

University of Maryland Research Safety Standard

Scope

The *University of Maryland (UMD), Research Safety Standard (Research Safety Standard)* and the associated *Procedures* herewith, applies to all research conducted under the auspices of UMD where hazardous materials or hazardous operations are present. This includes research laboratories, studios, makerspaces, workshops, machine shops in research departments, shared support facilities, field research, and research at university-owned farms.

Purpose

The University of Maryland is committed to the protection of the health and safety of its students, employees, visitors, the campus community and our environment. Our [Principles of Ethical and Responsible Conduct](#) emphasizes the University's guiding expectation to uphold the highest of ethical standards and legal requirements in Environmental Health, Safety and Sustainability.

The University research community shall comply with all federal, state, and local regulations, and established safety and compliance programs documented in programs and specific manuals, including this *Research Safety Standard* which requires actions beyond minimum regulatory compliance to ensure the protection of individuals and the effective management of a safe research environment. This standard supports the intent of the UMD Policies and acts as procedural support to the following:

- VI-13.00(A) University of Maryland, College Park Policy on Occupational Exposure to Hazardous Chemicals in Laboratories
- VI-16.00(A) University of Maryland, College Park Policy on Occupational Exposure to Laser Light
- VI-17.00(A) University of Maryland Policy on Biosafety
- VI-18.00(A) University of Maryland Policy on Hazard Warning Signage System for Educational, Research and Diagnostic Laboratories
- VI-19.00(A) University of Maryland Policy on Protective Equipment Program
- VI-21.00(A) University of Maryland Policy and Procedures for Environmental, Safety and Health Management
- X-7.00(A) University of Maryland, College Park Policy Concerning Fire Emergencies

Fundamental Safety Requirements in ALL Research Spaces

1. The principal investigator is ultimately responsible for the safety of the individuals present within their assigned research spaces on and off campus; this includes the responsibility for the safe performance of all activities conducted.
2. Faculty, staff, students and visitors shall adhere with federal, state, and local regulations, this Research Safety Standard, and other applicable University of Maryland policies and procedures related with research safety, including those set forth by the Department of Environmental Safety, Sustainability and Risk (ESSR), institutional compliance committees, the colleges and schools, individual departments, and those set forth by the faculty member or principal investigator in the research space.
3. Consumption and storage of food and drink is strictly forbidden in laboratories where hazardous materials, chemicals, biological materials, radioactive materials or work with animals occurs. See ***Research Safety Standard Procedure 1: Laboratory Hygiene***.
4. Appropriate personal attire and assigned personal protective equipment (PPE) are to be worn in laboratories. Principal investigators shall conduct a risk assessment to specify the types of personal clothing and PPE required to enter the laboratories and the PPE required to perform the specific research objectives. See ***Research Safety Standard Procedure 2: Laboratory Attire and Personal Protective Equipment***.

5. Principal investigators shall ensure individuals within their laboratories and assigned spaces have been adequately trained. Training shall be accomplished before an individual has unescorted access to areas where hazardous materials are present, where hazardous equipment/operations are occurring, and where work with animals occurs. See ***Research Safety Standard Procedure 3: Research Safety Training***.
6. Research spaces are to be maintained orderly and clean, free of clutter and unwanted/unusable debris/equipment so that the materials do not contribute to unsafe work conditions and the spaces reflect the university's highest standards of quality. Compliance with the regulations for the use, storage and waste management of hazardous materials is required. This includes the posting of appropriate warning signs and labels. See ***Research Safety Standard Procedure 4: Laboratory Housekeeping***.
7. Work-related incidents, including personnel injury or illnesses, hazardous materials spills, or research security related events, are to be promptly reported in accordance with campus incident reporting policies and procedures (e.g., first report of injury forms). Without delay, necessary medical treatment and emergency support services shall be obtained.
8. Faculty, staff, students and visitors have the responsibility to report safety concerns to a principal investigator, compliance officer, department chair, college leadership, ESSR and/or the University's [Ethics, Integrity and Compliance Reporting](#) system. Reports involving safety concerns shall be promptly addressed.

Specific Responsibilities

President, Senior Vice President and Provost, Vice President for Research, Vice President for Administration & Finance

1. Allocate resources and establish priorities to adequately manage recognized risks within all research enterprise operations to maintain compliance with federal, state, and local regulations, the *Research Safety Standard*, and other applicable University of Maryland policies and procedures related to research safety.
2. Demonstrate that safety is a core value of the institution through public discussion of the importance of safety and publication of UMD's *Expectations for Conducting Safe Research*.

Deans, Directors, Department Chairs

1. Demonstrate that safety is a core value of the college through public discussion of the importance of safety.
2. Assign a responsible authority (faculty member, principal investigator) to all research spaces, including maker spaces and machine shops.
3. Assign a responsible authority to serve as a departmental Compliance Officer. Provide the Compliance Officer with the authority and resources to act upon safety matters and to manage identified departmental safety responsibilities.
4. Promptly inform ESSR of college and departmental changes that affect the laboratory safety program. This includes notification to ESSR when new principal investigators arrive or at the negotiation stage when discussions involve a new high-risk or regulatory-complex research aim, prior to existing principal investigator departure and at the planning stages of laboratory renovations, space alterations and high risk and/or highly regulated research.
5. Ensure that appropriate and safe research spaces are present for the types and scope of research conducted; this includes coordinating the availability of necessary infrastructure related engineering and safety controls (e.g., ventilation, fume hoods, utilities, eye washes and safety showers, atmospheric monitoring, and fire protection) for the specific research performed.
6. Allocate resources to mitigate safety risks in order to provide a safe and compliant work environment.
7. Upon notification of inspection findings, and especially of serious or continuing non-compliance, promptly act to resolve the findings. See ***Research Safety Standard Procedure 5: Stop Work & Escalation of Communication***.
8. When a safety finding is identified by state or federal agencies, the College responsible for the research will be responsible for paying any regulatory fines incurred.

Compliance Officers

1. Serve as main contact person for the department for environmental, health and safety concerns.
2. Communicate safety information in both directions between ESSR and the department.
3. Work within the department to resolve safety concerns, compliance issues, and non-emergency situations involving potential safety hazards, exposures, accidents, injuries, illnesses, spills, releases, or other regulatory and environmental issues. If concerns are unable to be resolved, inform the chair of the department.
4. Maintain contact information for all operational areas for use in emergency situations.

Principal Investigators

1. Principal investigators are primarily responsible for the safety of the individuals present within the laboratories, research areas under their purview on campus, and at field sites; this includes the responsibility for the safe performance of all activities conducted.
2. Serve as a role model in conducting research. Maintain compliance with federal, state, and local regulations, this *Research Safety Standard*, and other applicable University of Maryland policies and procedures related to research safety.
3. Conduct thorough hazard identification and risk assessments and establish written Standard Operating Procedures (SOPs) for processes that incorporate hazardous materials, equipment, or hazardous conditions. Train laboratory personnel on the SOPs prior to conducting the experimental procedure. Ensure that emergency response procedures are defined for potential incidents.
4. Develop research-specific safety rules and requirements. Discuss and revise them with laboratory personnel. Halt operations immediately whenever serious new hazards are recognized or lack of compliance with requirements present a danger to individuals.
5. Facilitate an open dialog with the faculty, staff, students and visitors and demonstrate that safety is a core value through laboratory group discussion of the importance of safety. Discuss lessons learned from accidents, incidents, and near misses with the group.
6. Maintain an accurate SciShield Safety Management System account. Promptly respond to safety inspection finding reports. See *Research Safety Standard Procedure 6: SciShield*.
7. Ensure individuals receive the required safety training, including research-specific safety awareness training related to the work conducted; ensure individuals are proficient at performing experimental lab procedures prior to authorizing their work with limited supervision.
8. Provide individuals with access to medical surveillance if required for their work.
9. Provide required personal protective equipment, ensure it is properly maintained, and require that individuals are trained in its proper use and application.
10. Establish clear requirements for working alone in the research spaces, including within machine shops, maker spaces or student-operated research spaces, and at field sites. See *Research Safety Standard Procedure 7: Working Alone*.
11. Ensure research safety documentation and required recordkeeping is accurate. This includes, where applicable, fulfilling all recordkeeping elements of the Chemical Hygiene Plan.
12. Ensure the availability and operability of required building safety equipment (e.g. eye washes, showers) and engineering controls (e.g. fume hoods, glove boxes) and discuss with college/school leadership and/or Facilities Management at the time of research proposal submission.
13. Control access to laboratories, hazardous materials, and equipment. Promptly report losses and security concerns to the Compliance Officer, Department Chair, and the University of Maryland Police Department.
14. Investigate and address safety related concerns raised by personnel.
15. Report all safety related incidents to ESSR.

Research Personnel within Laboratories, Shops, Makerspaces and at Field Sites

1. Be knowledgeable about the hazards and tasks performed. Discuss any hazards with the principal investigator or senior personnel and conduct a hazard identification and risk assessment prior to initiating an experimental procedure. Discuss any differences in risk assessment findings with the principal investigator prior to proceeding. Obtain safety related information prior to using an unfamiliar hazardous material or performing a new task.
2. Know and follow all verbal and written safety rules for the work being performed and implement the identified controls (engineering, PPE, administrative procedures) to manage safety risks.
3. Complete all assigned training.
4. Participate in required medical surveillance programs; meet required due dates.
5. Immediately inform principal investigator of an incident or unsafe condition. When necessary, involve the department and college leadership, ESSR and the University's [Ethics, Integrity and Compliance Reporting](#) system. Reporting concerns is a responsibility of all individuals and it is strongly encouraged. It is illegal for retaliatory action to be taken against the person reporting safety concerns.
6. Discuss lessons learned from incidents and near misses with faculty, principal investigator, and fellow researchers.

Department of Environmental Safety, Sustainability and Risk

1. Establish and maintain research safety programs and guidance that is consistent with current regulations, industry standards, guidelines, and accepted best practice. Work collaboratively with university faculty, staff and students to establish research safety programs and procedures to ensure safe practices in research.
2. Perform periodic inspections of facilities and operations to confirm the implementation of safety and environmental standards, federal, state, and local regulations, and established safety and compliance programs documented in programs and specific manuals, including this *Research Safety Standard*. Provide timely reports to the responsible authority. Work with research personnel to resolve any findings.
3. Provide safety training courses that meet regulatory requirements and best practice standards.
4. Respond to and investigate safety-related incidents.
5. Elevate significant concerns, repeated non-compliance, and/or stop work orders to Compliance Officer, Department Chair, Dean, and/or Senior Leadership.
6. Act as the liaison with federal and state regulatory agencies with authority and oversight in areas of environmental health and safety. ESSR offices with delegated regulatory jurisdiction (e.g., Fire Marshal's Office, Radiation Safety Officer) are authorized to act within their defined regulatory capacity.
7. ESSR will notify the Provost, Vice President for Research, College Deans, Department Chair, and/or Center Directors when reporting of a safety finding to federal or state agencies is necessary.
8. The Executive Director of ESSR, or their designee, may shutdown any University activity considered to constitute an immediate danger to life and health. The Executive Director may also confer with the Dean and Vice President for Research regarding the need to curtail, pause or shut down additional lab activities to address non-compliance or other existing safety concerns.

Institutional Oversight Committees

Institutional Biological Safety Committee

1. Review and vote to approve, disapprove, or require changes to protocols for all research involving biological material (unfixed human and non-human primate materials including cells lines, blood, and body tissues, recombinant or synthetic nucleic acids, pathogens (human, arthropod, animal, and plant)), infectious or potentially infectious agents.
2. Provide assurance as the cognizant institutional authority that research activities are carried out in appropriate and secure facilities in accordance with federal, state, and local regulations.
3. Provide guidance, direction, and oversight to assist researchers and staff in designing appropriate procedures and observing safe research practices.

Radiation Safety Committee

1. Review and vote to approve, disapprove, or require changes (e.g., additional information, training and safety related practices, equipment, etc.) to protocols for all research involving the use of ionizing radiation, radiation producing machines and radioactive materials.
2. Provide institutional assurance that research activities are carried out in appropriate and secure facilities in accordance with federal, state, and local regulations.
3. Provide guidance, direction, and oversight to assist researchers and staff in observing safe research practices for research and education involving use of ionizing radiation and radioactive materials.

Institutional Animal Care and Use Committee

1. Review and vote to approve, disapprove, or require changes to protocols for all research involving the use of animals.
2. Provide institutional assurance that research activities are carried out in appropriate and secure facilities in accordance with federal, state, and local regulations.
3. Provide guidance, direction, and oversight to assist researchers and staff in observing safe research practices for research and education involving use of animals.

Dive Control Board

1. Review and vote to approve, disapprove, or require changes to protocols for all research involving scientific diving.
2. Provide institutional assurance that scientific diving activities are carried out in accordance with federal, state, and local regulations.
3. Provide guidance, direction, and oversight to assist researchers and staff in observing safe research practices.

Laboratory Operations and Safety Committee

1. Draft *Research Safety Standard Procedures* in collaboration with ESSR, for incorporation into this *Research Safety Standard*. *Procedures* are supporting documents that define accepted best practices and regulatory requirements in specific areas. Procedures will be developed by ESSR, reviewed by the LOSC, and ultimately approved by the Vice President for Research.
2. Report identified risks within research enterprise to Vice President for Research and support the establishment of priorities for mitigating risks.
3. Act as a conduit between the research community and ESSR to enhance communication about safety risks.

Compliance, Enforcement, and Exemptions

Compliance with this *Research Safety Standard* is to be enforced on a routine basis by the principal investigator. Department leadership and department Compliance Officers may also enforce this *Research Safety Standard*. During routine visits and inspections, ESSR and other compliance units/officers (e.g., IACUC, Biosafety Officer, Radiation Safety Officer, Chemical Hygiene Officer, Fire Marshal) will report compliance deficiencies related to this standard to the appropriate authority and guide corrective actions.

Resolving Non-Compliance

The principal investigator is responsible for correcting research safety non-compliance issues, in consultation with ESSR and compliance committees. Inspection findings are escalated when necessary based upon the nature of the infraction, its severity and frequency, and the delay in addressing it. In cases where ESSR offices are delegated regulatory authority, (e.g. Maryland State Fire Marshal) reports are legal correction orders subject to enforcement, penalties, and appeals as prescribed by State law. See *Research Safety Standard Procedure 5: Stop Work & Escalation of Communication*.

Senior Leadership shall determine when administrative action is warranted to enforce compliance based upon severity and risk. Sanctions remain enforced until full compliance is achieved. These administrative actions could include exclusion from the lab, fines, halting research expenditures or proposal submissions, lab closure, or termination of employment.

Exemptions

Principal investigators may request an exemption to any part of this *Research Safety Standard* by documenting the request in writing to labsafety@umd.edu. The exemption request shall include:

- (1) the specific exemption sought,
- (2) the justification for the equivalency or requested change in procedure, and
- (3) the specific measures to ensure the safety of the individuals occupying the space.

ESSR will document a regulatory review and risk assessment to determine if an exemption is permitted by regulation. If permitted by regulation, the Laboratory Operations and Safety Committee will be consulted for review of the request and risk assessment.

Exemptions take effect only when granted in writing. Exemptions are subject to routine review and may be revoked if conditions or compliance in the space change; exemptions may be reinstated by ESSR pending a review.

Mary Ann Rankin
Senior Vice President and Provost

Date

Laurie E. Locascio
Vice President for Research

Date

Carlo Colella
Vice President for Administration and Finance

Date

Research Safety Standard Procedure 1: Laboratory Hygiene

This Research Safety Standard Procedure applies to all faculty, staff, students and visitors entering University facilities where hazardous materials such as chemicals, biological materials, radioactive materials are used, handled or stored, where work with animals is present, and/or where hazardous equipment and hazardous operations are occurring. The principal investigator may require more restrictive requirements based upon specific hazards. Deviations that are less restrictive must follow the process outlined in the “Exemptions” section of this Standard.

Eating & Drinking

Consumption of Food and Drink

- 1) Consuming food and beverages within areas that utilize hazardous materials increases the risks for the ingestion of harmful materials. Therefore, consuming food and drinks are strictly forbidden in laboratories and spaces that use or store hazardous materials including chemicals, biological material, and radioactive material or where work with animals occurs.
- 2) Chewing of gum is not permitted, even if the gum was inserted into the mouth outside of the laboratory.
- 3) Consumption of food and drinks is allowed in non-laboratory areas that are physically separated from the lab by a door or partition which can be closed, such as office areas. A desk area within the laboratory that is not separated by a door or partition is not exempt from the laboratory restriction on consumption of food and drink. The designation of “clean” or “safe” areas for food consumption by use of floor tape, signage or half-wall partitions is also not allowed and does not comply with these requirements.

Storage of Food and Drink

- 1) Food and drink may be stored within a sealed food storage container or bottle if it is then stored within a closed secondary container or bag, so long as the primary food container remains sealed while in the laboratory, and neither storage container contacts lab surfaces potentially exposed to hazardous materials.
- 2) An example of an acceptable storage of food in a sealed container is a closed water bottle stored in a closed backpack; this is acceptable as long as the backpack remains separated from chemicals, work surfaces, waste containers, etc. (e.g. stored on a shelf near the area entrance and away from the research space).
- 3) Food and drink for consumption cannot be stored in lab refrigerators, freezers or cold rooms, even if the food is in secondary containment.
- 4) Trash related to food and drink consumption (e.g., wrappers, bottles, utensils) shall not be disposed of in the laboratory trash. This is considered evidence of food or beverage consumption within the laboratory. If federal and state regulatory agencies inspect laboratories and find food waste items, this can result in serious consequences to the University and the laboratory.
- 5) Research related food items not intended for human consumption shall be clearly labeled as “not for human consumption” or equivalent. They cannot be stored in the same place as human food and drink.

Equipment for Food Preparation and Storage

- 1) Food plates, beverage cups, coffee cups, and other drinking and eating utensils shall not be stored in laboratories where chemicals, radioactive materials, biological materials or animals are present.
- 2) Rinsing of utensils or food/beverage containers is not allowed in laboratory sinks.
- 3) Laboratory refrigerators, ice chests, cold rooms, and microwave or other ovens shall not be used for food storage or preparation.
- 4) Each refrigerators or freezer used to store chemicals, biological materials, radioactive materials, or other potentially hazardous materials must bear a sticker indicating that no food storage is allowed.
- 5) Laboratory equipment, including glassware and hot plates, are never to be used to prepare or store food or beverages.

Contact Lenses

- 1) Except where specified below, the wearing of contact lenses is broadly permitted in laboratories across the University of Maryland so long as additional, appropriate eye protection is worn when required.
- 2) Placement, removal, or other manipulation of contact lenses is not allowed in laboratories or other spaces where chemicals, radioactive material, biological material, or animals are present.
- 3) Exceptions to this permission include instances where contact lens use is banned by regulation or contraindicated by medical or safety recommendations. OSHA guidance states that contact lens use must not be permitted when working with the following chemicals:
 - a) Methylene chloride (29 CFR 1910.1052)
 - b) 1,2-dibromo-3-chloropropane (29 CFR 1910.1044)
 - c) Acrylonitrile (29 CFR 1910.1045)
 - d) Ethylene oxide (29 CFR 1910.1047)
 - e) 4,4'-Methylenedianiline (MDA) (29 CFR 1910.1050)
- 4) In addition, safety data sheets shall be evaluated to identify if any other chemicals have restrictions on contact lens use. Principal investigators can be more restrictive and ban contact lens wear in the lab based on risk assessments performed for the materials in the spaces.

Cosmetics

- 1) Application of cosmetics is not allowed in laboratory spaces where hazardous materials are used.
- 2) Storage of cosmetics shall follow the same rules as storage of food, outlined above.

Mouth Pipetting Is Prohibited

Use of mouth suction to siphon or pipette can easily lead to ingestion of chemical or biological hazards. Mouth pipetting in any laboratory is strictly prohibited.

Handwashing

- 1) In laboratories where chemicals, radioactive material, biological material or animals are present, materials for routine handwashing must be available.
- 2) Routine handwashing materials include: potable water sink, soap, and paper towels.
- 3) Research-specific training must contain language that addresses the need to wash hands after handling hazardous materials, after removal of PPE, and before leaving the lab.
- 4) Use of sink is permitted for emergency handwashing if contaminated area can be adequately flushed.

Research Safety Standard Procedure Adoption History

Date Approved by LOSC: 10/30/2020

Date Approved by VPR: 1/28/2021

Effective Date: 1/28/2021

Research Safety Standard Procedure 2: Laboratory Attire and Personal Protective Equipment

This Research Safety Standard Procedure applies to all faculty, staff, students and visitors entering University facilities where hazardous materials such as chemicals, biological materials, radioactive materials are used, handled or stored, where work with animals is present, and/or where hazardous equipment and hazardous operations are occurring. The principal investigator may require more restrictive requirements based upon specific hazards. Deviations that are less restrictive must follow the process outlined in the "Exemptions" section of this Standard.

Appropriate Clothing/Attire

- 1) Appropriate clothing must be worn in laboratories and spaces where hazardous material or work with animals is conducted. "Appropriate" depends on conditions; minimal standards are listed in this Procedure.
- 2) Clothing shall leave no exposed skin on the legs and feet. Footwear must be closed-toe and it must cover the top of the feet. Personal attire that does not offer adequate protection must not be worn in a laboratory.
- 3) When handling pyrophoric reagents outside of a glovebox, natural-fiber personal clothing shall be worn under body protection (e.g. lab coats). It is highly recommended natural-fiber clothing be extended to all activities that pose a risk of fire.
- 4) Loose clothing, jewelry, and unsecured long hair are not allowed in spaces where exposed mechanical hazards are present.

Personal Protective Equipment (PPE)

- 1) Laboratories and departments are required to have clear policies describing access and PPE requirements.
- 2) Required PPE will vary dependent upon the hazards present and the activities being conducted; therefore, principal investigators shall conduct a risk assessment and identify the specific PPE for all hazardous operations and update these requirements when conditions change.
- 3) ESSR can assist by providing guidance on the selection and use of PPE and reviewing PPE assessments.
- 4) PPE requirements must be documented. It is recommended PPE be documented directly within SOPs for the laboratory operation.
- 5) The appropriate PPE shall be made readily available to the research laboratory personnel at no cost.
- 6) No research activity or experiment may be conducted if the appropriate personal attire is not worn, or if the required PPE is not available and used.
- 7) Disposable PPE designed for single use, such as nitrile gloves, must not be reused.
- 8) PPE must be stored away from the hazardous operations requiring the PPE.
- 9) Individuals must be able to don PPE before entering the areas where it is deemed required. This may require PPE to be made available at the entrances or outside the laboratory. When PPE is required for entry to spaces, the entry requirement shall be posted on the exterior of the entrances, and control of access to the space shall be maintained.
- 10) Except at the entry where required, PPE is to remain within the laboratory.
 - a) Protective gloves must not be worn in any public area outside of the laboratory (i.e., hallways, elevators, offices). Materials moving from lab to lab are to be placed into secondary containment/transport containers with clean external surfaces that can be moved without the requirement to wear gloves. When necessary, an individual may wear a single glove when traveling in a corridor between laboratories or support rooms, such as a cold room or an instrument room, in order to permit the opening of doors, or selection of elevator buttons with the ungloved hand.

- b) Laboratory coats may not be worn outside of a laboratory unless the individual is traveling directly to an adjacent laboratory work area.
- 11) Faculty and principal investigators are responsible for overseeing and providing for the appropriate care (e.g., cleaning, storage, disposal and replacement) and inspection of PPE.
- 12) Defective or damaged PPE must be taken out of service immediately and replaced.
- 13) Whenever possible, procedures should not be designed to routinely rely on PPE as the primary control to prevent accident or injury. The use of engineering controls and standard operating procedures should be used to prevent splashes or release of gases rather than relying on PPE to solely protect the researcher.

Training Specific to PPE

- 1) Personnel shall receive research-specific training that includes PPE selection, use, care, and limitations of use. This training must be completed and documented prior to exposure to the hazard necessitating the PPE. Documentation must be kept by the laboratory and be available during routine inspections.

Body Protection

- 1) Laboratory coats are required when working on processes that involve chemicals, biological material or unsealed radioactive material.
- 2) Lab coats must be appropriately sized for laboratory personnel and be able to be closed.
- 3) The sleeves of laboratory coats must be of a sufficient length to prevent skin exposure while wearing gloves; the addition of sleeve protector PPE may be deemed necessary depending upon the risk assessment.
- 4) Flame-resistant lab coats are required when handling pyrophoric reagents outside of a glovebox or any amount of flammable liquids near ignition sources.
- 5) Chemical resistant aprons must be available when lab operations involve working with large volumes (>1 L) of hazardous chemicals or any quantity of acutely toxic chemicals.

Laboratory Coat Management & Laundering

- 1) Grossly contaminated lab coats are to be submitted as hazardous waste using the Regulated Waste Management System.
- 2) Contaminated or potentially contaminated lab coats shall not be cleaned at private residences or at public laundry facilities.
- 3) Each school, department or research unit shall be responsible for providing access to professional laboratory coat laundry services or for the replacement of laboratory coats as needed to maintain the hygiene and replacement of contaminated laboratory coats.

Hand Protection

- 1) Protective gloves must be worn while utilizing hazardous chemical, biological or unsealed radiological material. These gloves must be appropriate for the material being used.
- 2) The Safety Data Sheet for the chemical is to be referenced when determining glove-type compatibility.
- 3) Specialty glove material may be required, including but not limited to flame-resistant gloves worn when handling pyrophoric reagents outside of a glovebox and cryogenic gloves when working with liquid nitrogen.

Eye/Face Protection

- 1) Eye protection must be used while handling hazardous chemicals, biological materials or unsealed radioactive materials.
- 2) Eye protection must be American National Standards Institute (ANSI) Z87.1 rated.

- 3) Specialty eyewear must be provided when required. This includes but is not limited to protective eyewear where open beam Class 3b and 4 lasers are in use, and face shields when ultraviolet light sources exist.
- 4) Face shields must be available and worn by those conducting work with large volumes or acutely toxic materials.

Respiratory Protection

- 1) Laboratory operations should seek to utilize primary containment engineering controls, such as a fume hood, before employing respiratory protection PPE to control personnel exposures to airborne hazards.
- 2) The use of respirators must follow the University's Respiratory Protection Program, managed by ESSR.
- 3) Before the procurement and use of respiratory protection, users must enroll in ESSR's Respiratory Protection Program for an evaluation of the airborne hazard, selection of PPE, PPE fit-testing and medical clearance requirements.
- 4) Voluntary use of respirators is permitted, only after the hazard evaluation has determined a respirator is not required. Voluntary use of use of respiratory protection must meet all OSHA regulations.

Field Work PPE

- 1) Field operations may have specific clothing and footwear requirements based on field location and activities.
- 2) Principal investigators must specify clothing, footwear, and other gear/PPE requirements for field research activities prior to travel.
- 3) Every-day clothing, skin creams, and footwear used solely for the protection of weather (e.g., winter coats, jackets, gloves, parkas, rubber boots, hats, raincoats, ordinary sunglasses, and sunscreen) are the responsibility of the individual researcher to purchase and maintain; these items are the personal property of the researcher.

Hearing Protection

Compliance with hearing protection standards by wearing ear protection (e.g. earmuffs or earplugs) may be necessary to minimize noise exposures from laboratory operations or equipment to within regulatory standards. As a general guideline, if a lab operation generates noise conditions such that researchers must raise their voices to be heard, contact ESSR for a noise assessment. Required hearing protection is provided by the principal investigator.

Foot Protection

Steel-toed or composite safety shoes may be necessary when there is a risk of heavy objects falling or rolling onto the feet as determined by a risk assessment.

Additional PPE Types

Additional task-specific PPE may be required by the principal investigator, as determined through the risk assessment process and to comply with established laboratory safety regulations (e.g. Biosafety Level 3 laboratories, work in the vivarium, exposure to animal allergens).

Research Safety Standard Procedure Adoption History

Date Approved by LOSC: 10/30/2020

Date Approved by VPR: 1/28/2021

Effective Date: 1/28/2021

Research Safety Standard Procedure 3: Research Safety Training

This Research Safety Standard Procedure applies to all faculty, staff, students and visitors entering University facilities where hazardous materials such as chemicals, biological materials, radioactive materials are used, handled or stored, where work with animals is present, and/or where hazardous equipment and hazardous operations are occurring. The principal investigator may require more restrictive requirements based upon specific hazards. Deviations that are less restrictive must follow the process outlined in the “Exemptions” section of this Standard.

Training

- 1) Researchers must receive appropriate safety training before initiating research operations.
- 2) Researchers must be fully aware of any hazards and the controls in place to mitigate risks before starting a new experiment.
- 3) Training is required to be documented. Institutional training records will be recorded in the SciShield platform and managed by ESSR. Research-specific training must be managed by the principal investigator within the research group’s records.
- 4) Standard Operating Procedures (SOPs) must be developed, implemented and reevaluated as needed to describe hazards fully.
- 5) Individuals must have read and understood all written guidelines, manuals, plans, policies, programs and SOPs that pertain to their activities, and they shall implement training content into practice.
- 6) Supervisory personnel (senior students, postdocs, or the principal investigator) must be present whenever unfamiliar or potentially dangerous procedures are performed by researchers who lack the appropriate level of training, experience and a demonstrated proficiency to carry them out independently.
- 7) Individuals are responsible for notifying the principal investigator if they encounter a hazard for which they have not been trained.
- 8) Short-term visitors, one month or less, must be provided research-specific training relevant to their work activities. Short-term visitors present on campus for longer than one month, or who are granted unescorted access to laboratory facilities at any time, must take all applicable ESSR provided institutional training.

Training Linked to Access

- 1) Only appropriately trained personnel are allowed to have access to research laboratories. Both institutional training and research-specific training is required prior to starting work activities that expose personnel to hazardous materials/processes.
- 2) Before key or swipe-card access is provided to any individual, that person must demonstrate successful completion of appropriate institutional training.

Institutional Training

- 1) ESSR is responsible for managing the institutional safety trainings that meet regulatory requirements and best practices.
 - a) This institutional level training is assigned to individuals by the selection of job activities within the SciShield system.
 - b) Principal investigators, or their designated SciShield compliance liaison, must accurately select job activities and update them when necessary to ensure the appropriate institutional safety training is assigned.
- 2) Compliance with institutional training identified as required, applies to all laboratory members, including the principal investigator.

- 3) Training courses with a refresher/renewal requirement must be completed at the designated frequency.
- 4) Training from another institution may be accepted as equivalent to meet parts of the institutional training; a documented agreement with ESSR and the Department seeking equivalency is required.

Research-Specific Training

- 1) Research-specific training is provided by the principal investigator, or a designated senior research member, to all users of their space.
- 2) The research-specific training must cover:
 - a) hazards present
 - b) rules specific to the research group
 - c) availability of safety documentation/resources/equipment
 - d) appropriate use of controls available to mitigate risk
 - e) experimental procedures relevant to their work
 - f) emergency response procedures
- 3) Research-specific training documents and SOPs must be regularly reviewed.
- 4) Research-specific training must be documented and available to ESSR during inspections.
- 5) Active discussion of safety issues, near-misses, and incidents among laboratory and department personnel is encouraged and used as safety training opportunities.

Research Safety Standard Procedure Adoption History

Date Approved by LOEC: 10/30/2020

Date Approved by VPR: 1/28/2021

Effective Date: 1/28/2021

Research Safety Standard Procedure 4: Laboratory Housekeeping

This Research Safety Standard Procedure applies to all faculty, staff, students and visitors entering University facilities where hazardous materials such as chemicals, biological materials, radioactive materials are used, handled or stored, where work with animals is present, and where hazardous equipment and hazardous operations are occurring. The principal investigator may require more restrictive requirements based upon specific hazards. Deviations that are less restrictive must follow the process outlined in the “Exemptions” section of this Standard.

Laboratory Housekeeping

- 1) Housekeeping is paramount to the appearance and reflection of the university’s highest standards of quality.
- 2) Research spaces are expected to be orderly and clean, free of clutter and unwanted debris.
- 3) Laboratory signage must accurately reflect hazards and provide current contact information.
- 4) Storage of combustible materials, such as waste paper and cardboard, is to be kept to a minimum.
- 5) Wastes and unwanted chemicals shall not be permitted to accumulate.
- 6) Egress pathways within research spaces (including hallways) must be clear from obstructions and hazards, and maintain a minimum clearance width of 36 inches. Hazardous material and equipment are not to be stored in the path of emergency egress.
- 7) Emergency equipment (e.g., eye wash, shower, fire extinguishers, sprinkler heads) and electrical panels must not be obstructed by storage of any material or equipment.
- 8) Individuals using common equipment and working within common use facilities must clean up after use and attend to their samples and waste generated.
- 9) In all research spaces, chemical, biological material and radioactive material spills and residues must be cleaned up immediately.
- 10) Work surface material for use with chemicals, biological material and radioactive material is to be selected for ease of decontamination. Wood surfaces where these materials are used is not permitted. Cloth covered chairs or stools are not to be used in the laboratory.
- 11) All compressed gas cylinders must be properly secured; they must be chained to the wall or a secure bench. Caps must be in place on all tanks when not in use or when they are moved.
- 12) Fume hoods are not to be used for storage of chemicals or other materials.
- 13) Samples and research materials must be appropriately labeled and stored. After use, they must be disposed of within the appropriate waste stream, by personnel with up-to-date Hazardous Waste Generator training provided by ESSR. Researchers leaving the university must either dispose or formally transfer possession of their research materials to another researcher.
- 14) Attention must be paid to electrical safety, especially as it relates to the use of extension cords, proper grounding of equipment, avoidance of overloaded electrical circuits, and avoidance of the creation of electrical hazards in wet areas. Electrical cords should generally be off the floor and neatly organized. If electrical cords must cross aisles along the floor, they should be protected using a cable protector bridge.

Laboratory Cleaning

- 1) The cleaning of laboratory floors by Facilities Management must follow ESSR Guidance, “Researcher Guide to Preparing the Laboratory for Housekeeping Services.”
- 2) General (non-hazardous) laboratory trash is not managed by Facilities Management; this waste stream must be managed by laboratory personnel.
 - a) Laboratory trash should be securely bagged and taken to the building dumpster by laboratory personnel unless specific procedures are in place with Facilities Management.
 - b) Trash must never overflow within receptacles.
- 3) Chemical bottles must be properly emptied and have their labels defaced before disposal in lab trash.

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- 4) Broken glass is to be placed into a sturdy box and taped shut. The building facility manager shall identify the appropriate dumpster for glass, as some trash compactors may not be appropriate for glass disposal.

Storage of Chemicals

- 1) Chemical storage must be designated to appropriate cabinets or shelving units in areas away from heat/ignition sources and direct sunlight.
- 2) Chemicals must be stored according to the Safety Data Sheet specifications. Separation of chemicals is required between hazard classes (e.g., oxidizing and flammable must be segregated) to prevent potential incompatible reactions.
- 3) All flammable chemicals must be stored within approved flammable liquids storage cabinets, or when necessary, specially designed flammable liquids storage refrigerators/freezers with no internal electrical components.
- 4) Corrosives must be stored in dedicated corrosives storage cabinets.
- 5) Chemical fume hoods are not to be used for the storage of chemicals or chemical waste.
- 6) All liquid hazardous chemicals and waste must be stored in secondary containment bins.
- 7) Fixed lids or caps for all chemicals not in use are required. Parafilm and foil lids are not sufficient.
- 8) Hazardous chemicals must not be stored above eye level.
- 9) The required postings for storage of materials must be present.

Research Safety Standard Procedure Adoption History

Date Approved by LOSC: 10/30/2020

Date Approved by VPR: 1/28/2021

Effective Date: 1/28/2021

Research Safety Standard Procedure 5: Stop Work & Escalation of Communication

This Research Safety Standard Procedure applies to all faculty, staff, students and visitors entering University facilities where hazardous materials such as chemicals, biological materials, radioactive materials are used, handled or stored, where work with animals is present, and where hazardous equipment and hazardous operations are occurring. The principal investigator may require more restrictive requirements based upon specific hazards. Deviations that are less restrictive must follow the process outlined in the “Exemptions” section of this Standard.

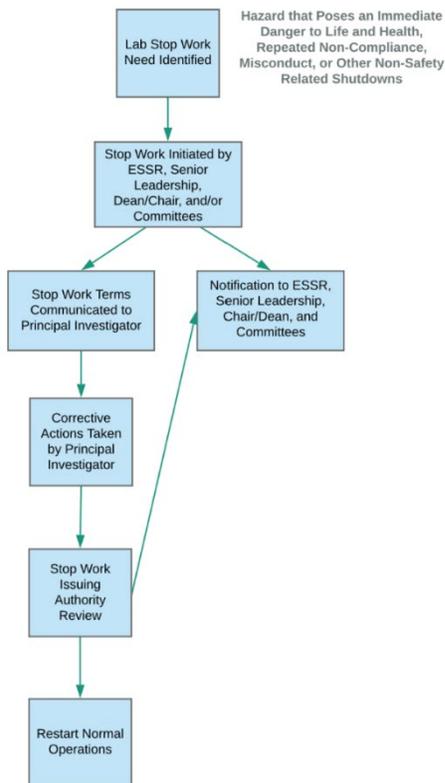
Self-Identified Stop Work

The principal investigator has the responsibility to control research activities in assigned spaces and may self-impose a pause in research operations at any time. Notification beyond that of the laboratory personnel, must continue to follow regulatory and campus reporting requirements (e.g. reporting of incidents to ESSR). Principal investigators may inform and seek support from ESSR, the Dean, Chair or senior leadership as deemed necessary to effectively respond to and to mitigate the safety issue necessitating the self-imposed stop work.

Imminent Danger to Life and Health

An “imminent danger” is a condition or behavior that is reasonably expected to cause death or serious injury, or environmental harm. All faculty, staff and students are responsible for stopping their work should it be identified as an imminent danger to life and health. Due to the severity of the risk, all “imminent danger” conditions are to be reported to ESSR for investigation and resolution.

Authority & Communication of Stop Work

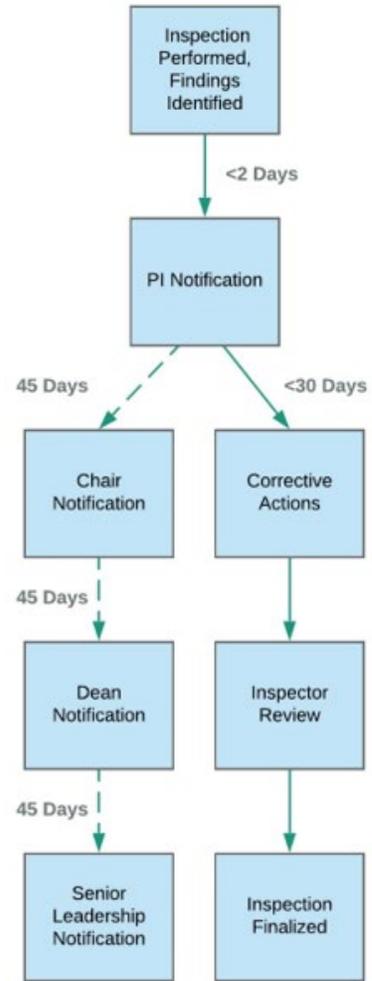


- 1) Faculty, students and staff have the authority and responsibility to alert affected individuals engaged in unsafe work believed to constitute an imminent danger. When an imminent danger is recognized:
 - a) Alert the affected individuals and request the work be stopped immediately.
 - b) Call UMPD Emergency (301-405-3333) to report the incident to ESSR for investigation.
 - c) Notify the principal investigator.
- 2) The Vice President for Research, Senior Vice President and Provost, college Deans and Chairs, the Executive Director of ESSR, including ESSR staff acting in accordance with delegated regulatory authority (e.g. State Fire Marshal), may stop or shut down research activities where serious regulatory risks and/or serious health and safety risks are found to be unmitigated.
 - a) The Executive Director of ESSR shall confer with senior leadership (Vice President for Research, Dean, or Chair) in determining a measured response. This includes notification to the Senior Vice President and Provost for areas impacting teaching operations. Research compliance committees are notified as required.

- 3) Immediate notification is made to the principal investigator. A corrective action plan is developed in collaboration with ESSR.
- 4) Normal operations shall not resume until the corrective actions have been completed, reviewed and approved by ESSR. The Executive Director of ESSR, or their designee, will confer with Senior Leadership as appropriate.

Research Space Inspection Communication

- 1) Deficiencies that are an immediate danger to life and health will be addressed immediately, following the above protocol.
- 2) Non-compliance with federal, state, and local regulations, established safety and compliance programs, including this *Research Safety Standard* are recorded as safety inspection findings by ESSR and provided to the principal investigator in the form of a SciShield generated inspection report.
- 3) Inspection reports are provided within 2 business days of the inspection.
- 4) Inspection reports shall have the following elements: description of findings, suggested corrective actions, and a timeline for correction. Note, alternative corrective actions may be submitted to the ESSR inspector for review and approval.
- 5) Principal investigators will have 1 week to acknowledge the inspection report, and 30 days to close out the finding.
- 6) Inspection findings that are not closed out within 45 days, will be communicated automatically to the Department Chair where the lab is assigned.
- 7) If not corrected within 45 days after Chair notification, the communication is provided to the Dean.
- 8) After an additional 45 days, the Vice President for Research is informed.
- 9) This timeline represents the maximum allowable time assuming the inspection in question contains low severity findings.
- 10) Projects that incur resources or time to correct can be placed into a “communication escalation hold” – after actions to place work orders, procure required equipment, etc. are initiated and communicated to ESSR.
- 11) ESSR reserves the right to adjust this timeline in accordance with the severity of the findings and may escalate notification more quickly for severe findings.
- 12) Repeat non-compliance, severe deficiencies (e.g. willful non-compliance) may escalate directly to senior leadership (i.e., Dean, Vice President of Research) as circumstances dictate. ESSR will communicate with principal investigators any deviations in the standard communication path described above.



Resolving Disputes

- 1) A principal investigator may formally dispute either general inspection findings or a shutdown. Exception to this is where one of the parties has delegated regulatory authority and is acting in a regulatory capacity.

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- a) For a general inspection finding, the principal investigator may contact the inspector directly. If the dispute cannot be resolved with the inspector, the principal investigator may contact the Assistant Director Research Safety, or the Executive Director ESSR.
 - b) For a laboratory shutdown order, the principal investigator may contact the Executive Director ESSR, the Dean, Chair and senior leadership, as appropriate. The operation in question shall remain in a shutdown state until an agreement is reached lifting the laboratory shut down order.
- 2) ESSR will review the inspection finding, applicable regulatory mandates, and the information provided by the principal investigator. When practical to do so, and as not to expose the university to regulatory and health and safety risks, consideration will be given to alternative approaches for achieving compliance.

Research Safety Standard Procedure Adoption History

Date Approved by LOSC: 10/30/2020

Date Approved by VPR: 1/28/2021

Effective Date: 1/28/2021

Research Safety Standard Procedure 6: SciShield

This Research Safety Standard Procedure applies to all faculty, staff, students and visitors entering University facilities where hazardous materials such as chemicals, biological materials, radioactive materials are used, handled or stored, where work with animals is present, and where hazardous equipment and hazardous operations are occurring. The principal investigator may require more restrictive requirements based upon specific hazards. Deviations that are less restrictive must follow the process outlined in the “Exemptions” section of this Standard.

The University of Maryland purchased and implemented the SciShield platform in order to centrally manage research safety inspections, training, and Institutional Biosafety Committee protocol submissions. This platform streamlines compliance by allowing both ESSR and laboratories to manage research safety through a single portal.

SciShield Profiles

- 1) All laboratories, machine shops, animal care spaces, support spaces, and makerspaces must be registered in SciShield. Registration includes a principal investigator, the current list of laboratory hazards, spaces, personnel, and their associated job activities.
- 2) Short-term visiting researchers who are working in UMD lab facilities longer than one month, or who are granted unescorted access at any time, must be added to SciShield. If they do not have UMD CAS log-in credentials, contact labsafety@umd.edu.
- 3) Building and room numbers of all research spaces must be sent to labsafety@umd.edu.
- 4) Shared spaces are listed under every laboratory principal investigator that uses that space.
- 5) All machine shops and makerspaces (facilities support and research support) must also be registered in SciShield. In these instances, the shop manager will be considered the principal investigator.

Bi-Annual Certification of SciShield Laboratory Profiles

Principal investigators must certify that laboratory profile information (e.g., personnel, spaces, and hazards) is accurate at least twice per year, as prompted by SciShield. This action cannot be delegated to other laboratory personnel.

Inspections

All safety related inspections of laboratories, machine shops, makerspaces, and animal housing/care spaces will be conducted through the SciShield system. All correspondence regarding inspection findings must be conducted and/or recorded through the response section on the inspection report.

IBC Registration

- 1) UMD laboratories working with biological research that involves infectious and/or recombinant material must register using the SciShield with the Institutional Biosafety Committee for review and oversight per federal and institutional requirements.
- 2) Laboratories working with biological materials that are neither infectious or recombinant are expected to register their work in SciShield for “acknowledgement” by the Biosafety Office.
- 3) A laboratory must be “Bio-enabled” in order to have access to the SciShield tab where they can describe biological materials and research processes, as well as submit protocols to the IBC. If a lab is not “Bio-enabled”, contact biosafety@umd.edu. Once “Bio-enabled”, the ‘Bio’ tab will appear at the top of the lab page and the registration process can begin.

Research Safety Standard Procedure Adoption History

Date Approved by LOSC: 10/30/2020

Date Approved by VPR: 1/28/2021

Effective Date: 1/28/2021

Research Safety Standard Procedure 7: Working Alone

This Research Safety Standard Procedure applies to all faculty, staff, students and visitors entering University facilities where hazardous materials such as chemicals, biological materials, radioactive materials are used, handled or stored, where work with animals is present, and where hazardous equipment and hazardous operations are occurring. The principal investigator may require more restrictive requirements based upon specific hazards. Deviations that are less restrictive must follow the process outlined in the “Exemptions” section of this Standard.

Working Alone

- 1) Working alone is defined as working when no other person could see or hear calls for help during an emergency. Working alone with hazardous materials or conducting hazardous operations, especially after normal work hours, should therefore be avoided, as it increases the potential for delays in receiving emergency support and it could be critically dangerous if a researcher is injured and unable to call for help.
- 2) The principal investigator has the responsibility to approve or prohibit researchers to work alone after conducting a hazard review and documented risk assessment. Approval is to consider the risks present, potential emergencies/incidents and the experience and proficiency of the researcher.
- 3) Principal investigators must develop a rule for working alone, communicate and train researchers on it. The rules for working alone may be incorporated directly into specific SOPs.
- 4) No one shall be permitted to perform an unfamiliar or highly hazardous procedure when alone in the lab.

Protecting Unique Populations

- 1) *High School Students:* High school students are never permitted to work alone in a research laboratory, even with non-hazardous materials.
- 2) *Undergraduate Students:* Undergraduate students are never permitted to work alone with hazardous materials or equipment in a research laboratory.

Field Research Locations

- 1) Lone workers in field research environments (including boating) must have access to a means of emergency communication and a preplanned “check-in” protocol with a university contact.
- 2) Procedures for responding to a missed “check-in” must be developed by the principal investigator with the researcher, prior to trip departure.
- 3) Check-in frequency and escalation procedures may differ based on field location and situation.

Remote Research Work

- 1) Remote research work must be approved by the principal investigator.
- 2) Hazardous materials are not authorized to be transferred or shipped to a researcher’s private residence.

Research Safety Standard Procedure Adoption History

Date Approved by LOSC: 10/30/2020

Date Approved by VPR: 1/28/2021

Effective Date: 1/28/2021