

CASE WESTERN RESERVE UNIVERSITY
DEPARTMENT OF ENVIRONMENTAL HEALTH & SAFETY
RADIATION SAFETY
ANNUAL REPORT 2023-2024

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INTRODUCTION

This report is submitted to the president and designated members of the senior administration of the University as required by the Radiation Safety Committee'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 7/1/2023 – 6/30/2024.

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 2023-2024

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

- Disposed two Irradiators (60Co, 137Cs) through the Department of Energy (DOE) Office of Radiological Security (ORS) in October and November 2023.
- Established new transfer interface of radioactive materials between Cleveland Clinic and CWRU SAIRC researchers in 11/2023.
- Hired a radiation safety specialist 1/2024.
- Generated in-house savings accrued from meter calibration, recycling and decay-in-storage programs amounting to more than **\$15,140** in 2023-2024 through its services to the research community at CWRU.

RADIATION SAFETY GOALS FOR 2024-2025

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 within and around the adjacent community through educational and programmatic interaction with local partners and emergency responders. Specific efforts currently address:

- Planning and Preparation for Irradiator purchase of an X-Ray Irradiator through the DOE Office of Radiological Security (ORS) in Fall 2024.

OHIO DEPARTMENT OF HEALTH LICENSE

CWRU has one Ohio Department of Health (ODH) broad scope license. The license covers possession and use of both nuclear accelerator-produced radioactive materials (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 10/27/2022.

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 12/13/2022. The ODH RGE (X-ray) general inspection was conducted on 12/12-19/2023.

ODH LICENSE	EXPIRATION DATE	PURPOSE
011-011800-11	January 1, 2025	Broad Scope License
09-M-06944-12	May 31, 2026	Radiation-Generating Equipment Registration
06-E-06944-020	March 31, 2025	Radiation-Generating Equipment Registration (Bus Mobile Units)

DECOMMISSIONING FUNDING PLAN

The CWRU broad scope license and the decommissioning funding plan became effective in 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, 2220 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 isotopes used at the University are for biomedical research. The most typical isotopes used are ^{14}C , ^{18}F , ^3H , ^{124}I , ^{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 the 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 the use of RAM.

The 2023-2024 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 Term Expires: 9/1/2026 Chairperson Term Expires:9/1/2026	Felice T. Porter EHS Associate Director/RSO Quality Assurance Specialist Service Bldg., First Floor	Dr. Saba Valadkhan Dept. of Molecular & Microbiology HG Wood 210A Term Expires: 9/30/2025
Dr. Colleen Croniger Dept. of Nutrition BRB 925 Term Expires: 9/30/2025	Dr. Suhrim Fisher Animal Resource Center BRB RB5P Term Expires: 9/1/2026	Dr. Christine Duval Dept. of Chemical Engineering AW Smith Building 147 Term Expired: 9/1/2023
Dr. Zhenghong Lee Dept. of Radiology Bolwell Building S107 Term Expires: 9/1/2026	Dr. Thomas Gerken Dept of Biochemistry Wood 477 Term Exp: 9/30/2025	

EX-OFFICIO MEMBERS

Richard Jamieson Vice President Dept. of Campus Services Administration Adelbert Hall 229	Marc Rubin EHS Senior Director Service Bldg. First Floor
Bruce DeMeza University Hospitals Asst. RSO Bishop S621	Joseph Nikstenas EHS Asst. Dir./Asst. RSO/Laser Safety Officer Service Bldg. First Floor

SUPPORT STAFF

Naomi Boles Department Assistant Service Bldg., First Floor

The RSC acts as an advisory and enforcement body to ensure that all RAM is safely used in accordance with the 'As Low As Reasonably Achievable' (ALARA) principles. The committee conducts audits each trimester, addressing 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 and in person on 9 occasions during the 2023-2024 fiscal years to review applications for radioisotope use and action on other business. There were no quorum meetings. Three RSC meetings were canceled 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. The presence of radioactive materials and use of irradiators required continuing audit activities over this period by both the RSOF staff and the RSC members.

APPLICATIONS	23/ 24	22/ 23	21/ 22	20/ 21	19/ 20	18/ 19	17/ 18	16/ 17	15/ 16	14/ 15
New AU	1	1	1	1	0	2	3	3	1	3
Additional Isotopes	3	1	2	3	2	1	2	0	2	2
Radioisotope use in Animals	1	1	1	1	1	0	2	2	4	1
Sealed Sources	0	1	2	3	0	0	1	5	0	6
Sealed Sources Update	1	0	1	1	2	2	1	0	0	0
AU Reactivation	0	0	0	0	0	0	0	0	0	0
Possession Limit Increase	0	0	0	0	0	0	0	0	0	2
AU Protocol Update	8	3	5	4	3	16	4	7	2	7
TOTAL APPROVALS	14	7	12	13	8	21	13	17	9	21

Important topics acted upon or discussed by the RSC:

- 23 Laser workers trained, and 7 laser audits performed. (6/2024)
- X-ray irradiator is due to arrive in early Fall. Structural test will be done on that room. (6/2024)
- Yanming Wang is retiring this week. His labs will be decommissioned. Chunying Wu is expected to take his equipment and materials. C-11 will need to be added to her protocol (6/2024)
- Tom Gerken is retiring but will stay on a year to work with his student. (6/2024)
- One laser in Think box is being removed. Kenneth Singer in Rockefeller Building is offering lasers to others before he retires. He now has one laser left. Laser Equipment in the White Building is going to E-waste. (5/2024)
- The Yost Building has been demolished and construction of the ISBE Building has begun. (6/2024)
- The Med School must be notified a month prior to the researcher leaving. (5/2024)
- Inactive and Unused Lasers are now being reconciled. (5/2024)
- RSC Guidelines have been updated (5/2024)
- RSC Annual Report is in progress. (5/2024)
- No questions on RSC operational guidelines. (5/2024)
- Gerken, Scintillation issue continues (5/2024)
- 8 Laser workers were trained, and 14 laser audits were completed (3/2024)
- In contact with Revvity for source removals for old DOA 990 LSC and the Medof LSC. It should be happening this week. (3/2024)
- Working with GMI concerning maintenance and old Beckman LSC removals. Different departmental money being looked at to combine work in one visit. (3/2024)

- Working with Revvity and Procurement to remove the credit hold that Revvity has placed on all CWRU research orders. This is impacting orders of radioactive materials, equipment purchase, and equipment maintenance. Perkin Elmer transformed into Revvity as of 5/2023. (3/2024)
- Liability Transfer is complete for both Cobalt & Cesium Irradiator Disposals. This means that the DOE and the State of Texas, as owners of the facilities, assumes ownership and all future liability. This eliminates CWRU's future risk and liability. (2/2024)
- Maintenance of irradiator room floors continues due to the metal and old wax deposits left after the irradiator removal. (2/2024)
- There are no high doses this quarter and no fetal monitoring this quarter. (2/2024)
- 32P Shipment Change - Revvity (Perkin Elmer). 32P shipments will no longer be shipped in lead pig containers, therefore users must reuse previous gray lead pig containers to store new vials. RSOF can also provide lead pigs and other needed shielding. (2/2024)
- Annual Irradiator Training, which must be done in February 2024, will be completed this week. This training is required for Police, Security, Dispatch, Radiation Core, & RSOF. (2/2024)
- The Dispatcher RMS Training on High Security Alarms will be done next week. It is given by the DOE. (2/2024)
- Robert Salomon has agreed to give his new yet unused 2014 Perkin Elmer Liquid Scintillation Counter (LSC) to the Biochemistry/RNA Core. They are working out the details of the move currently. (2/2024)
- The ODH X-Ray Inspection is now completed as of 2/2024 after the repair and certification of a few units. The next inspection will be in 7/2026. (2/2024)
- Jeffrey Neistadt, new Radiation Staff member, introduced. (2/2024)
- 37 workers received laser training, and 14 laser audits were completed. (2/2024)
- X-Ray inspection of our CWRU analytical and diagnostic x-ray units during 12/12-19/2024 was completed with a few minor deficiencies. We will submit our response this week. (1/2024)
- RSC January 2024 audits continue. (1/2024)
- There are no high doses nor fetal monitoring this quarter. (1/2024)
- We hope to replace the two inactive units with a state-of-the-art X-Ray Irradiator in collaboration with the DOE research group project. The replacement should take place in 6 months. (1/2024)
- Maintenance of irradiator room floors continues due to the metal and old waste deposits left after the irradiator removal. (1/2024)
- The ARC Room where the irradiator was locked has been cleaned and returned to ARC on 11/2023. (1/2024)
- Shared receipt of the final disposal manifest for both Irradiator sources along with confirmation receipt with the ODH and DOE Federal Registry. (1/2024)
- Letter from the CWRU President Kaler for receipt of the 2022/2023 RSC Annual Report was shared along with picture of RSO taken with CWRU President. (1/2024)
- Picture of Duval receiving the RSC plaque was shared. (1/2024)
- The ARC Incident with waste disposal was resolved. (1/2024)
- Joseph Nikstenas returned to work from shoulder surgery during the Holiday. (1/2024)
- Over the last 2 years, the government has become more concerned with terrorism concerning cesium blood Irradiators. With the McCain Act, they began to develop financial incentives to encourage hospitals and research facilities to give up their Irradiators and replace them with X-Ray Irradiators. (11/2023)
- The CWRU RSC developed a questionnaire for our Irradiator researchers to gauge interest in the use of X-ray Irradiators. 50% wanted to continue using the cesium Irradiators as they had several years of research material confidence. 50% were willing to consider X-Ray Irradiator use in their research but needed comparison studies. (11/2023)
- We have 4 irradiators (2 active, 2 inactive) and decided to utilize the DOE incentive program to offload our inactive Irradiators (Cesium-137 & Cobalt-60) and replace them with the new X-Ray Irradiator and take part in a research collaboration with the DOE. The DOE approved the award to work in collaboration in early 2023. (11/2023)
- In the last 2 weeks: Maintenance was conducted on the 2 active irradiators on 10/31-11/1/2023. (11/2023)
- Project 1 highlights (11/2/2023 inactive cesium source 4K-pound unit removal). 11 government officials came (DOE LANL) at 11:30am. Request to move cask truck to MCCO location which had level sidewalk. At 4:30pm, Used a short path in the ARC, quickly up the ramp, signed over the unit from CWRU to DOE so that they could take the unit on the public road to the MCCO location without getting a citation from the NRC. Gratefully, there was no rain, and the temperature was 45F. Everything went smoothly, and the truck and officials left the CWRU at around 9:30pm. (11/2023)
- Project 2 highlights (11/8/2023 inactive cobalt source 6K-pound unit removal). It has been considered an antique since 1965. 5 contractor officials came (Bionomics) at 1:30pm. At 3:30pm, we entered the room to remove the cobalt source unit It took 5 men to move the unit on Masonite to the elevator 3 elevator

- technicians monitored putting the unit on the elevator with no passengers and manually sending the elevator to the Ground floor. The passengers used another elevator. The 5 men moved the unit to the garage where a forklift was used to take it to the truck at the dock. The riggers put the unit on its side into the source container and lifted and secured it into the truck. Everything went smoothly. The room was surveyed for contamination, all forms were signed, and the truck left CWRU at 6:40pm. (11/2023)
- After 30 years, 2 inactive units in high security locations were removed from CWRU. One high security location will be returned to ARC as a regular room. The other room remains a high security room. (11/2023)
 - In Project 3, We hope to replace the two inactive units with a state-of-the-art X-Ray Irradiator in collaboration with the DOE research group projects. That should take place in 6 months. (11/2023)
 - The VA replaced their cesium Irradiators for a basic X-ray Irradiator, and it has not been used once since it's receipt 2 years ago. Several VA researchers use our Cesium Irradiators regularly. (11/2023)
 - We have also had requests for use from several Metro Health researchers as well. (11/2023)
 - It was told that soon CCF plans to replace some of their cesium Irradiators with the X-ray Irradiator as well. (11/2023)
 - It was shared that UH plans to do the same. (11/2023)
 - In other news, we had our 1st external transfer of radioactive material from CWRU to CCF. It went smoothly. (11/2023)
 - There are no high doses this quarter and fetal monitoring this quarter. (11/2023)
 - We are working on making changes to Laser training and Laser audits since taking LSO training last month. (10/2023)
 - Three components of irradiator project: Remove Cobalt and Cesium potentially in November. Receive x-ray irradiators in 3-6 months. Work with the City and CWRU for security guidelines for moves. (10/2023)
 - Thanks for continued RSC service for McCormick, Fisher, & Lee. (9/2023)
 - Duval has completed her RSC service and will receive RSC plaque. (9/2023)
 - Addition of new RSC member for 10/2023. (9/2023)
 - Archive/Decommission of the RAM AU RAM application & rooms by 9/2023. (9/2023)
 - Revised RSC Roster & Audit Schedule for 2023-24. (9/2023)
 - Cobalt & Cesium Irradiators that are in storage may be decommissioned and removed by 12/2023. (9/2023)
 - Beckman LSCs and the disposal of the cesium sources is under discussion. Only two have requested cesium disposal. Each department has at least one active LSC and is not looking to purchase another. We will discuss next steps. (9/2023)
 - RSC Annual meeting will be held in 10/2023. Currently working on RSC Annual Report 2022-2023. (9/2023)
 - RSC Annual audits begin 10/2023. (9/2023)
 - The Cesium Irradiator is not being used. Also, the Cobalt Irradiator is not being used. \$50,000 will come from the School of Medicine (SOM) to purchase irradiator(s). \$135K Funding will come from PNNL. The Research Administration stated he would pay the entire amount. DOE will pay to remove the Cesium Irradiator. More research is needed on the specifics for Safe removal. The DOE will be instrumental in the planning. (7/2023)
 - Rad Specialist 2 update (7/2023)
 - No high doses, no fetal monitoring, badge exchange in process for this 1QTR2023. (7/2023)
 - ACS CHAS Peer-Led Workshop: RAMP in the Research Lab - 8/2/2023 (W) - 2-5pm. (7/2023)
 - Dispatcher Virtual Training is next week, with Y-12 National Security. Several New dispatchers after moving to a new building. (7/2023)
 - New dispatchers hired after moving to a new building. (7/2023)
 - Beckman LS6500s Service Discontinuance - determine interest in collection/disposal of sources as well as collective LSC purchase for new LSC for researcher use. (7/2023)
 - RSC Annual Audits complete - staff correcting deficiencies in progress. (7/2023)
 - RAM Application Renewal (3) (7/2023)
 - Increase of requests for IRR use by Metro Researchers with connection to CWRU. (7/2023)
 - Increase of UH clinical reviews for use of CWRU X-Ray equipment for Dental School, IRB, & IACUC applications. (7/2023)
 - Increase of requests (up to 20mCi) for use of short-lived isotopes for Small Animal Imaging Research (SAIRC). (7/2023)
 - New CCF relationship with SAIRC, Dual CCF Users. Cautioned to ensure that setup is not for Human Production (7/2023)
 - Progress report for the new Irradiation task with Research project. (7/2023)
 - 137Cs & 60Co Irradiators Source Removal - possibly in the late Fall early Winter. (7/2023)
 - RSC member, Christine Duval, received the prestigious early-career grant from the National Science Foundation. Congratulations! (7/2023)

SENIOR MANAGEMENT

The Radiation Safety Program monitors, inspects and audits RGE and sources 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 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, seven were the result of unsecured RAM found during after-hours security checks and routine compliance reviews. One of the laboratories was assessed with a moderate violation that had three or more minor violations during compliance reviews by radiation safety during routine audits. Documented follow up and resolutions were completed for all major and moderate violations.

VIOLATIONS	23/24	22/23	21/22	20/21	19/20	18/19	17/18	16/17	15/16	14/15
Minor	36	16	31	24	19	38	43	70	78	81
Moderate	8	6	3	7	2	17	13	11	10	13
Major	0	0	0	0	0	0	0	0	0	0
Total	44	22	34	24	21	55	56	81	88	94

The assistant RSO, the RSOF staff and the RSO updated and revised most of the department manuals, training, licenses, certificates, and standard operating procedures in 2023-2024.

AU CATEGORIES:

RADIATION ACTIVE (RA)

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

RADIATION INACTIVE (RI)

These AUs do not currently use or possess RAM.

RADIATION ACTIVE STORAGE MODE (SM)

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	23/24	22/23	21/22	20/21	19/20	18/19	17/18	16/17	15/16	14/15
RA	28	29	32	35	44	47	49	50	54	62
SM	10	12	16	18	16	18	20	15	20	8
RI	2	4	5	5	2	2	7	5	5	3
D	0	3	1	1	2	3	5	5	2	6
Total in Program	38	41	48	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:

Associate Director/RSO/Quality Assurance Specialist (1)	Specialist positions (3)
Asst. Director/Asst. RSO (1)	Department assistant (2)
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 2023-2024 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 (cwruehs@gmail.com) and the website case.edu/ehs, 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 training offered online are also maintained. Classes and online sessions attended are essential components of CWRU's safety philosophy. Training is audited on a monthly basis by the assistant RSO to ensure compliance. 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 training. 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 bi-annual retraining for all laser 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. The table below summarizes worker training over the past 10 years.

TRAINING	23/24	22/23	21/22	20/21	19/20	18/19	17/18	16/17	15/16	14/15
Radiation	74	91	70	69	108	143	133	118	61	92
Online Retraining	197	208	217	258	298	398	342	349	563	615
X-ray	41	10	7	15	12	32	22	43	58	50
Ancillary	486	865	1764	1651	725	1561	710	741	619	279
Laser	48	55	71	30	58	66	59	40	46	41
Laser Online	65	51	62	42	48	40	68	22	67	27

Over 911 laboratory workers were trained through the Radiation Safety Program in 2023-2024.

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	Glennan	HEC Dental
HEC Main	HG Wood	Kent Hale Smith	Lerner Tower
Med East/Robbins	Millis	Olin	Pathology
Research Tower	Rockefeller	Service	Wearn
West Quad (CCSB)	White	Wickenden	Wolstein Research
Startup Incubator (formerly BioEnterprise)			

LABORATORIES

There are 214 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	70
X-ray	64
Laser	80

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 Protection 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, a multi-channel analyzer (MCA) that was upgraded (2016) to a universal serial bus (USB) version, new software & computer, decontamination supplies and essential analytical and calibration equipment. A Perkin Elmer 2470 automatic gamma counter (Wallac Wizard 2) was acquired.

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 secondary backup liquid scintillation counter in the DOA Office was decommissioned and disposed January 2024.

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 removed. 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. Five iodination hoods are in storage. Their locations are as follows:

WRB 1119 - Radiation Waste Facility Storage (1) – 1 hood with fan and one pump
DOA 990 – Storage (3) – three hoods with fans and three pumps; one extra fan unit
Bishop S629C – Storage (1) – one hood with fan and one pump

ANIMAL RESOURCE CENTERS

Conventional animal care facilities are in the following buildings: Robbins, Wearn, Wickenden, Metro Health Hospital, the Small Animal Imaging Research Center (SAIRC), and the Wolstein Research (WRB). 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 and the Perkin Elmer Tricarb 4910 are in the service building's radiation laboratory. The old LSC was moved to the WRB laboratory, while the WRB LSC was moved to the DOA990 office. The DOA 990 office LSC was decommissioned and disposed in January 2024.

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

RADIOACTIVE MATERIALS RECEIVED & DISPOSED

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 64 isotope transfers approved this year.

ISOTOPE	ORDERS		TRANSFERS	
	#	mCi	#	mCi
¹⁴ C	4	0.80	0	0
⁵⁷ Co	1	8.69	0	0
¹³⁷ Cs	1	0.0004	1	0.001
⁶⁴ Cu	1	1	0	0
¹⁸ F	0	0	47	380.58
⁶⁸ Ga	0	0	7	49.56
⁶⁸ Ge	2	0.49	0	0
³ H	1	1	0	0
¹²⁴ I	4	4.86	0	0
¹³⁸ La	1	0	0	0
¹⁷⁷ Lu	1	100	5	43
³² P	8	40.38	4	0.34
³⁵ S	2	10.85	0	0
⁸⁹ Zr	2	13.75	0	0
Total	28	181.82	64	473.48

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, 28 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 73 isotope waste pickups by the RSOF staff, or by 5 AU-directed disposals into the sanitary sewers. The following table presents a breakdown by isotope of radioactive materials entering and leaving laboratories over the past 10 years.

RADIOACTIVE MATERIALS	23/24	22/23	21/22	20/21	19/20	18/19	17/18	16/17	15/16	14/15
Orders	28	35	32	43	86	131	137	164	193	241
mCi	182	1381	97.97	206	335	444	363	383	578	732
Pickups	53	73	31	53	100	106	44	176	306	250
Sewer Disposals	8	5	15	14	35	37	21	53	69	50
Transfers	64	85	53	27	63	110	85	123	77	61
mCi	473	1415	299.4	220	471	227	641	462	173	814

SEALED SOURCES

CWRU's sealed source inventory contains 77 sealed sources. Of these, 69 sealed sources are required to be inventoried every six months. Eight sealed sources require six-month leak tests as stated in our ODH license. This includes 8 gamma sources.

There are two high-dose active irradiators on campus. These irradiators are the only radioactive material sources that could produce significant external dose hazards should their shielding be compromised. Two low-dose inactive irradiators were removed from campus by the Department of Energy (DOE) and the SCATR Programs.

See the APPENDIX for a list of sealed sources currently housed on campus. These sources are not included in the general summary reports for radioactive materials. This fiscal year, 2 sources were changed to inventory due to decay, no sources were disposed by Ecology Services, and two new sources were received. The RSOF has actively encouraged AUs to dispose of sealed sources for which there is no anticipated use.

INVENTORY	23/24	22/23	21/22	20/21	19/20	18/19	17/18	16/17	15/16	14/15
Sealed Sources	75	75	77	78	84	82	86	94	93	93
Exempt	69	71	73	73	78	76	79	89	88	88
Irradiator	2	3	3	3	3	3	3	3	3	3
Neutron	0	0	0	0	0	0	1	1	1	1

IRRADIATORS

Two licensed low-to-high activity radiation sources are possessed for biomedical and other research. These include two high dose irradiators that contain ¹³⁷Cs sources. There were 34 irradiator users.

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

IRRADIATOR	23/24	22/23	21/22	20/21	19/20	18/19	17/18	16/17	15/16	14/15
Total Workers	34	31	22	22	19	20	26	34	30	38
Total Active Irradiators	2	2	2	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 Rad Eye meters, pump, and filter changes were not done in house, thus the total EHS in-house services generated were \$13,200 in cost savings over the fiscal year in lieu of using outside vendors.

CALIBRATION/ SERVICE	COST PER SERVICE	COST SAVINGS
66 meters	\$200/meter	\$13,200 (EHS)
12 Rad Eye meters	\$200/meter	\$2,400 (vendor)
1 pump	\$300/pump	\$300 (vendor)
0 thyroid assays	\$100/assay	\$0 (EHS)
4 pre-filter changes	\$100/ set of 4/quarterly	\$400 (vendor)
	TOTAL COST	\$13,200

The RSOF calibrated 78 survey meters in the last fiscal year. There was 8 meters added into 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 now performs this function. 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.

The Bioassay Program is Inactive since 2021. There were no pumps calibrated for use in iodination hood and thus no thyroid assays were done. The CAM system is not in service and has not been calibrated.

CALIBRATION/ SERVICE	23/24	22/23	21/22	20/21	19/20	18/19	17/18	16/17	15/16	14/15
Meter Calibration	78	70	75	81	73	88	95	91	115	112

METERS IN USE	23/24	22/23	21/22	20/21	19/20	18/19	17/18	16/17	15/16	14/15
Hi-Q	1	1	1	1	1	1	1	2	2	1
Inovision	0	2	2	0	1	1	1	2	1	1
Ludlum	45	45	50	52	45	58	63	61	81	87
RPI Mini Monitor	3	3	4	4	2	4	6	10	13	8
Technical	0	0	0	1	1	1	1	1	1	1
Victoreen	11	3	0	4	2	3	2	4	6	4
WB Johnson	5	5	6	7	6	6	6	7	10	10
Fluke Biomedical	0	0	0	0	1	1	1	1	1	1
Research Product	1	1	1	1	2	1	1	1	1	1
Rad Eye	12	12	12	11	12	12	12	2	2	0

METER CALIBRATION BY MONTH	23/24	22/23	21/22	20/21	19/20	18/19	17/18	16/17	15/16	14/15
7/2023	11	10	12	16	10	13	24	12	18	17
8/2023	1	6	4	17	20	17	12	8	12	10
9/2023	5	5	25	13	9	15	9	7	8	6
10/2023	21	26	14	11	10	2	4	5	7	6
11/2023	15	6	4	3	0	5	4	4	6	1
12/2023	4	4	2	8	10	5	6	8	8	12
1/2024	3	1	2	5	1	0	1	0	7	9
2/2024	5	5	8	5	5	8	0	0	12	15
3/2024	1	4	2	1	1	1	23	8	10	13
4/2024	3	1	1	2	2	13	4	17	8	10
5/2024	2	5	0	1	2	8	7	9	7	12
6/2024	7	1	1	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	23/24	22/23	21/22	20/21	19/20	18/19	17/18	16/17	15/16	14/15
Violations	7	6	3	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 and area monitors 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. ODH will be notified when exposure limits are exceeded.

The contract for dosimetry was renewed with Landauer, Inc., which provides radiation monitoring services. The date of the contract was extended to 6/2025.

PREGNANT WORKER PROGRAM

Any radiation worker who is, or thinks she may be, pregnant is advised to complete a declaration of pregnancy form found on the EHS website <https://case.edu/ehs/> under the 'radiation safety' link and send it to the RSOF. Counseling is provided and an additional dosimeter is issued to the worker that is read every month. This additional fetal dosimeter is worn to conservatively measure any dose to the developing baby. No women declared 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 2 neutron dosimeters used in the Surgical Training and Research Laboratory (STAR) 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 4 fluoroscopy users had collar badges. We ceased the badging of fluoroscopy observers and chose to use area monitors for the STAR Facility as of 2019.

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	23/24	22/23	21/22	20/21	19/20	18/19	17/18	16/17	15/16	14/15
Pregnant Workers	0	0	1	0	1	1	1	0	0	0
Neutron	2	2	2	2	2	2	2	2	2	2
RGE/ X-ray	32	25	25	25	175	76	251	32	25	37
Dental	35	47	47	51	38	35	41	27	37	28
General	347	340	342	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 2023.

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. Machines must be always locked, except under operator surveillance, to prevent unintentional exposures. 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 ten AUs of RGE with equipment in 76 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	23/24	22/23	21/22	20/21	19/20	18/19	17/18	16/17	15/16	14/15
Diagnostic units Disposed	2	0	0	25	0	0	0	0	2	0
Diagnostic units Purchased	2	0	0	0	0	0	0	0	1	3

The ODH has changed the radiation generating units' classification. As of the 12/2023 inspection, the classification for the photoelectric spectrometers has been changed on the ODH RGE registration as they are considered electron microscopes and can be removed from the registration. Electron Microscopes are no longer regulated by the state of Ohio and do not need to be registered. There were 2 units purchased, 1 removed, and 6 units disposed of in 2023-2024. One X-Ray unit was taken off the ODH list because it is an electron gun which is not regulated anymore. The table below reflects that change.

RADIATION GENERATING EQUIPMENT (IN USE)	23/24	22/23	21/22	20/21	19/20	18/19	17/18	16/17	15/16	14/15
Closed Beam Analytical	5	5	5	5	5	6	6	6	6	6
Dental Computer Tomography (CT)	2	2	2	2	5	5	2	2	2	1
Photoelectron Spectrometer (No longer under ODH)	0	1	1	1	4	0	0	16	16	10
Fluoroscopy	1	1	1	1	2	2	2	2	2	3
Handheld non-medical	1									
Hand-held Dental	8	8	8	8	8	13	4	3	2	3
Hand-held Dental (Inoperable)	6	1	1	1	1	1	0	1	1	0
Intraoral	46	55	55	55	73	72	30	30	28	27
Intraoral (Inoperable)	2									
Panoral (Only)	1	1	1	1	1	1	1	1	1	1
Cabinet System exclude admittance	3	2	2	2	3	3	3	3	3	3
Cabinet System exclude Admittance (In-Op)	2									
Tube Only (Inoperable)	1	11	11	11	9	0	0	9	9	12
TOTAL TUBES	78	87	87	87	112	103	49	71	71	74

RADIOACTIVE MATERIAL RELEASES

SEWER EXPOSURE CONTROL and MONITORING

The Northeastern Ohio Regional Sewer District (NEORS) lifted the requirement for annual report submission; however, 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 2023 was filed by 12/31/2023 and the report for January through June 2024 was filed by 6/30/2024. Twelve 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 2023 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 were no experiments requiring the use of volatile iodine conducted this fiscal year. This program had been inactive since 2021.

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. The Bioassay Program has been inactive since 2021.

RADIOACTIVE IODINE

During 2023-2024, 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. There were no iodination procedures performed this fiscal year. No workers exceeded 10 percent of the ODH limits.

IODINATION PROCEDURES	23/24	22/23	21/22	20/21	19/20	18/19	17/18	16/17	15/16	14/15
Total	0	0	0	0	0	1	0	0	0	0

¹²⁵ I BIOASSAYS	23/24	22/23	21/22	20/21	19/20	18/19	17/18	16/17	15/16	14/15
RSOF Staff	0	0	0	16	16	16	16	16	16	16
Additional	0	0	0	0	0	2	0	0	0	0
Total	0	0	0	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 was one major incident and twenty-two minor incidents documented over the past year.

INCIDENTS	23/24	22/23	21/22	20/21	19/20	18/19	17/18	16/17	15/16	14/15
Major	1	2	0	0	0	0	0	0	0	0
Minor	22	12	15	19	7	11	20	21	22	30
TOTAL	23	14	15	19	7	11	20	21	22	30

DATE	INCIDENT	CONTAMINATION	ROOT CAUSE	FOLLOW UP
6/25/2024	Minor Incident	IRR Panic Alarm	Security requested activation of panic alarm without notifying EHS.	EHS requests advance notice of Police/Security panic alarm evaluations.
6/26/2024	Minor Incident	IRR Alarm	Researcher entered wrong code and alarm went off.	Proper procedures were discussed with the researcher.
5/28/2024	Minor Incident	IRR Monitor Frozen	IRR monitor in Dispatch froze.	The monitor was reset, backed up, and is functioning properly.
5/10/2024	Minor Incident	IRR Alarm	Researcher accidentally set off IRR alarm.	Proper procedures were discussed with the researcher.
4/12/2024	Minor Incident	DOA Door Alarm	Inadvertently Opened the DOA after setting alarm. Awaited Police/Security.	Reminded Dispatch of the importance of notifying EHS about alarms as well as incidents of fire on campus.
4/8/2024	Minor Incident	IRR Inquiry	Researcher inquired about allowing volunteers in the IRR rooms.	Researchers were advised against this. A memo was sent reminding IRR users against allowing unauthorized individuals into the IRR rooms.
3/19/2024	Minor Incident	IRR Monitors Down	IRR monitors down in Dispatch. Security vendor called.	Computer reboot and monitors are working.
3/10/2024	Minor Incident	Fire Panel in DOA Alarm	Fire panel alarm was triggered in DOA 990 but could not find the key to disarm the panel.	Dispatch & Fire Safety were contacted and able to disarm the panel. The key for the panel box was found.
2/29/2024	Minor Incident	IRR Alarm	IRR door left open too long, and alarm did not reset.	System working. New dispatchers attended Dispatcher Training to make them more familiar with procedures and address questions.
2/18/2024	Minor Incident	HVAC Flooding in Millis Ground & 1 st Floors	RAM & X-Ray were not affected.	Most water was in the halls. HVAC equipment on the 1 st floor was repaired.
1/30/2024	Minor Incident	IRR Monitor Down	IRR monitors were shutting down.	IRR monitors were reset and were functioning properly.
1/30/2024	Minor Incident	Missing 22Na Button Source	While conducting source inventory, noted 22Na source was missing	The missing 22Na button source was disposed in 5/2022 yet had not been updated in Onsite. The database was corrected.
1/29/2024	Minor Incident	Laser Hazard Inquiry	Inquiry about use of lasers in the dance studios requirements.	Np tracking or evaluation needed.
1/23/2024	Minor Incident	Shielding Inquiry	Researcher complaint that vendor shipped 32P without lead pig shielding thereby raising exposure levels. The researcher was instructed to use the old lead shipment container before storing the isotope	Reviewed proper procedure with researcher. The copy of the shipment change by Revvity (formerly Perkin Elmer) was reviewed with all RAM researchers.

			in the freezer to decrease exposure levels.	
1/17/2024	Minor Incident	DOA Waste Facility Alarm	DOA Chemical Waste Facility door was left ajar.	All doors were closed and the alarm was reset.
1/8/2024	Minor Incident	Lost Keys/UH ID	EHS Rad Staffer lost RAM waste security key & UH ID.	CWRU Access Services and UH Security notified.
12/11/2023	Minor Incident	RAM in Black waste bag	177Lu woodchuck materials found in black waste bag were not decayed. Should have been in yellow Rad bags and tagged.	Reviewed proper procedure with ARC and researcher. The waste was properly bagged and tagged for decay by EHS for the ARC.
11/20/2023	Minor Incident	IRR Comm Loss	RMS Communication crashed and needed a reset.	Vendor was called to reset the system. Dispatch was instructed on system reset procedures.
10/26/2023	Major Incident	Improper Radioactive Material	Vendor allowed Admin to purchase radioactive material (14C) with a CWRU credit card rather than use PeopleSoft.	14C package was disposed by EHS. A complaint was filed with the vendor and the proper order procedures were reviewed with the Admin staff.
11/7/2023	Minor Incident	IRR Alarm	IRR alarmed while researcher was in the room. The researcher called the IRR Manager to assist. EHS, Police, & Security arrived.	Reviewed the proper procedure with the researcher. Noted prompt response by Police/Security.
10/12/2023	Minor Incident	IRR Meter Alarm	IRR Timer on meter alarmed during an experiment and shut down.	The meter was due for calibration and was replaced with another meter.
8/4/2023	Minor Incident	Door Intrusion Alarm	Forgot to turn off DOA alarm before entering which set off alarm. Immediately called Dispatch and was told to wait for Police & Security to arrive.	Police/Security had difficulty finding the DOA Waste Rooms as several were new to CWRU. EHS provided safety training and a tour of the EHS waste facilities.

EHS WEBSITE & NEWSLETTERS

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 weekly basis.

EHS also produces a bi-monthly general newsletter and a Radiation/Laser Safety newsletter. The EHS newsletter is filled with articles that are designed to keep the campus community abreast of general 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. The Radiation/Laser Safety bi-monthly newsletter was introduced in 2024 and focuses on common radiation concerns and violations that are discovered during routine radiation safety audits. Articles included:

- Troubleshooting Common Radiation Survey Meter Problems
- Training Opportunities available
- Name that Isotope!
- Nonionizing Radiation: Is it dangerous??

LASER SAFETY PROGRAM

As noted by an Occupational Safety and Health Administration (OSHA) director, “OSHA does provide technical guidance regarding protecting employees from ultraviolet light with respect to laser hazards. This guidance is found in the OSHA Technical Manual (TED 1-0.15A, Section III - Chapter 6) on the website link at <https://www.osha.gov/otm/section-3-health-hazards/chapter-6>. The relevant chapter includes information on control measures and safety programs for laser hazards associated with exposure to ultraviolet light.”

There are 259 lasers/laser systems in our database for the campus used by 61 laser PIs in 23 buildings (52 Active, 9 Storage). The lasers of greatest concern are those labeled Class 3B and Class 4. There are 56 class 3B/4 enclosed laser systems that are considered eye-safe (class 1) under normal use that decrease the hazard to the user. Fifty-four audits of laser systems were performed during this fiscal year. There were no laser incidents reported this year.

LASERS	23/24	22/23	21/22	20/21	19/20	18/19	17/18
Active Lasers	52	38	39	42	38	33	29
Storage Lasers	9	5	6	2	4	6	9
Laser PI	61	43	45	44	43	39	38
Laser Bldgs.	23	21	19	16	16	16	16
3B/4 PIs	33	26	26	27	24	25	25
3B/4 Lasers	150	146	146	145	144	133	124
1,2,3R PIs	28	17	19	17	12	14	13
1,2,3R Lasers	109	104	90	91	92	77	76
Enclosed Lasers	56	51	41	36	36	31	29
Total Lasers	259	253	236	243	238	210	216

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. Also, the American Conference of Governmental Industrial Hygienists (ACGIH), a non-governmental organization, has established allowable employee threshold limit recommendations (TLVs) for direct ocular and skin exposures to ultraviolet radiation. The values are published in the annual Threshold Limit Values for Chemical Substances and Physical Agents & Biological Exposure Indices.”

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 564 pieces of equipment and 11 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. As of 2022, the waste is surveyed and subsequently sent to Daniels Intl Facility in Michigan, a transfer and treatment disposal facility for incineration of medical waste. 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 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.

COLLECTION AND DISPOSAL OF ANIMAL REMAINS AND BIOHAZARDOUS WASTE

The RSOF maintains two -20°C freezers (BRB B05A) for storage of radioactive animal remains and waste. One is located at the ARC and the other in Wolstein 1118. Radioactive waste is 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, 2023 - JUNE 30, 2024

	GENERATED 7/1/2023 6/30/2024	DISPOSED: DANIELS INTL FACILITY	DISPOSED: SEWER	DISPOSED: CHEMICAL SAFETY	DISPOSED: Ecology Services	IN STORAGE AS OF 6/30/2024
Short-Lived Dry	2	0	0	0	0	2
Long-Lived Dry	1	0	0	0	1	0
Scintillation Vials	3	0	0	0	3	0
Animals	0	0	0	0	0	0
Long-Lived Sewer	20	0	20	0	0	0
Long-Lived Non-Sewer	0	0	0	0	0	0
Short-Lived Sewer	0	0	0	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 7/1/2023, kept for decay in storage and disposed during the period of 7/1/2023-6/30/2024. 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 Daniels Intl Facility is \$25 per container (average of 2 containers per 55-gallon drum). There were 2 drums of decay-in-storage dry waste surveyed and disposed of during 2023-2024. Thus, the indirect savings to researchers due to the decay in storage program was \$940.

WASTE GENERATION	23/24	22/23	21/22	20/21	19/20	18/19	17/18	16/17	15/16	14/15
Short-Lived Dry	2	1	3	5	4	6	18	9	11	10
Long-Lived Dry	1	2	2	2	6	8	6	5	9	6
Scintillation Vials	3	4	2	2	6	6	6	12	9	10
Animals	0	0	0	0	0	0	0	1	0.25	1
Long-Lived Sewer	20	22	20	35	25	35	28	30	23.75	25
Long-Lived Non-Sewer	0	0	0	0	1	5	2	2	2	2
Short-Lived Sewer	0	0	5	10	20	30	25	21	18	20
Short-Lived Non-Sewer	0	0	0	0	1	1	2	0	4	5

The contract for radioactive waste disposal has been extended to 6/2025 with Ecology Services. This contract provides for disposal of all long-lived dry materials, scintillation vials and animal wastes.

RECYCLING PROGRAM

The RSOF occasionally obtains laboratory equipment in very good condition from AUs who have either left the University or ceased to use RAM. The equipment includes radioactive waste containers (lead and Lucite), shielding (lead and Lucite) and survey meters. This equipment is offered to the AUs 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 2023-2024.

E-WASTE PROGRAM

As CWRU researchers depart the campus, relocate within the campus, or discard equipment, EHS steps in to assist with removal of old, unused, or broken equipment, thus providing more space in the areas. CWRU utilizes the RET3 Job Corp., a nonprofit organization dedicated to refurbishing and recycling electronic equipment to donate to the community. The Green Computing Program provides refurbished computers to schools and non-profits in Northeast Ohio.

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 2023 and between March and June 2024. This effort resulted in the review of more than 170 files in the program areas listed above.

RSC TRI-ANNUAL AUDITS FOR 2023-2024

RSC AUDIT COMMENT:

In October 2023, the RSC members conducted a trimester audit of the following components of the RSOF:

Active/Decommissioning Room Surveys
AU/Worker Training
Dosimetry Program
Incident Reports

Irradiator User Training/Irradiators
Laser Program
Licensing Status
Radiation Generating Equipment (RGE) Inventory & Training
Security checks
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.

Active/Decommissioning Room Surveys

An audit was performed on October 30th, 2023 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. Colleen Croniger examined 10 files and found no deficiencies. Dr. Croniger also noted one newly decommissioned room, BRB1013.

RSOF RESPONSE:

No response required.

AU/Worker Training

Authorized users and worker training files were audited for up-to-date training on radiation safety procedures on October 31st, 2023. Dr. Valadkhan reported ten workers that were over 60 days past training. The Radiation Safety Office was notified of these deficiencies.

RSOF RESPONSE:

The 10 workers were notified, and the files were updated.

Dosimetry Program

An audit of Current Dose records held by the RSOF was performed on October 27th, 2023 to verify that AU laboratory workers were current in dose record and active radiation badges. Dr. Thomas Gerken audited ten (10) records and reported 9 users that failed to pick up a badge, and one (1) worker that failed to pick up a ring dosimeter. In addition, one worker's file was missing from the records. These workers were notified and the RSOF was notified.

RSOF RESPONSE:

The 10 workers were notified, and the badges were collected.

Incident Reports

A review of monthly incident reports was performed by Dr. Thomas McCormick on October 18th, 2023 for verification and documentation of follow-up by the RSOF. During this period two incidents were reported, both alarm activations. The RSOF followed up on these alarms and the incidents were addressed.

RSOF RESPONSE:

No response required.

Irradiator User Training/Irradiators

An audit of the Irradiator Information Files was performed by Dr. Valadkhan on October 31st, 2023 to verify that the irradiators were audited by the RSOF in the last quarter. The logbook for each irradiator was used to match users for each irradiator. Two Irradiators were active on campus and Dr. Valadkhan reported on non-authorized users in the logbook. The RSOF was informed of this individual's identification and follow up was performed.

RSOF RESPONSE:

The unauthorized user was removed from the list, no longer works at CWRU, and has no access.

Laser Program

The Laser program was audited by Dr. Zhenghong Lee for accuracy regarding laser inspections, inventory and status of personnel training on October 30th, 2023. Ten (10) files were audited. Two (2) deficiencies in inspection was noted and the RSOF was notified of the responsible PI to contact for follow up on worker training.

RSOF RESPONSE:

The workers were notified to update training.

Licensing Status

An audit was conducted to verify the licensing status of all ODH licenses and registrations on October 30th, 2023 by Dr. Colleen Croniger. Components of the audit include: Broadscope license and Radiation Generator License (RGE). Dr. Croniger 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

Inventory status and equipment surveys were examined by Dr. Suhrim Fisher on November 14th, 2023 who examined 10 files for RGE status, including authorized possessors (APs), and persons responsible for RGE. Dr. Fisher noted three (3) semiannual inventories that were past due. The RSOF was informed of these deficiencies.

RSOF RESPONSE:

The three Authorized Possessor were notified to submit the semiannual inventories and one unite was decommissioned.

Security checks

Verification and documentation of radioisotope security checks were performed on October 26th, 2023. Dr. Fisher reports no security checks during this period.

RSOF RESPONSE:

No response required.

Survey Meters

Compliant calibration of survey meters was audited on October 18th, 2023. Ten (10) files were examined by Dr. McCormick who noted that all meters surveyed had calibration dates that matched the calibration date in the database. No meters were past due or not in the inventory.

RSOF RESPONSE:

No response required.

Valid Ram Applications

RAM applications were audited on October 18th, 2023 to verify that the applications were complete and valid. Dr. Thomas Gerken audited ten (10) files and reported six (6) deficiencies. Dr. Gerken noted several classes of deficiencies including meter recalibrations, incorrect possession limits and missing RAM applications for some nuclides. The RSOF office was notified of these deficiencies for follow up.

RSOF RESPONSE:

The six AU files were notified and the deficiencies were corrected.

Waste Disposal Facilities

The waste disposal facilities (DOA990/Wolstein1118, 1119) and RSOF Laboratory were inspected to ensure safe operation and maintenance as required by RSOF on October 30th,

2023. 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 January/February 2024, the RSC members conducted a tri-annual audit of the following components of the RSOF:

- Active/Decommissioning Room Surveys
- Compliance
- Direct Package Pickup
- EHS Webpage
- Dosimetry Program
- 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 30th, 2024 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. Saba Valadkhan examined 20 files and reported 6 deficiencies where the data on file differed from the system. These discrepancies were reported to the RSOF.

RSOF RESPONSE:

The six deficiencies of data were corrected in the database.

Compliance

Compliance review audits were reviewed on January 10th, 2024 to ensure that any non-compliance issues were appropriately resolved. Upon examination of 10 files, Dr. Colleen Croniger noted no deficiencies. Dr. Croniger noted that in 4 instances the printed list and computer records differed. The RSOF was notified of these discrepancies.

RSOF RESPONSE:

No response required.

Direct Package Pickup

An audit was performed on January 30th, 2024 to verify that package receipts were completed with each transfer of material from site to site. Dr. Valadkhan noted no deficiencies regarding receiving dates.

RSOF RESPONSE:

No response required.

Dosimetry Program

An audit of Current Dose records held by the RSOF was performed on January 10th, 2024 to verify that AU laboratory workers were current in dose record and active radiation badges. Dr. Suhrim Fisher audited 10 records and reported 10 badges that had not been picked up. The RSOF was informed of these users.

RSOF RESPONSE:

The ten workers were notified and their badges were collected.

Incident Reports

A review of monthly incident reports was performed by Dr. Thomas Gerken on January 9th, 2024 for verification and documentation of follow-up by the RSOF. During this period one incident was reported, an alarm activation. The RSOF followed up on these alarms and the incidents were addressed.

RSOF RESPONSE:

No response required.

Isotope Possession Limits

Dr. Thomas McCormick audited 10 PI files on January 26th, 2024 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 Helix Database. Dr. McCormick noted that no isotope orders exceeded the PI possession limit. He also noted that a PI # was missing from one file folder. The RSOF was notified of this discrepancy.

RSOF RESPONSE:

A label was created for one file.

Licensing Status

An audit was conducted to verify the licensing status of all ODH licenses and registrations on January 29th, 2024 by Dr. Zhenghong Lee. Components of the audit include: Broadscope license and Radiation Generator License (RGE). Dr. Lee 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 29th, 2024. Ten (10) files were examined by Dr. Lee who reported no deficiencies.

RSOF RESPONSE:

No response required.

Security checks

Verification and documentation of radioisotope security checks were performed on January 10th, 2024. Dr. Croniger reports 3 security check issues regarding signage on 3 PI rooms during this period. The RSOF was notified of the needed signs.

RSOF RESPONSE:

The three PIs submitted and received revised lab sign.

Semi-Annual Mailings (Air/Sewer Inventory)

An annual audit of the air/sewer disposal inventory was performed on December 31st, 2023. Ten (10) files were reviewed by Dr. Gerken who noted 4 deficiencies in files not updated by the responsible PI. The RSOF was informed of these deficiencies.

RSOF RESPONSE:

The four AUs were notified to submit inventories and the database was updated.

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 January 10th, 2024. Dr. Fisher examined

10 files and reported 10 deficiencies in past due training for ancillary staff. The RSOF was notified of these deficiencies for follow up.

RSOF RESPONSE:

The ten support staff workers were contacted, and the database was updated.

Waste Disposal Facilities

The waste disposal facilities (DOA990/Wolstein1118, 1119) and RSOF Laboratory were inspected to ensure safe operation and maintenance as required by RSOF on January 26th, 2024. Dr. McCormick 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 2024, 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
Dosimetry Program
EHS Website
Incident Reports
Irradiator Information Review
Laser Program
Licensing Status
RGE inventory and training
Security Checks
Support Staff Training
Survey Meters
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 May 3rd, 2024. Dr. Thomas McCormick reported seven workers that were between 30-60 days past training. He also noted that two files were either mislabeled or missing. RSOF was notified of the findings.

RSOF RESPONSE:

The seven workers were contacted and the training was updated in the database.

Dosimetry Program

An audit of Current Dose records held by the RSOF was performed on April 15th, 2024 to verify that AU laboratory workers were current in dose record and active radiation badges. Dr. Zhenghong Lee audited 10 records and reported 9 deficiencies where badges were not picked up. The RSOF was notified of the results.

RSOF RESPONSE:

The nine workers were promptly notified and came to collect their badge.

EHS Website

The website for the RSOF was audited to ensure proper operation, access and current links were operational on April 13th, 2024. Dr. Saba Valadkhan 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. Saba Valadkhan on April 30th, 2024 for verification and documentation of follow-up by the RSOF. During this period there were no incidents reported. No deficiencies were reported by Dr. Valadkhan.

RSOF RESPONSE:

No response required.

Irradiator Information Review

An audit of the Irradiator Information Files was performed by Dr. Colleen Croniger to verify that the irradiators were audited by the RSOF within the past six months. The audit was performed on April 16th, 2024. Two Irradiators were active on campus and each file was up-to-date and compliant, Dr. Croniger noted one individual that was overdue for user training. The RSOF was notified of this individual.

RSOF RESPONSE:

The one worker was notified and the training was updated.

Laser Program

The Laser program was audited by Dr. Thomas Gerken for accuracy regarding laser inspections, inventory and status of personnel training on April 25th, 2024. Dr. Gerken noted 2 deficiencies, both concerning out-of-date training. The Laser Training Program was notified of these results.

RSOF RESPONSE:

The two laser PIs were contacted concerning worker training, which must be updated every two years instead of annually.

Licensing Status

An audit was conducted to verify the licensing status of all ODH licenses and registrations on April 17th, 2024. Components of the audit include: Broadscope license, RGE license, and RSC guidelines. Dr. Thomas Gerken reviewed all license programs and noted that all licenses were current (no deficiencies), Dr. Gerken further noted that the Radiation Safety Committee Guidelines needed to be updated. The RSOF was informed of the findings.

RSOF RESPONSE:

The RSC Guidelines were updated and approved.

Radiation Generating equipment (RGE) inventory and training

Quarterly inventory status and equipment surveys were examined by Dr. Suhrim Fisher who examined 8 files on April 17th, 2024. Dr. Fisher noted two deficiencies, both concerning multiple personnel listed without proper training dates. The RSOF was notified of the deficiencies.

RSOF RESPONSE:

The two x-ray workers were notified and the training was updated.

Security checks

Verification and documentation of radioisotope security checks were performed on April 16th, 2024. Dr. Colleen Croniger 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 17th, 2024. Dr. Fisher examined the files and reported 18 deficiencies in past due training for ancillary staff. The RSOF was notified of these deficiencies for follow up.

RSOF RESPONSE:

The eighteen Support Staff workers were notified and their training was updated.

Survey Meters

Compliant calibration of survey meters was audited on April 30th, 2024. Ten (10) files were examined by Dr. Valadkhan who noted no meters whose calibration date was past due.

RSOF RESPONSE:

No response required.

Valid Ram Applications

RAM applications were audited on May 5th, 2024 to verify that the applications were complete and valid. Dr. Thomas McCormick audited ten (10) files and reported no deficiencies.

RSOF RESPONSE:

No response required.

Waste Disposal Facilities

The waste disposal facilities (DOA990/Wolstein1118, 1119) and RSOF Laboratory were inspected to ensure safe operation and maintenance as required by RSOF on April 15th, 2024. Dr. Zhenghong 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.

Overall, this tri-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 expedites 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 in June 2024. The committee reviewed the performance of 20 components of the RSOF. Please note that surveys for October, January/February, April, and the annual audit were performed as scheduled in person on campus. The RSC members are to be commended for their participation and response to the duties of the committee. The areas audited were:

- Ancillary Staff Training
- AU and Worker Training
- Bioassays (Inactive)
- 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 on June 13th, 2024 to verify the training status of Ancillary users and worker training files for a period from July 1st, 2023-June 30th, 2024. 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. Thomas Gerken examined fifty (50) files and noted 50 individuals were overdue for training. The RSOF office contacted those individuals overdue for training.

RSOF RESPONSE:

Fifty workers were notified via email and phone calls to determine if they were still at CWRU. Those that had left were archived in the database, while the others did retrain.

AU and Worker Training

An annual audit was conducted on May 30th, 2024 to verify the training status of Authorized users and worker training files for a period from July 1st, 2023 - June 30th, 2024. Dr. Colleen Croniger reported forty-two (42) workers were overdue. The RSOF was notified of the overdue training and performed follow-up contact.

RSOF RESPONSE:

The forty-two workers were notified via email and phone calls to determine if they were still at CWRU. Those that had left were archived in the database, while the others did retrain.

Bioassays

This program is currently inactive since 7/2021 as there have been use of >10mCi of ³H and/or 1mCi ¹²⁵I in the laboratories.

RSOF RESPONSE:

No response required.

Compliance

Compliance review audits were reviewed for the period July 1st, 2023-June 30th, 2024 on June 13th, 2024 to ensure that any non-compliance issues were appropriately resolved. Upon examination of 50 files, Dr. Gerken noted Six (6) files that needed to be reviewed/updated. The RSOF was informed of these missing files.

RSOF RESPONSE:

The six compliance reviews were processed, and the database was updated.

Direct Package Pickup

An audit was performed on June 17, 2024 to cover the period of July 1st, 2023 - June 30th, 2024 to verify that package receipts were completed with each transfer of material from site to site. Dr. Zhenghong Lee noted 5 files with deficiencies regarding receiving dates. The RSOF was informed of these likely typos in the records.

RSOF RESPONSE:

The five package receipts were corrected and entered in the database.

Dosimetry Program

An audit of Current Dose records held by the RSOF was performed on June 14th, 2024 to verify that AU laboratory workers were current in dose record and active radiation badges for the period July 1st, 2023-June 30th, 2024. Dr. Suhrim Fisher audited 50 records and reported 3 missing files. The RSOF was informed of these deficiencies.

RSOF RESPONSE:

The three missing dosimetry files were new workers, and a file was made for each.

EHS Webpage

The website for the RSOF was audited on June 26th, 2024 to ensure proper operation, access and current links were operational for the period July 1st, 2023-June 30th, 2024. Dr. McCormick reports all links within the Radiation Website were operational.

RSOF RESPONSE:

No response required.

Incident Reports

A review of yearly incident reports for the period July 1st, 2023-June 30th, 2024 was performed by Dr. Saba Valadkhan on June 26th, 2024 for verification and documentation of follow-up by the RSOF. During this period there were 22 incidents reported. Dr. Valadkhan reports that all incidents were resolved satisfactorily.

RSOF RESPONSE:

No response required.

Irradiator Information Review

An audit of the Irradiator Information Files was performed by Dr. McCormick on June 26th, 2024 to verify that the irradiators were audited by the RSOF from July 1st 2023-June 30th, 2024. Two 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 Database

Dr. Fisher audited eighteen (15) PI files on June 24th, 2024 to verify that the amount of radioactive material (RAM) ordered was within the possession limits of the AU and that all orders placed were in the Onsite Database covering the period July 1st, 2023-June 30th, 2024.

Dr. Fisher noted that no isotope orders exceeded the PI possession limit. She also noted some discrepancies between the paper total inventory versus the database report of on-hand amount of isotope. The RSOE was notified of this discrepancy.

RSOE RESPONSE:

The discrepancies between the total inventory versus the on-hand amount reflect the decay of isotope.

Laser Program

The Laser program was audited by Dr. Colleen Croniger for accuracy regarding laser inspections, inventory and status of personnel training on May 30th, 2024 for the period July 1st, 2023-June 30th, 2024. Dr. Croniger audited 50 folders, any deficiencies were noted and the RSOE was notified of the responsible PI to contact.

RSOE RESPONSE:

The nine laser inspections noted as past due were completed within the month and filed promptly. Notifications were also sent to workers for training and the database was updated.

Licensing Status

An audit was conducted on June 26th, 2024 to verify the licensing status of all ODH licenses and registrations during the period July 1st 2023-June 30th, 2024. Components of the audit include: Broadscope license, RGE license, Waste license, Radiation Manual, X-ray Manual, Laser Manual, Radiation Training, X-Ray Training, Radiation Online Training, UV online training and RSC guidelines were reviewed by Dr. McCormick. He reported that the Laser Manual was due for updating, and that the UV online training was no longer applicable. The RSOE was notified of these findings.

RSOE RESPONSE:

The Radiation Safety Manual, X-Ray Safety Manual, and the Laser Manual were reviewed, revised, and added to the EHS Radiation Webpage.

Radiation generating equipment (RGE) inventory and training

Quarterly inventory status and equipment surveys were examined by Dr. Zhenghong Lee on June 13th, 2024 who examined 50 files for the period July 1st, 2023- June 30th, 2024. Dr. Lee noted four individuals who were either overdue for training or required initial training. The RSOE was informed of the individuals in need of training.

RSOE RESPONSE:

The four laser workers were notified and the database was updated.

Room Surveys

An audit was performed on June 26th, 2024 to validate active RAM use files and Decommissioned room files for the period July 1st 2023-June 30th, 2024 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 fifty (50) files and noted 2 rooms that had out of date decommission postings. The RSOF was informed of the location of these rooms.

RSOF RESPONSE:

The two room folders were updated to reflect the date of decommissioning.

RAM Security Checks

Radioisotope security checks Verification and documentation of radioisotope security checks were performed on June 26th, 2024 for the period July 1st, 2023-June 30th, 2024. Dr. McCormick audited the security checks and noted that three rooms were in need of updated radiation safety signs. The RSOF was informed of the location for the signs.

RSOF RESPONSE:

The three AUs were notified to submit laboratory sign requests and the signs were posted.

Sealed Source Leak Tests

Files verifying that sealed sources had been leak tested were audited on June 24th, 2024 by Dr. Suhrim Fisher for the period of July 1st, 2023-June 30th, 2024. Thirteen PI files were examined by Dr. Fisher who reported two deficiencies regarding inventory surveys that were needed, or out of date in the database. The RSOF was notified of these deficiencies.

RSOF RESPONSE:

The two overdue sealed sources were inventoried and/or leak-tested and the database was updated.

Semi-Annual Mailings (Air/Sewer Inventory)

An annual audit of the air/sewer disposal inventory was performed on June 13th, 2024 for the period July 1st, 2023 - June 30th, 2024. All files were reviewed by Dr. Gerken who noted 3 deficiencies in Active PIs, as well as missing files for one investigator. The RSOF was informed of these deficiencies.

RSOF RESPONSE:

The three AUs with notified to submit their semi-annual mailing and the database was updated. One file was made for the new AU.

Survey Meters

Compliant calibration of survey meters was audited on June 13th, 2024 for the period July 1st 2023-June 30th, 2024. Fifty (50) files were examined by Dr. Lee who noted six (6) meters with missing calibration data, or overdue calibration dates. The RSOF was informed of the status of these meters.

RSOF RESPONSE:

Of the six overdue meters, one were inactive, and seven were sent notifications and the database was updated to reflect current status.

Valid Ram Applications

RAM applications were audited on June 26th, 2024 for the period July 1st 2023 - June 30th, 2024 to verify that the applications were complete and valid. Dr. Valadkhan audited thirty (30) files and reported two (2) deficiencies. The RSOF was informed of these deficiencies.

RSOF RESPONSE:

Of the two RAM applications, one was active and in the process of renewal and one was inactive.

Waste Disposal Facilities

The waste disposal facilities (DOA990/Wolstein 1118, 1119) and RSOF Laboratory were inspected on May 30th, 2024 to ensure safe operation and maintenance as required by RSOF for the period July 1st 2023-June 30th, 2024. Dr. Colleen Croniger 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	RAM Security Checks	Bioassays
Shipping Papers	Semi-Annual Mailings	Dosimetry
Valid RAM Applications	RGE Inventory/ Training	Survey Meters
Isotope Orders/ AU Possession Limits	Ancillary Training	Compliances
AU/ Worker Training	Licensing	EHS Radiation Webpage
Waste Disposal Facility	Incidents	Laser Program
Active/Decommissioned Room Surveys	Irradiator	

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 10/11/2024. It covers fiscal years 7/1/2023-6/30/2024.

APPENDIX

AUTHORIZED USERS WITH STATUS CHANGE DURING FISCAL 2023-2024

RADIATION ACTIVE

Parameswaran Ramakrishnan (12/18/2023) Alan Diehl (1/17/2024)

STORAGE MODE

None

RADIATION INACTIVE

David Danielpour (9/29/2023) Piet DeBoer (3/8/2024)

DEPARTED

None

X-RAY AUTHORIZED POSSESSOR LIST

<u>AP NAME</u>	<u>CONTACT PERSON</u>	<u>UNITS</u>
Corbin Covault	Andrew Lininger	1
Syed Ali	Susan Opsitnick	61
Harihara Baskaran	Evan Guarr	1
Zhenghong Lee	Chris Flask	3
Suparna Mahalaha	Aeysha Kisner	4
Jeffrey Pigott	Jeffrey Pigott	3
Anna Samia	Anna Samia	1
Steve Schomisch	Steve Schomisch	1
Andrew Shoffstall	Andrew Shoffstall	1
Lei Zhu	Lei Zhu	2

LASER USERS

Ozan Akkus (1)	Eric Baer (3)	Harihara Baskaran (2)	James Basillon (2)
Jesse Berezovsky (14)	Walter Boron (2)	Clemens Burda (3)	Sudha Chakrapani (1)
Brian Cobb (1)	Carlos Crespo (6)	Amar Desai (1)	Alan Diehl (2)
Mohammed Draz (1)	Diana Driscoll (16)	Dominique Durand (2)	Steven Eppell (10)
Robert Gao (3)	Jeffrey Garvin (1)	Stanton Gerson (1)	Alex Huang (2)
Hatsuo Ishida (5)	Michael Jenkins (15)	Jonathan Karn (1)	Kathleen Kash (17)
Chirag Kharangate (8)	Lydia Kisley (10)	Michael Martens (14)	Thomas McCormick (1)
Claudia Mizutani (2)	Michael Moffitt (3)	Svetlana Morozova (8)	Patrick Osei-Owusu (1)
Andre Paes (2)	Paul Park (1)	Valentin Rodionov (1)	Andrew Rollins (8)
Britton Sauerbrei (1)	Daniel Scherson (17)	Bryan Schmidt (6)	Alp Sehrioglu (6)
Andrew Shoffstall (2)	Scott Sieg (3)	Daniel Simon (1)	Jonathan Stamler (1)
Giuseppe Strangi (13)	Carlos Subauste (1)	David Wald (1)	Gary Wnek (2)
Gabriella Wolff (1)	Lei Zhu (1)	Peter Zimmerman (1)	Christian Zorman (5)
Roger French (Storage) (3)	Heidi Martin (Storage) (1)	Ben Strowbridge (Storage) (1)	RSOF (Storage) (7)
Michael Martens (Inactive)			
Brian Grimberg (Departed)	James McGuffin Cawley (Departed)	Kenneth D. Singer (Departed)	

EHS Organizational Chart 2023-2024

