Reed College Chemistry Lab Safety Manual

July 2025

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0.1 Preface

This manual serves as a resource document for the department of Chemistry in compliance with Reed College Environmental Health and Safety, accreditation boards, and various state and federal organizations (Environmental, Occupational Health, and Safety). Laboratories must develop written manuals which include specialized safety procedures, respective to discipline, for all facets of laboratory activities.

Emergency Information

Fire, Ambulance/Rescue, Police.....911

Community Safety.....503-788-6666

Poison Control Center (OHSU).....800-222-1222

Reed Health and Counseling Services (M-F 9 am - 5 pm).....503-777-7281

Reed Environmental Health and Safety 503-777-7788

Providence Hospital Emergency Room.....503-215-6000

Reed Physical Plant Maintenance.....503-777-7283

Reed Public Affairs.....503-777-7289

Radiation Safety Officer.....503-777-7788

Chemical Hygiene Officer.....503-777-7788

Please note the location of your nearest:

Fire Alarm Pull Station: _____

Fire Extinguishers: (1) _____

(2) _____

Emergency Shower/Eyewash: _____

First Aid Kit: _____

Spill Kit: _____

Automated External Defibrillator: _____

Outside Assembly Point Location: _____

Shelter-in-Place Location: _____

SDS Location: https://www.reed.edu/ehs/

1.0 Chemistry Safety Manual

- This manual provides general guidelines and basic rules within the chemistry department to:
    - encourage awareness of the risks in doing laboratory procedures
    - promote safe and best practices in the laboratory
    - protect the wellness and health of students, instructors, and laboratory personnel
- Additional references include:
    - Reed College Department of Environmental Health and Safety https://www.reed.edu/ehs/

1.1 Emergency Response

This section describes the actions needed to be undertaken in an emergency situation. For information about specific hazards (e.g., lasers, explosives) refer to a corresponding subsection of chapter two (2) of the safety manual.

- **IF YOU HEAR AN EVACUATION ALARM, EVACUATE THE BUILDING IMMEDIATELY.**
- **NOTIFY A CHEMISTRY FACULTY MEMBER IF POSSIBLE.**
- **FOLLOW DIRECTIONS GIVEN BY YOUR INSTRUCTOR, SUPERVISOR, MANAGER AND/OR EMERGENCY OFFICER.**
- **ACT AS DESCRIBED IN THE FOLLOWING PROCEDURES.**

1.1.1 Medical Emergencies

- **Notify the Reed community safety office (CSO) at 503-788-6666; ext. 6666;** inform them of the incident and follow any instructions given by the CSO.
- **Contact 911** if so instructed. The dispatch operator will ask you whether you need fire, police, or ambulance, and the location of the emergency. Respond "ambulance," and the location as "Reed College chemistry department, which is located at the back of the east parking lot across the street from 3626 SE Woodstock Blvd."
- **For chemical burns,** immediately remove any affected clothing and flush the affected area with water for 15 minutes.
    a. If eyes are affected, use the eyewash station. Hold eyes open and rotate the eyeballs to clear the material from all the areas.
    b. For skin contact, use the emergency shower station.
- **For minor accidents,** injured students should report to HCC. Faculty and staff should report to the Kaiser Permanente or other specified medical care facilities.
- **Consult Section 1.3 Accident Report.**

1.1.2 Fire

- **Do NOT attempt to fight an uncontained fire.** The person discovering a fire shall go to the nearest pull alarm (small red boxes on the walls) and pull it to alert the building occupants of fire.
- **Evacuate IMMEDIATELY via the nearest designated emergency exit.** Loud buzzer-like noise is a sign to evacuate.
- **Proceed to the nearest designated assembly area location.** For the Chemistry building it is the East Parking Lot.
- **ONLY if the fire is small and contained**, should you attempt to fight it.
    a. If you are trained to use the fire extinguisher, you can use it to put up the fire.
    b. If the fire is small enough, you could attempt to put it down by cutting the oxygen supply (e.g., putting a watch glass on top of an Erlenmeyer flask will cut off the oxygen supply to a fire inside the flask.)

1.1.3 Chemical Spills

- **Avoid skin contact and isolate the area.** If skin contact occurs, refer to section 1.1.1 Medical Emergencies.
- **Contact the lab supervisor for assistance.**
- **If the spill is larger than 1 liter or is highly hazardous** (high toxicity, flammability and/or volatility), call Community Safety (503-788-6666) and EHS (503-777-7788).
- **If spill is small**, does not produce harmful gas or vapors, and can be safely cleaned
    a. Surround or cover spill with the absorbent material. **DO NOT COVER OXIDIZER WITH THE ORGANIC MATERIALS.**
    b. Neutralize the spill if possible. Use baking soda for acids and boric acid/vinegar for bases.
    c. Place spill debris in a bag, label with “Hazardous Waste” label, and transport it to room Chem 211.

1.2 Personal Protective Equipment

- Wear safety glasses or goggles whenever working in a laboratory. Consult SDSs for recommended protective equipment for the chemicals you are working with. Contact lenses or eyeglasses may be worn in combination with eye protection (goggles). If your eyeglasses do not fit under eye protection, talk to your lab supervisor about obtaining prescription eye protection before working in the laboratory.
- Protective clothing (lab coat or apron) is required whenever working with hazardous chemicals, heated substances, or biological agents.
- Certain experiments may require increased eye and face protection due to the possibility of impact. Safety glasses and face shields should meet ANSI Z87.1v-2020 standards. Consult with lab supervisors about appropriate PPE.
- Tie back long hair when working with hazardous materials or other lab equipment.

- Remove or tie back any loose articles of clothing or jewelry including scarves & bulky shirts or jackets. Shirts should have tight-fitting long sleeves and pants/slacks with socks that cover your ankles. Short skirts are not appropriate — add tights underneath for full protection. Bare midriffs and low-cut necklines are not safe in the lab and will not be allowed.
- Gloves are required whenever there is the potential for contact with hazardous materials, and should never be reused. Do not attempt to wash disposable gloves. Change them when they are dirty, contaminated or ripped. Dispose of properly. The following lists the most common types of protective work gloves and the types of hazards they can guard against:
    - Chemical Resistant Gloves – protect hands from corrosives, oils, and solvents; made from rubber, neoprene, polyvinyl alcohol, vinyl, or nitrile – the most common type found on campus.
    - Disposable Gloves – guard against mild irritants; usually made of lightweight plastic.
    - Fabric Gloves – generally used to improve grip when handling slippery objects and may help insulate hands from mild heat or cold; made of cotton or fabric blends.
    - Leather Gloves – protect against injuries from sparks, heat, cold, scraping against rough surfaces; use in combination with an insulated liner when working with electricity.
    - Metal Mesh Gloves –protect hands from accidental cuts and scratches while working with cutting tools or other sharp instruments.
    - Aluminized Gloves – insulate hands from intense heat when working molten materials.
- Shoes must have closed toes and closed backs. Do not wear sandals or open toed shoes in the laboratory. “Crocs” are not considered closed toed shoes.

1.3 Accident Report

- Report all accidents, spills or broken glassware & equipment, no matter how minor, to your instructor immediately.
- Complete and submit the appropriate incident report form for each incident that occurs during lab time.
    - The form can be found online on the EHS website at https://www.reed.edu/ehs/assets/downloads/safety-information-forms/Accident-Report-Form.pdf

1.4 General Rules and Standard Laboratory Practices

- Conduct yourself in a responsible manner at all times in the laboratory. Never leave your lab activity unattended.

- All doors must be closed when lab begins.
- Be sure you understand all procedures in any lab investigation and possible hazards associated with it.
- **Do not work alone** in the laboratory when conducting hazardous procedures. **Always have at least two people present** when using a highly toxic chemical or one of unknown toxicity.
- Read ALL directions for an investigation several times, and follow directions EXACTLY as they are written. Ask questions if you are not sure how to proceed.
- All work that involves organic compounds, toxic materials, or malodorous compounds should be carried out in the fume hood. If the fume hood is not working properly, report to your instructor/supervisor.
- Never perform unauthorized experiments.
- Never handle equipment unless you have specific permission.
- No eating, drinking, smoking, applying make-up, and no mouth pipetting.
- Notify your instructor of any medical conditions you may have, such as pregnancy, allergies, asthma, or epilepsy. It is recommended that you discuss your condition with your family physician for guidance and monitoring. Be sure your instructor has your emergency contact information.
- Keep your laboratory area clean. Store bags, packs & purses in appropriate places and off the lab tables. Do not handle electronic devices, phones or keys while working in the lab without the permission of your instructor or lab supervisor.
- Return all glassware, chemicals, and apparatus to appropriate locations. For ongoing operations left unattended for several hours or overnight, write instructions that include:
    - Contents and hazards.
    - Name of responsible party.
    - Procedures for contacting the responsible party should a mishap occur.
    - Provisions to contain any solid or liquid chemical released in the event of breakage.
- Be sure to clean your area thoroughly 5-10 minutes before the end of the class and keep the lab space clean for the next class period. Wipe down the counters, put away all equipment in clean, cool & dry condition. Wash your hands before leaving the lab area.
- The location of exits, safety showers, eye wash, fire extinguishers and the nearest telephone (emergency) should be ascertained before beginning work.

1.5 Hazardous Waste & Waste Disposal

- NEVER put anything down the sink unless instructed to do so.
- All waste should be disposed of into a designated waste container. Ask your instructor/supervisor how to dispose of a chemical if uncertain.

- Close waste containers unless actively filling or venting to relieve pressure.
- All broken glassware, including disposable pipettes, should go into a glass disposal box.
- Evaporation, neutralization, or dilution for the purpose of hazardous waste treatment or disposal is prohibited.
- Label waste containers as you fill them. Include all the information asked for in the label. Chemical waste labels can be found on the EHS website: https://www.reed.edu/ehs/assets/downloads/safety-information-forms/labels/chemical-waste-labels.pdf
- Incompatible wastes should be separated from one another. Do not collect incompatible waste in the same container.
- When containers are full or the waste generating process is completed, date the waste label and bring the containers to Chemistry 211. Transport waste using secondary containment.

2.0 Specific Hazards

This section describes precautions and procedures needed to be undertaken while working with chemicals or equipment that could pose danger to the health and well-being of an individual. Information regarding hazards not discussed below, including allergens, embryotoxins, and suspected carcinogens may be found in the Reed College Chemical Hygiene Plan.

2.1 Lasers

- Keep the protective cover on the laser head at all times.
- Avoid looking at the output beam. Even diffuse reflections are hazardous.
- Avoid wearing reflective jewelry while using the laser
- Use protective eyewear at all times. Selection of it depends on the wavelength and intensity of radiation. For UV light, basic plastic safety goggles are sufficient.
- Expand the beam wherever possible to reduce beam intensity.
- Avoid blocking the output beam or its reflection with any part of the body
- Maintain a high ambient light level in the laser operation area so the pupils of the eyes remain constricted, reducing the possibility of damage.
- Set up experiments so the laser beam is either above or below eye level.
- Provide enclosures for beam paths whenever possible.
- Set up shields to prevent unnecessary specular reflections.
- Set up an energy-absorbing target to capture the laser beam, preventing unnecessary reflections or scattering.
- For more information see Reed College Laser Safety Manual

2.2 Explosives and Flammables

- Flammables:

    - Before pouring any volatile liquid (b.p. less than 150 °C), inspect the bench area for flames or for hot plates turned on. If there are any, turn them off.
    - Before opening any system containing hot organic vapors, turn off the hot plate that has supplied the heat.
    - Do not use Bunsen burners, except in unusual circumstances. Utilize steam baths, silicone oil baths for use on hot plates, and heating mantles as heating sources instead.
- Explosives:
    - Following are some example compounds considered of high risk of detonation: azo compounds, diazonium salts, azides, triazenes, and terazenes, diazomethane, peroxides, hydroperoxides, peracids, diacyl, diaryl peroxides, fulminates, heavy metal salts of acetylene, and organic esters of nitric, chromic perchloric and permanganic acids.
    - While working with compounds listed above and others not listed, use a dilute aqueous solution to prevent a danger of detonation anticipating the use of a mixture of organic materials with any of these acids

2.3 Gas Tanks

- Securely fasten all gas tanks, functioning at floor level, in position with a strap and a device anchored to the edge of the bench.
- Refer to the manufacturer's catalog to determine the appropriate type of regulator for a particular gas tank.
- Never try to fit a regulator to a tank without first checking with your instructor or with the stockroom manager.
- Never use any lubricant on a high-pressure oxygen regulator; it will explode.
- Always use a well-ventilated hood if your gas tank contains toxic or corrosive gasses.

2.4 Radiation

- Any student working with radioactive materials (RAM) must do so under the authorization of a Principal User
- Students working with radiation-emitting equipment (e.g., facilities for X-ray diffraction, gamma-ray spectroscopy or liquid scintillation counting) must receive appropriate training prior to use.
- Contact EHS for any further questions and concerns involving radiation.

2.5 Low Pressure within Vacuum Systems

- Certain vessels may implode and shatter when evacuated.
- Always inspect your glassware for small cracks and etched lines before using it.
- Round-bottom flasks larger than one liter should not be evacuated. Desiccators that are evacable are made out of especially thick glass, including flanges that must be well greased and/or fitted with O-rings.

- Eye protection is required when handling Dewar flasks.

2.6 High Temperatures

- Use only hot plates that are fitted with a light that indicates that they are working.
- When you switch off a hot plate, do not forget that while it is still hot, it is a hazard to others. Label it appropriately so that the next person who tries to pick it up does not suffer an accident.
- **Do not move hot oil baths**; consult the instructor if it is necessary to do so. Never connect heating mantles directly to the 110-volt VC supply. Use a voltage control device.

2.7 Particularly Hazardous Substances

"Particularly Hazardous Substances" include select carcinogens, reproductive toxins, and substances that have a high degree of acute toxicity. Consult SDSs and ANSI standards to ensure that the appropriate protective gear is in use. Avoid exposure to these toxic substances via various routes by using all reasonable precautions:

- Have at least two people present at all times.
- Always work in a designated area.
- Always use fume hoods, glove boxes, proper PPE, such as chemically compatible gloves, long sleeves, goggles, and other equipment as recommended.
- Protect surfaces from contamination.
- Use mechanical pipetting aids for all pipetting procedures. *Never use a mouth pipette*.
- Have appropriate measures in place for decontamination.
- Wash hands and arms immediately after working with these materials.
- Report all accidents, incidents, and near misses (those unplanned events that did not result in injury, illness, or damage – but had the potential to do so) to your supervisor/instructor and file a Reed College accident/incident form.
- Consult a qualified physician when appropriate.

2.7.1 High Chronic Toxicity

The following rules apply for work with substances of known high chronic toxicity in quantities above a few milligrams to a few grams, depending on the substance:

- Conduct all transfers and work with these substances in a "controlled area," such as a restricted access hood, glove box, or portion of a lab designated for use of highly toxic substances.
    - For a negative pressure glove box, the ventilation rate must be at least two volume changes per hour with pressure at least 0.5 inches of water.
    - For a positive pressure glove box, thoroughly check for leaks before each use.
    - In either case, trap the exit gasses or filter them through a HEPA filter and then release them into the hood.

- Inform all people with access to the substances used and their precautions.
- Decontaminate vacuum pumps and all other contaminated equipment in the hood before removing them from the controlled area.
- Decontaminate the controlled area before resuming normal work.
- Inactivate all other forms of the carcinogen before disposal.
- Remove any protective apparel and place it in an appropriately labeled container when leaving a controlled area.
- Thoroughly wash forearms, face, hands, and neck.

2.8 Peroxides and Peroxide Formers

All peroxides and peroxidizable compounds should be stored and treated with the precautions described in 2.8.1 and 2.8.2

2.8.1 Peroxides and Peroxide Formers Storage and Testing

- All containers for these ethers and alcohols should remain well sealed when not in use. Particularly in the case of a more volatile ether or alcohol, a loose stopper allows both a slow evaporation and reaction with oxygen. Consequently, the peroxides gradually accumulate in the residue as the volume declines.
- Do not return unused chemicals to the container.
- Keep containers away from all ignition sources such as direct light, hot surfaces, flames, sparks, and other heat-producers.
- Store the substance in an airtight amber glass bottle that protects the chemical from light while allowing you to see the chemical without opening the container. Store under inert gas when possible.
- To minimize the rate of decomposition, store peroxides at the lowest possible temperature consistent with their solubility or freezing point. Do not store liquid peroxides or solutions at or lower than the temperature at which the peroxide freezes or precipitates because peroxides in these forms are extremely sensitive to shock and heat.
- Testing and logging requirements are as follows:
    - Record on each container the date received, the expiration date, and the date the container is opened. Open containers will be tested for peroxides once opened and discarded as necessary. Peroxide labels can be found on the EHS website. For the list of peroxide formers and corresponding testing frequency requirements consult Appendix C, Table 1 of Reed College Chemical Hygiene Plan.
    - Monitor container volume for evaporative loss and test for the presence of peroxides before each use. Assume peroxide forming chemicals contain peroxides unless they have been recently tested. Record on the container the test data for the next user.
    - Test and properly dispose of chemicals past their expiration date.

- Peroxides can be detected by using peroxide test paper available in the stockroom (see the stockroom manager for more information) or conducting an iodide test with a freshly prepared solution of KI that has been acidified with glacial acetic acid. Before taking these steps, you must talk with your instructor.

2.8.2 Peroxide and Peroxide Formers Handling

- Do not use metal spatulas to handle peroxides. Contamination by metals can lead to explosive decomposition. Magnetic stirring bars can unintentionally introduce iron, which can initiate an explosive reaction of peroxides. Use ceramic, Teflon, or wooden spatulas and stirring blades if you know that the material is not shock sensitive.
- Never scrape or scrub glassware and containers that have been used with peroxide-forming compounds if you see an oily or crusty residue. Avoid friction, grinding, and all forms of impact near peroxides, especially solid peroxides.
- Whenever possible, consider process modification and material substitution.

2.9 Biohazardous Materials

All research utilizing recombinant DNA or synthetic nucleic acid molecules must adhere to the NIH guidelines which includes registration and authorization by Reed College's IBC (https://www.reed.edu/ibc/). Biohazardous material (i.e. human tissue and fluid) and infectious agent work also requires IBC notification via email even though they are not regulated by the NIH guidelines. For detailed instructions regarding the standard laboratory procedures and safety precautions required for working with biological agents, consult Reed College Biosafety Manual.

3.0 Administration

The following subsections describe the rules, regulations, and expectations of Chemistry Department faculty, staff, students, and visitors.The following subsections describe the rules, regulations, and expectations of Chemistry Department faculty, staff, students, and visitors.

3.1 Instructor Compliance and Enforcement

- It is the responsibility of the instructor to ensure the safety of each person working or volunteering in the laboratory.
- Instructors must know the laboratory safety guidelines and procedures applicable to the Chemistry Department.
- Instructors must abide by all safety policies and procedures particular to their discipline.
- At the start of each semester, instructors must provide and review the safety policies associated with their particular laboratory.
    - Provide demonstration/ explanation about the location and use of safety equipment and proper use of laboratory items.

    - Review emergency procedures related to a fire emergency, earthquake, act of violence, needle/stick/sharp object injury, etc.
- Instructors will ensure compliance with the approved safety policies with all students, volunteers or other people who enter their laboratory.
- Instructors will document and report any lab-related incident to the laboratory personnel, EHS, and the department chair.
- The Chemistry Department Chair will be responsible for addressing any situation involving non-compliant students, staff, or faculty.
- The Chemistry Department Chair will be responsible for enforcing consequences in cases of non-compliance in relation to the approved safety policies.

3.2 Policies and Regulations

- The chemistry building is normal hours are:

  7 a.m. through 11 p.m. Monday-Friday,

  7 a.m. through 7 p.m. Saturday,

  Noon to 11 p.m. Sunday.

  Different hours may apply during reading week, finals week, academic holidays, and the summer.

- Smoking is prohibited everywhere in the building.

- Unless part of an officially sanctioned college event, consumption of alcoholic beverages within the building is prohibited.

- No one may ever engage in lab work after taking medication or substances known to impair judgment, motor skills, memory, alertness, or other mental faculties critical for safe lab work. Students found working under the influence of these substances risk loss of lab privileges and dismissal from lab courses.

- In general, no pets may be brought into the building. Exceptions may be made for pets that are kept confined in an office (approval must be obtained from appropriate faculty before keeping a pet in an office) or for service animal accommodations. Students should consult with Disability & Accessibility Resources for appropriate steps and guidance regarding service animals in academic spaces. Pets must never be brought into labs. If students or workers encounter stray dogs inside the building, they should attempt to remove them or obtain assistance to that end.

- Students may store bicycles on the 2nd floor under the stairway. Students may not store a bicycle in any lab or office. Bicycle and skateboard riding are prohibited in the building at all times.

- Department faculty and staff may remove students or other individuals from laboratory spaces due to unsafe work practices or failure to follow directions. Return to lab timeline is contingent on departmental review.

3.3 Work after Hours

- **Lab courses.** Students enrolled in lab courses may engage in lab work only during the normal scheduled lab hours, and *only* when an instructor or other lab supervisor is present. Instructors may permit work beyond normal hours subject to the following conditions:
    - Permission for working beyond normal scheduled lab hours must be obtained in writing from the instructor before beginning any work. Instructors may decline to issue permission for such work at their discretion.
    - Work must be limited to the experiments and/or procedures specified by the instructor.
    - Work must be performed in the location specified by the instructor.
    - Work must be performed during the hours specified by the instructor and subject to whatever supervision is specified by the instructor. In most cases, permission will only be granted for work that will be done while the instructor or other lab supervisor is in the chemistry building.
- **Other Lab Work.** Thesis and independent study students should discuss work hours and work activities with their research instructors before beginning work. As a rule, limit work to experiments and/or procedures specified by the instructor, and be sure to perform them in the location specified by the instructor.
    - If a research student needs to work beyond an instructor's normal working hours, then the student should find another student who can be in the same lab with the student and monitor the student's safety.

Appendix 1.0 Chemistry Laboratory Student Agreement

I, the undersigned

_____

(print student's name)

hereby declare that I have read the Reed College chemistry department's 2024 edition of *Chemistry Laboratory Safety Manual* and that I have understood its contents. I hereby undertake not to engage in any laboratory work whatsoever except that covered by the statement in Chapter 3.0 Administrative of the above manual.

In particular, I agree never to undertake experimental work, or to remove chemicals or equipment from the chemistry building, without written prior approval of my instructor.

I understand that any chemistry building activity on my part that is counter to the regulations in this manual may result in disciplinary action by the chemistry department or by the college. In the case of persistent and/or severe infringement of the regulations, I may expect to be denied registration in the college.

Name of Student (print) _____

Signature of Student_____

Date _____

Name of Instructor (print)_____

Signature of Instructor _____

Date _____

PLEASE RETURN THIS PAGE, FILLED OUT IN ITS ENTIRETY, TO THE DEPARTMENT ADMINISTRATOR IN ROOM 303.

Appendix 2.0 Hazard Communication

Appendix 2.1 GHS Pictograms and Hazard Classes

Flame Over Circle  • **Oxidizers**	**Flame**  • **Flammables** • **Self-Reactives** • **Pyrophorics** • **Self-Heating** • **Emits Flammable Gas** • **Organic Peroxides**	**Exploding Bomb**  • **Explosives** • **Self-Reactives** • **Organic Peroxides**
Skull and Crossbones  • **Acute Toxicity (severe)**	**Corrosion**  • **Corrosive to Metal** • **Skin Corrosion** • **Serious Eye Damage**	**Gas Cylinder**  • **Gases Under Pressure** • **Liquified Gas**
Health  • **Carcinogen** • **Respiratory Sensitizer** • **Reproductive Toxicity** • **Target Organ Toxicity** • **Germ Cell Mutagen** • **Aspiration Toxicity**	**Environment**  • **Environmental Toxicity**	**Exclamation Mark**  • **Skin Irritant** • **Dermal Sensitizer** • **Acute Toxicity (harmful)** • **Narcotic Effects** • **Respiratory Irritation** • **Eye Irritation**

Appendix 2.2 Biohazard Symbol

All laboratory entryways working with RG2 materials or higher must be labeled with the universal biohazard symbol. Warning labels shall be affixed to containers of medical waste, refrigerators, freezers, incubators, and centrifuges containing BL2 or BL3 agents, human blood or "other potentially infectious material". Other equipment such as water baths, sonicators, and biological safety cabinets do not require a permanent biohazard label if decontaminated after each use. In these situations, a biohazard label should be temporarily posted on the equipment while in use with human blood, other potentially infectious materials, or an infectious agent.

Appendix 2.3 Radiation Symbol

All laboratory entryways and storage areas working with radioactive materials must be labeled with the radioactive material use sign below. Warning labels shall be affixed to containers of waste, refrigerators, freezers, incubators, and centrifuges containing radioactive materials.