lee examined 20 files and noted six deficiencies. These were reported to the Radiation Safety office for follow up.

RSOF RESPONSE:

Decommissioned rooms that were still labeled as active were corrected in the database.

Bioassays

An audit was performed to verify completion of bioassays for laboratories using >10mCi of ^3H and/or 1mCi ^{125}I on January 26, 2021. Dr. McCormick noted that no bioassays had been performed for this period, with no deficiencies.

RSOF RESPONSE:

No response required.

Compliance Reviews

Compliance review audits were performed by Dr. Licatalosi on February 3, 2021, to ensure that any non-compliance issues were appropriately resolved. Upon examination of ten (10) files, Dr. Licatalosi noted one deficiency with a review date that did not match with the database. The RSOF was informed of the incongruity.

RSOF RESPONSE:

Data error was corrected in the database.

Direct Package Pickup

Isotope orders received within the last three months destined for direct pickup were reviewed by Dr. Licatalosi on February 3, 2021. Dr. Licatalosi audited ten (10) files to ensure that direct pickup was denoted in the files. Dr. Licatalosi noted no deficiencies.

RSOF RESPONSE:

No response required.

Dosimetry Program

An audit of current dose records held by the RSOF was performed on January 26, 2021, to verify that AU laboratory workers were current in dose record and active radiation badges. Dr. McCormick audited ten (10) records and reported no deficiencies.

RSOF RESPONSE:

No response required.

EHS Website

The website for the RSOF was audited to ensure proper operation, access and current links were operational on January 26, 2021. Dr. McCormick reports all links within the radiation website were operational.

RSOF RESPONSE:

No response required.

Incident Reports

A review of monthly incident reports was performed by Dr. Christine Duval on January 29, 2021, for verification and documentation of follow-up by the RSOF. During this period there were six incidents reported. No deficiencies were reported by Dr. Duval.

RSOF RESPONSE:

No response required.

Isotope Possession Limits

Dr. Croniger audited 10 files on January 29, 2021, 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 database. Dr. Croniger noted no deficiencies in the audited records.

RSOF RESPONSE:

No response required.

Licensing Status

An audit was conducted to verify the licensing status of all ODH licenses and registrations on January 29, 2021, by Dr. Duval. Components of the audit include broad scope license, RGE license, waste license, radiation manual, X-ray manual, laser manual, radiation training, X-ray training, radiation online training, UV online training and RSC guidelines. Dr. Duval reviewed all license programs and noted that all licenses were current (no deficiencies).

RSOF RESPONSE:

No response required.

Sealed Source Leak Tests

Files verifying that sealed sources had been leak tested were audited on January 26, 2021. Ten (10) files were examined by Dr. Croniger who reported one (1) deficiency, for one overdue RSOF inspection. The RSOF was notified of this inspection date.

RSOF RESPONSE:

The sealed source was leak tested.

Security Checks

Verification and documentation of radioisotope security checks were performed on January 13, 2021. Dr. Lee reports that one (1) security check during this period showed a deficiency in an unlocked freezer. The follow up resolution was documented in the RSOF follow up.

RSOF RESPONSE:

The AU was notified, and the unlocked freezer was locked.

Semi-Annual Mailings (Air/Sewer Inventory)

An audit of the air/sewer disposal inventory was on January 29, 2021, by Dr. Duval. Ten (10) files were reviewed by Dr. Duval who noted two (2) questionable status updates. The Assistant RSO was notified of these missing surveys.

RSOF RESPONSE:

The two reports were collected found and entered into 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 the Animal Resource Center (ARC), shipping & receiving, custodial, security and plant security on January 26, 2021. Dr. Croniger reported six (6) deficiencies in missing files. The RSOF was notified of these missing files.

RSOF RESPONSE:

The five workers information was filed.

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 January 13, 2021. Dr. Lee 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.

In April 2021, the RSC members did conduct a tri-annual audit of the RSOF. The Annual audit was performed as scheduled in person on campus with proper PPE and social distancing measures enacted during the process.

AU/Worker Training
Compliance Reviews
Dosimetry Program
EHS Webpage
Incident Reports
Irradiator User Training/Irradiators
Laser Program
Licensing Status
Radiation Generating Equipment (RGE) Inventory and Training
Security Checks
Survey Meters
Support Staff Training
Valid RAM Applications
Waste Disposal Facilities

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

AU/Worker Training

Authorized users and worker training files were audited for up-to-date training on radiation safety procedures on April 27, 2021. Dr. McCormick reported thirteen (13) overdue workers, who were notified by RSOF to update their training status.

RSOF RESPONSE:

Reminder emails were sent to the 13 overdue workers and training was completed.

Compliance Review

Compliance review audits were performed by Dr. Valadkhan on May 4, 2021, to ensure that any non-compliance issues were appropriately resolved. Upon examination of ten (10) files, Dr. Valadkhan noted two (2) deficiencies of outdated compliance. The RSOF was notified of these deficiencies.

RSOF RESPONSE:

Both compliances were completed within the week.

Dosimetry Program

An audit of current dose records held by the RSOF was performed on April 30, 2021, to verify that AU laboratory workers were current in dose record and active radiation badges. Dr. Licatalosi audited 10 records and reported no deficiencies.

RSOF RESPONSE:

No response required.

EHS Webpage

Dr. Saba Valadkhan inspected the operation of the EHS web pages for the radiation safety section. Dr. Valadkhan examined 10 random sites on May 4, 2021, within the web pages and associated links and reported no deficiencies.

RSOF RESPONSE:

No response required.

Incident Reports

Dr. Zhenghong Lee performed a review of monthly incident reports on April 20, 2021, for verification and documentation of follow-up by the RSOF. During this period, there were a total of eight (8) incidents reported. The incidents were effectively resolved in a timely manner.

RSOF RESPONSE:

No response required.

Irradiator User Training/Irradiators

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. The audit was performed on April 19, 2021. 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. Croniger for accuracy regarding laser inspections, inventory, and status of personnel training on April 19, 2021. Ten files were audited. Three (3) deficiencies in inspection were noted and the RSOF was notified of the responsible PIs to contact for follow up on worker training.

RSOF RESPONSE:

One of the laser users has left CWRU and the database was updated. Emails were sent to the two laser users and their training was updated.

Licensing Status

An audit was conducted to verify the licensing status of all ODH licenses and registrations on April 20, 2021, by Dr. Lee. Components of the audit include broad scope license, RGE license, waste license, radiation manual, X-ray manual, laser manual, radiation training, X-ray, training, radiation online training, UV online training and RSC guidelines. Dr. Lee reviewed all license programs and noted that all licenses were current (no deficiencies).

RSOF RESPONSE:

No response required.

Radiation generating equipment (RGE) inventory and training

Quarterly inventory status and equipment surveys were examined by Dr. Suhrim Fisher who examined 10 files on April 4, 2021. Dr. Fisher noted one (1) instance of a missing training date. The RSOF office was alerted to this deficiency.

RSOF RESPONSE:

The X-ray user was notified of the training deficiency and complied by retraining.

Security checks

Verification and documentation of radioisotope security checks were performed on April 28, 2021. Dr. Duval reports two (2) security checks during this period and noted a deficiency in an unsecured source and an unlocked facility. Follow up resolution was documented in the RSOF follow up file.

RSOF RESPONSE:

No further response required.

Survey Meters

Compliant calibration of survey meters was audited on April 30, 2021. Ten files were examined by Dr. Licatalosi who noted no deficiencies.

RSOF RESPONSE:

No response required.

Support Staff Training

An audit was conducted to verify the training status of personnel encompassing ancillary segments of the radiation safety program including Animal Resource Center (ARC), shipping & receiving, custodial, security and plant security on April 27, 2021. Dr. McCormick reported twenty (20) deficiencies in overdue worker training. The individuals that were overdue for training were identified to the RSOF for notification. These workers were sent notices.

RSOF RESPONSE:

Emails were sent to the overdue ancillary workers. The database was updated for those that have completed training or left CWRU.

Valid Ram Applications

RAM applications were audited on April 28, 2021, to verify that the applications were complete and valid. Dr. Fisher audited ten (10) files and reported seven (7) various deficiencies were noted.

RSOF RESPONSE:

Changes in personnel and equipment are now all documented in the database.

Waste Disposal Facilities

The waste disposal facilities (DOA990/Wolstein) and RSOF Laboratory were inspected to ensure safe operation and maintenance as required by RSOF on April 28, 2021. Dr. Duval inspected the facilities and reported that records of maintenance, housekeeping, records and waste storage and handling were all in compliance.

RSOF RESPONSE:

No response required.

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

ANNUAL RADIATION SAFETY PROGRAM AUDIT REPORT

The RSC conducted its annual audit of the RSOF the first week in June 2021. The committee reviewed the performance of 20 components of the RSOF. Please note that surveys for October, January, April/May and the annual audit were performed as scheduled in person on campus with proper PPE and social distancing measures enacted. The RSC members are to be

commended for their participation and response to the duties of the committee over the course of the COVID 2019 pandemic. The areas audited 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
- Room Surveys
- EHS Radiation Webpage
- Sealed Sources
- Direct Pickup & Package Receipt
- Semi-Annual Mailings (air/sewer inventory)
- Valid RAM Application
- Waste Disposal Facilities (DOA990, Wolstein) & RSOF Laboratory

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

Ancillary Staff Training

An annual audit was conducted to verify the training status of ancillary users and worker training files for a period from 7/1/2020 through 7/15/2021. The 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. Dr. Fisher examined fifty (50) files and noted no deficiencies.

RSOF RESPONSE:

No response required.

AU and Worker Training

An annual audit was conducted to verify the training status of authorized users and worker training files for a period from 7/1/2020 through 6/17/2021. Dr. Licatalosi reported seventeen (17) overdue workers. The RSOF was notified of the overdue training and performed follow up contact.

RSOF RESPONSE:

Emails were sent to those that were overdue. Those that have left CWRU were archived in the database.

Bioassays

An audit was performed to verify completion of bioassays for laboratories using >10mCi of ^3H and/or 1mCi ^{125}I between 7/1/2020 through 7/15/2021. Dr. Fisher noted that no bioassays had been performed for this period.

RSOF RESPONSE:

No response required.

Compliance

Compliance review audits were reviewed for the period 7/1/2020 through 6/28/2021 to ensure that any non-compliance issues were appropriately resolved. Upon examination of fifty (50) files, Dr. Croniger noted two (2) files that needed to be reviewed/updated. The RSOF staff was informed of the records that needed to update.

RSOF RESPONSE:

Both compliance reviews were completed within the week.

Direct Package Pickup

An audit was performed to cover the period of 7/1/2020 through 6/16/2021 to verify that package receipts were completed with each transfer of material from site to site. Dr. McCormick audited four (4) files and identified 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 for the period 7/1/2020 through 6/16/2021. Dr. McCormick audited fifty (50) records and reported four (4) inactive users with out-of-date files in the system. The RSOF was notified concerning the files.

RSOF RESPONSE:

The inactive users were archived in the database.

EHS Webpage

Dr. Duval inspected the operation of the EHS web pages for the radiation safety section on June 14, 2021. Dr. Duval examined all of the radiation safety websites within the web pages and associated links and reported no deficiencies. However, Dr. Duval noted flaws in some fields of the website. The RSOF was informed of the deficiencies.

RSOF RESPONSE:

The broken links were corrected, and the one file was revised and updated.

Incident Reports

A review of monthly incident reports from 7/1/2020 through 6/14/2021 was performed by Dr. Duval for verification and documentation of follow-up by the RSOF. During this period there were a total of seventeen (17) incidents reported. Dr. Duval noted four (4) cases where no documentation of the resolution was attached to the report. The RSOF was informed of these missing documents.

RSOF RESPONSE:

The incidents were documented and placed in the corrected file.

Irradiator Program

An audit of the irradiator information files was performed by Dr. Valadkhan to verify that the irradiators were audited by the RSOF from 7/1/2020 through 6/10/2021. Four irradiators were active on campus and each file was up-to-date and compliant.

RSOF RESPONSE:

No response required.

Isotope Orders, AU possession limits and the Helix Database

Dr. McCormick audited twenty-five (25) 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 database covering the period 7/1/2020 through 6/16/2021. Dr. McCormick noted three (3) questions regarding possession limits. The RSOF officer was informed of the questions.

RSOF RESPONSE:

The corrected possession limits were updated for the three users.

Laser Program

The laser program was audited by Dr. Valadkhan for accuracy regarding laser inspections, inventory and status of personnel training in the period 7/1/2020 through 6/10/2021. There were numerous (overdue) deficiencies – nineteen (19) were noted and the RSOF was notified of the responsible PI to contact.

RSOF RESPONSE:

The overdue documents for two lasers users were documented in the decommission files. One laser user left CWRU, and the equipment was transferred to another laser user.

Licensing Status

An audit was conducted to verify the licensing status of all ODH licenses and registrations during the period 7/1/2020 through 6/14/2021. Components of the audit include: broad scope license, RGE license, waste license, radiation manual, X-ray manual, laser manual, radiation training, X-ray training, radiation online training, UV online training and RSC guidelines. Dr. Duval 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. Valadkhan who examined fifty (50) files for the period 7/1/2020 through 6/10/2021. Dr. Valadkhan noted three (3) deficiencies in training. The RSOF was informed of the individuals who needed to retrain.

RSOF RESPONSE:

The current Xray instrument documents were requested and received.

Room Surveys

An audit was performed to validate active RAM use files and decommissioned room files for the period 7/1/2020 through 6/28/2021, 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. Croniger examined fifty (50) files and noted no deficiencies.

RSOF RESPONSE:

No response required.

Sealed Source Leak Tests

Files verifying that sealed sources had been leak tested were audited for the period of 7/1/2020 through 6/17/2021. Fifty (50) files were examined by Dr. Licatalosi who reported two (2) overdue tests. The RSOF was notified of these deficiencies

RSOF RESPONSE:

One overdue leak test was completed. The second leak test that was misfiled and filed correctly.

Radioisotope security checks

Verification and documentation of radioisotope security checks were performed for the period 7/1/2020 through 6/10/2021. Dr. Lee's audit noted that all security checks generated during this period for Wolstein 1118 were complete with no deficiencies.

RSOF RESPONSE:

No response required.

Semi-Annual Mailings (Air/Sewer Inventory)

An annual audit of the air/sewer disposal inventory was performed for the period 7/1/2020 through 6/10/2021. Forty-three (43) files were reviewed by Dr. Lee who noted eight (8) questions concerning staff and activity.

RSOF RESPONSE:

Four of the users were made inactive and two were placed in storage. Emails were sent to the two active and two storage users requesting reports.

Radiation Survey Meters

Compliant calibration of survey meters was audited for the period 7/1/2020 through 6/30/2021. Fifty (50) files were examined by Dr. Croniger who noted that one (1) file was missing, and 3 meters did not have an assigned PI. The RSOF was informed of these results.

RSOF RESPONSE:

The meter information was corrected in the database and the missing file was found.

Valid Ram Applications

RAM applications were audited for the period 7/1/2020 through 6/17/2021 to verify that the applications were complete and valid. Dr. Licatalosi audited fifty (50) files and reported no deficiencies.

RSOF RESPONSE:

No response required.

Waste Disposal Facilities

The waste disposal facilities (DOA990/Wolstein) and RSOF Laboratory were inspected to ensure safe operation and maintenance as required by RSOF for the period 7/1/2020 through 6/10/2021. Dr. Lee inspected the facilities for Wolstein and the RSOF laboratory and reported all other records of maintenance, housekeeping, records and waste storage and handling were 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 RSC, the assistant RSO conducts quality control reviews of all programs and records and assists with resolution. Full audit results of the program are available in the EHS office.

Sealed Source
Shipping Papers
Valid RAM Applications
Isotope Orders/ AU Possession Limits
AU/ Worker Training
Waste Disposal Facility
Active/Decommissioned Room Surveys

RAM Security Checks
Semi-Annual Mailings
RGE Inventory/ Training
Ancillary Training
Licensing
Incidents
Irradiator

Bioassays
Dosimetry
Survey Meters
Compliances
EHS Radiation Webpage
Liaison Program
Laser Program

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

This report was prepared by Felice T. Porter on 11/15/2021 and reviewed by Dr. David Sedwick. It covers fiscal years 7/1/2020-6/30/2021.

APPENDIX

AUTHORIZED USERS WITH STATUS CHANGE DURING FISCAL 2020-2021**RADIATION ACTIVE**

None

STORAGE MODE

Youwei Zhang (10/30/2020)
Jonathan Karn (4/12/2021)
Chris Dealwis (5/3/2021)
Derek Taylor (5/12/2021)
William Merrick (6/10/2021)

RADIATION INACTIVE

Fu-Sen Liang (7/14/2020)
Vincent Monnier (7/17/2020)
Youwei Zhang (3/16/2021)
Nelson Phillips (3/16/2021)
Jacek Skowronski (3/16/2021)

DEPARTED

Mohan Sankaran (9/14/2020)

X-RAY AUTHORIZED POSSESSOR LIST

<u>AP NAME</u>	<u>CONTACT PERSON</u>	<u>UNITS</u>
Gary Chottiner	Gary Chottiner	4
Syed Ali	Susan Opsitnick	61
Zhenghong Lee	Chris Flask	3
Suparna Mahalaha	Angel Henderson	4
Jeffrey Pigott	Nan Avishai	4
Anna Samia	Anna Samia	1
Daniel Scherson	Daniel Scherson	1
Steve Schomisch	Steve Schomisch	2
Lei Zhu	Lei Zhu	6

LASER USERS

Ozan Akkus (1)	James Basilion (2)	Jesse Berezovsky (14)
Walter Boron (2)	Clemens Burda (3)	Carlos Crespo (6)
Diana Driscoll (16)	Dominique Durand (2)	Steven Eppell (8)
Roger French (1)	Jeffrey Garvin (1)	Stanton Gerson (1)
Brian Grimberg (10)	Alex Huang (2)	Hatsuo Ishida (10)
Michael Jenkins (14)	Kathleen Kash (10)	Chirag Kharangate (14)
Lydia Kisley (7)	Lan, Minh (0)	Michael Martens (14)
McCormick, Thomas (1)	James McGuffin Cawley (1)	Claudia Mizutani (1)
Svetlana Morozova (4)	Andre Paes (2)	Paul Park (1)
Rajesh Ramachandran (1)	Andrew Rollins (14)	Charles Rosenblatt (16)
Daniel Scherson (20)	Bryan Schmidt (1)	Alp Sehirlioglu (6)
Andrew Shoffstall (0)	Scott Sieg (3)	Kenneth D. Singer (24)
Jonathan Stamler (0)	Giuseppe Strangi (4)	Fumiaki Takahashi (4)
Nicole Ward (1)	Gary Wnek (6)	Peter Zimmerman (1)
Christian Zorman (4)		
Alan Diehl (Storage) (1)	Heidi Martin (Storage) (1)	Eckhard Jankowsky (Storage) (2)
Liming Dai (Departed)	Rafick Sekaly (Departed)	Anirban Sen Gupta (Departed)

COVID-19 PANDEMIC WORK SCHEDULE

- * University Mandate due to Coronavirus (5 students sent home with pay) - 3/18/2020
- * Due to Coronavirus staggered work schedule – 2 Staff worked morning, 2 Staff worked evening - 3/19-20/2020
- * University Mandate due to Coronavirus (Skeleton Essential Staff only) - New Rad Staff Rotation beginning 3/23/2020 until further notice - week of 3/22 – 1 Staff and backup, week of 3/29 – 1 staff and backup, week of 4/5 - 1 Staff and backup, week of 4/12 - 1 Staff and backup, week of 4/19 - 1 Staff and backup, week of 4/26 - 1 Staff and backup, week of 5/3-1 Staff and backup
- * 1 Staff and backup in office - 3/23-27/2020
- * Zoom Rad Staff Mtg 10am - 3/25/2020
- * Zoom Rad Staff Mtg 10am – weekly (April-June 2020)
- * Zoom CWRU President Mtg (4 Asst Directors) 12-2pm weekly (April-June 2020)
- * Zoom EHS Student Mtg - 1:30pm – weekly (April-June 2020)
- * Zoom EHS Staff Mtg - 2pm - weekly (April-June 2020)
- * Due to Coronavirus Pandemic, vacation canceled, Laser Conference canceled - 3/30-31/2020
- * 1 Staff and backup in office - 3/30-4/3/2020
- * University Mandate due to Coronavirus (Skeleton Essential Staff only) - New Rad Staff Rotation beginning 5/11/2020 until further notice - week of 5/11 - 1 Staff and backup, week of 5/18 - 1 Staff and backup, week of 5/25 - 1 Staff and backup, week of 6/1 - 1 Staff and backup, week of 6/8 - 1 Staff and backup, week of 6/15-1 Staff and backup, week of 6/22 - 1 Staff and backup, week of 6/29 - 1 Staff and backup
- * University Mandate due to Coronavirus (Skeleton Essential Staff only) - New Rad Staff Rotation beginning 6/1/2020 until 7/6/2020.
- * All EHS Staff Back to Work - 7/6/2020
- * Staff completion of Comp Time - 7/6/2020-9/30/2020
- * Zoom Rad Staff Mtg 10am - 8/27/2020
- * Minimum EHS Staff - 9/29/2020
- * Zoom Rad Staff Mtg 10am - 10/29/2020
- * Zoom Rad Staff Mtg 10am - 11/2020 - cancelled
- * Reduced EHS Staff - 11/20-12/31/2020 (10 staff in the office)
- * Zoom Rad Staff Mtg 10am - 12/17/2020
- * CHRISTMAS/NEW YEAR HOLIDAY - 12/24/2020-1/3/2021
- * Reduced Staff due to Covid surge 11/20-12/31/2020. Schedule sent to all. Two Rad Staff (MTW) and Two Rad Staff (RF). This will be rotated so that all have an equal amount of time (including after the Holiday). This may be extended into Jan 2021, so I will provide a schedule. If this changes, I will notify as soon as I am aware of it.
- * Reduced EHS Staff - 1/1-24/2021
- * Full Staff in Office begins - 1/25/2021

EHS Organizational Chart 2020-2021



