

General Laboratory Safety Training



Scott Householder
Chief Safety Officer



Karen Cera
Safety Manager



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Safety Coordinator

Contact The LLE Safety Team with your questions and concerns

Emergency phone numbers



LLE Receptionist (West lobby)	(585) 275-5101
UR Public Safety *campus blue phones connect to public safety directly	(585) 275-3333
Local emergency services (Fire, Police, Ambulance)	911
Blood exposure hotline	(585) 275-1164

Add these emergency contact numbers to your cell phone now

The stickers on lab/desk phones provide dialing instructions for internal phones, specifically

Emergency Numbers
During working hours:
5-5101
After hours:
9-911

This presentation has two parts



- **Part I** is mandatory for all persons who have “badge access” to LLE
 - Part I is sufficient for office workers and persons who only visit laboratories as an escorted observer
- **Part II** is required for persons who
 - Work in or enter LLE laboratories without an escort (including facility mechanics, cleaning staff)
 - Supervise laboratory activity (e.g., line managers who supervise lab research)

Note: G_005 – “Safety Training for Guest Workers at LLE” is generally recommended for Guest Workers (those not regularly working at LLE), and satisfies the training requirements to obtain badge access to LLE. It is NOT necessary to complete both G_001 and G_005.

Outline



Part I – General Safety

- **Overview**
- **Fire safety**
- **Medical emergencies**
- **Laboratory access and visitors**
- **Computer and network safety**
- **Controlled Information and Export Control**
- **Ergonomics**

Part II – Laboratory Safety

- **Buddy system**
- **Personal Protective Equipment (PPE)**
- **Lockout/Tagout**
- **Incident reporting and investigation**
- **Contractors & guests**
- **Safe work practices**

Part I – General Safety

Employers and employees both have responsibilities to keep the workplace safe



The Occupational Safety and Health (OSH) Act of 1970¹ states:

(a) Each employer

(1) shall furnish ... a place of employment which is **free from recognized hazards** that are ... likely to cause death or serious physical harm to employees;

(2) **shall comply** with occupational safety and health standards promulgated under this Act.

(b) Each employee shall comply with occupational safety and health standards and all rules, regulations, ... applicable to **his own actions**

1) Excerpted from Occupational Safety and Health Act of 1970, General Duty Clause, Section 5

LLE has a proactive safety program to ensure the safety of personnel and protection of equipment



- Everyone must actively participate in making LLE a safe workplace
- Training, procedures, and qualification are critical elements of LLE's safety program
- Compliance with safety procedures and manufacturers' recommended operating procedures is mandatory
- Incidents are investigated and actions taken to prevent recurrence
- Laboratories are inspected every 6 months
- LLE's "Safety Zone" web site contains training information

No one is expected OR PERMITTED to undertake a job until having received instructions on how to do it properly, and authorization to perform it

Workers need to be aware of work area hazards



- Each work area is dynamic and presents unique hazards
- LLE informs workers of hazards by training, signs, and other communications
- Some of the hazards that may be present at LLE include:
 - Electromagnetic radiation (laser, x-ray, ...)
 - Radioactive sources (neutron, beta, electron, ...)
 - High-pressure gas and large volume vacuum systems
 - Cryogenic fluids
 - Chemicals, beryllium, lead, silica dust
 - High voltage
 - Working aloft (e.g., ladders, lifts, platforms)
 - Rotating machinery
 - Rigging operations

You must restrict your activities to those for which you are *trained, qualified, and authorized*

Never undertake a job that appears unsafe



- A **hazard** is a condition that poses a threat to life, health, property, or environment.
- The probability of a hazard causing harm increases with:
 - carelessness, ignorance, or failure to follow procedures
 - defective equipment
 - equipment or techniques unsuitable for a specific task
 - unforeseen circumstances
- Hazards that are **not adequately mitigated** may allow unsafe conditions to persist
- Hazards can be mitigated only when they are identified **and their full implications are understood**

Effective hazard mitigation requires thorough understanding

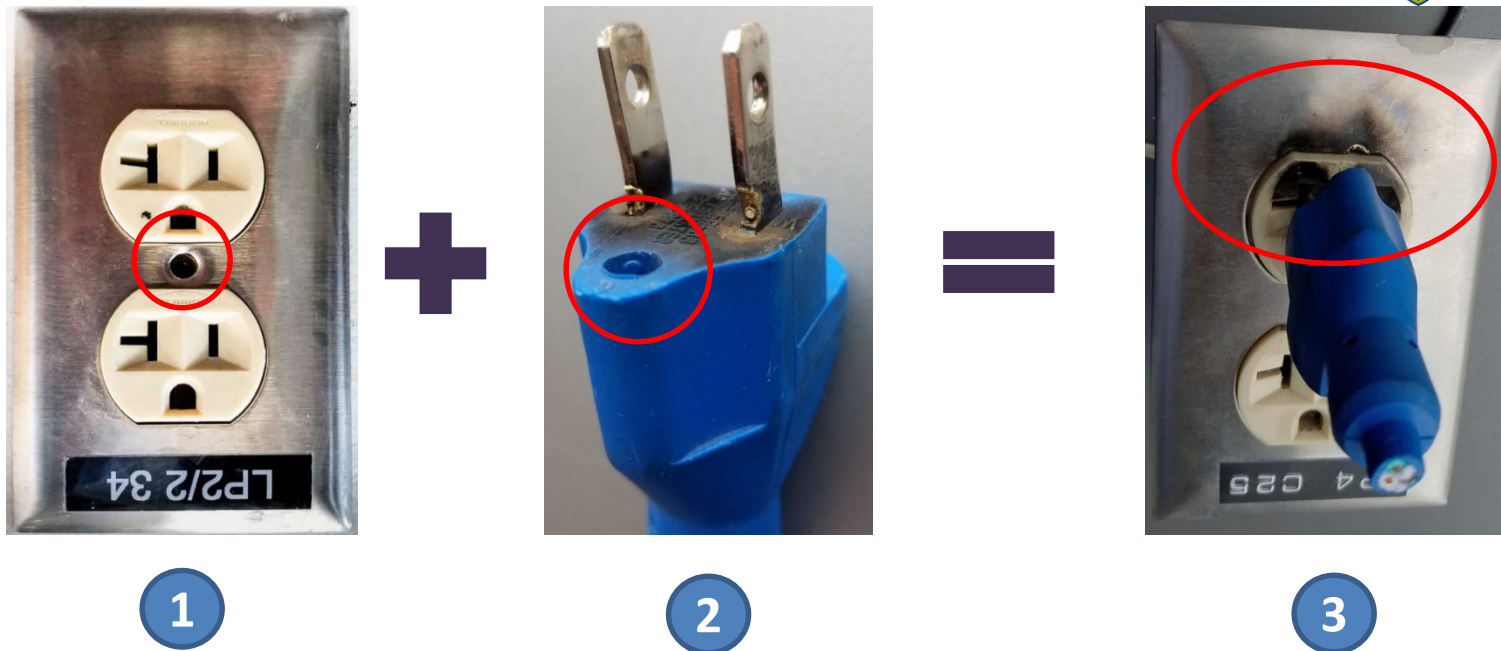
Report safety concerns immediately



- Bring safety concerns to the attention of persons with the **knowledge and authority** to rectify the situation
- Everyone has the right and RESPONSIBILITY to “**Stop Work**” if they perceive an imminent danger
- An **imminent danger** is a hazard or unsafe practice that presents an **unacceptable risk** of injury, environmental impairment, or property damage
- **STOP, get the right people involved** to resolve the problem:
 - Experienced co-workers, supervisors, Shot Directors, Safety Officers, and/or the Laser Facility Managers
- If you believe a safety issue is not being addressed, inform the Safety Manager or Chief Safety Officer

An employer may not take unfavorable personnel action for reporting a workplace safety deficiency when the complaint is made in good faith

Defective equipment can cause serious hazards



1. The cover-plate screw is missing (*note: this photo was staged*)
2. The ground conductor is missing, the connector blades are burned
3. The cover plate fell onto the plug which caused arcing

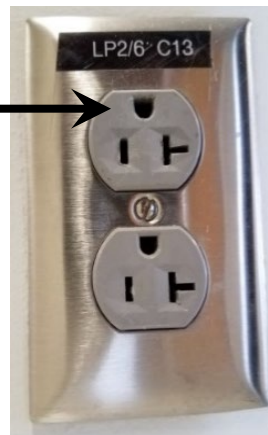
**Inspect equipment each time you use it, and use it properly.
Never knowingly use defective equipment.**

Ref: LLE Incident Report (IR) 253 – Electrical outlet fault

Why does it matter?

- The plate fell onto the plug because the screw was missing
- The missing ground pin created two shock hazards:
 - The appliance was not grounded
 - Power polarity was reversed; shutting off the appliance power switch may not have disconnected power from the appliance
- The outlet was installed with the live contacts facing up (permitted by code; preferred orientation is with the ground pin up)
- The broken outlet indicates mishandling of appliance plugs (e.g., forceful “wiggling” to remove them)

Preferred outlet
orientation:
Ground pin up



Your Job Hazard Assessment (JHA) is the first element of your safety training

Job Hazard Assessment

Name: _____
 Title: _____
 LLE Division: __ Admin; __ Engineering; __ Experimental; __ OMEGA Facility;
 __ Theory; __ Other Affiliation: _____
 Position: __ LLE Staff; __ Faculty; __ Contractor; __ Co-Op/TAR
 __ UR Undergraduate Student; __ UR Graduate Student
 __ Other _____
 Status: __ New Hire; __ Current; __ Re-Hire
 Room: _____ Phone: _____ E-mail: _____

All persons must obtain required safety training before undertaking related job duties and must keep training current as long as those duties continue.

Supervisors are responsible for ensuring that subordinates receive required safety training before undertaking related job duties and for ensuring that training is kept current at all times. Review the course descriptions below and check all that are applicable for the above named employee to conduct his/her duties.

New Personnel:

The supervisor must sign this form and submit it to the Laboratory Director's Executive Assistant (EA) prior to the new employee checking in. The employee's signature will be obtained during the check in process.

Current Personnel:

Review safety training course descriptions below and check all that are applicable to current or planned job duties. Initial bottom of each page where indicated. Review with supervisor and obtain his/her signature, then return to the Laboratory Director's Executive Assistant.

Employee's Signature _____ Date: ____/____/____
 Supervisor's Signature _____ Date: ____/____/____

ID	Title (Periodicity)	Required Attendees	Description	Comments
<input type="checkbox"/> C_001	Chemical Safety (12 months)	Persons who work in a laboratory with chemicals, hazardous materials and solvents, or persons who handle, work with, store, or dispense chemicals, hazardous materials and/or solvents.	Review of UR's Chemical Hygiene Program; Safe work practices; Hazard communications; MSDS; personal protective equipment; Hazardous Waste Management.	New personnel. Requires signature of Chemical Safety Officer after completing quiz.
<input type="checkbox"/> C_002	Beryllium Safety (12 months)	Persons who store, handle, process or use beryllium; those who handle potentially contaminated equipment, or enter the target chamber; supervisors of persons conducting the above activities.	Beryllium (Be) health hazards; LLE Instruction 6708; Policy for Be use and handling. Prerequisite: C_001	New personnel. Requires signature of Chemical Safety Officer after completing quiz.
<input type="checkbox"/> C_003	Formaldehyde Safety (12 months)	Persons who work with formaldehyde.	Specific procedures and protocols for working with formaldehyde at LLE. Prerequisite: C_001	~ 30 min Web-based

- The JHA defines
 - risks associated with your work, and
 - required training
- The JHA must be updated with input from you and your supervisor
 - annually
 - when job duties change

JHA changes must be approved by your supervisor

Safety training presentations, quizzes, and status reports are available on-line





LABORATORY FOR
LASER ENERGETICS
UNIVERSITY OF ROCHESTER

LLE Today About Omega Laser Facility Education Publications **Safety** Phonebook → URLLE → University of Rochester 🔍

Safety | Medical Emergency | PPE | **Safety Training** | Chemical | Electrical | Fire | Radiation

SAFETY TRAINING


MY TRAINING
(password required)


SAFETY SUGGESTION BOX

Welcome Karen Cera
Select the Training Report options below.


Display on the Screen

Send the Report via E-Mail

Report on those who report to me

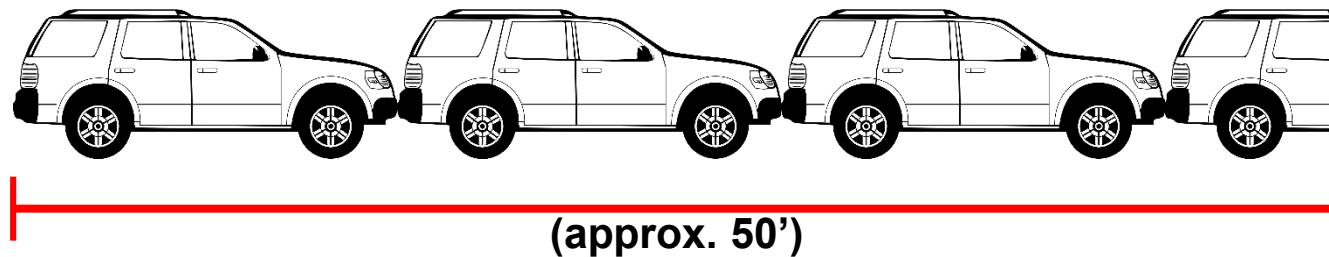
Also report on all subordinates

Submit

	Chemical Safety	Related links
C_001	Chemical Safety and Hazardous Waste Management	Chematix Instru Chematix Waste Hazardous Was
	Quiz	

Emergency evacuation may be required in response to a fire, bomb threat, active shooter, gas leak, et al.

- Move at least 50 feet from the building and emergency equipment

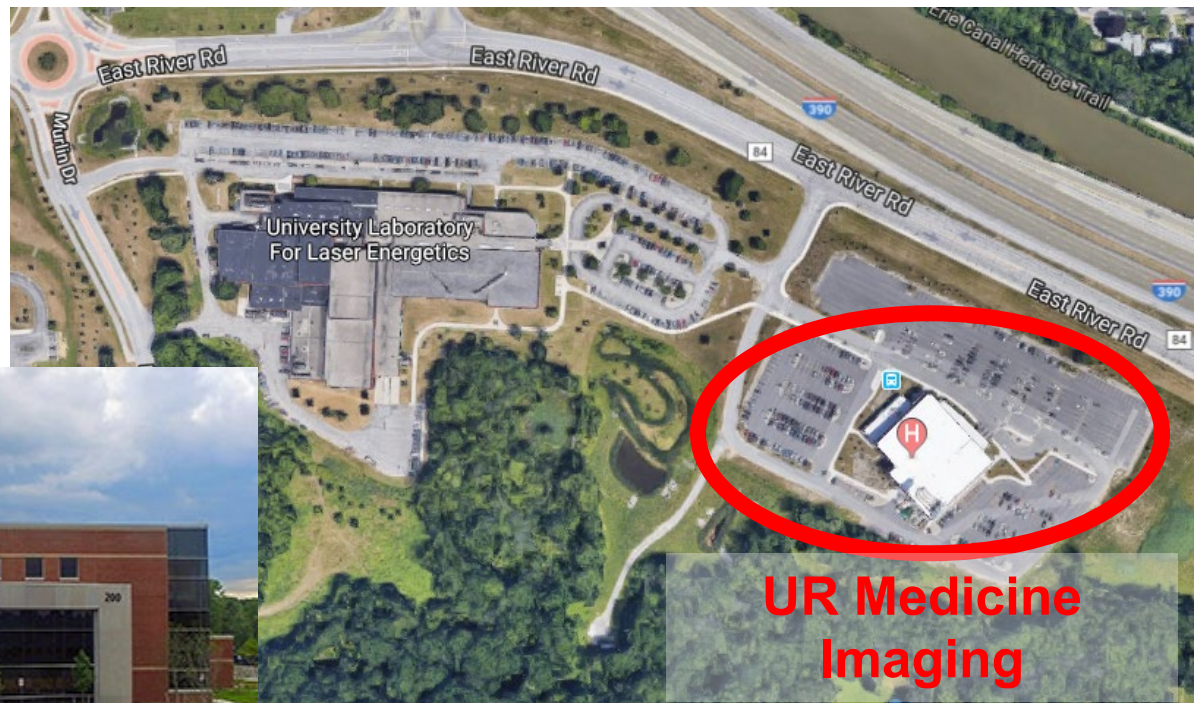


- ***DO NOT*** re-enter the building until alarms are silenced and beacons are off
- LLE hosts are responsible for their guests during an emergency

The UR Medicine Imaging is LLE's assigned meeting location during an emergency evacuation



If an emergency prevents employees from re-entering LLE, employees may shelter at UR Medicine Imaging at 200 E. River Rd (first building east of LLE)



Respond immediately to fire alarms



Activate the nearest fire alarm if you become aware of smoke or fire

Evacuate; use stairs



Assist those in need

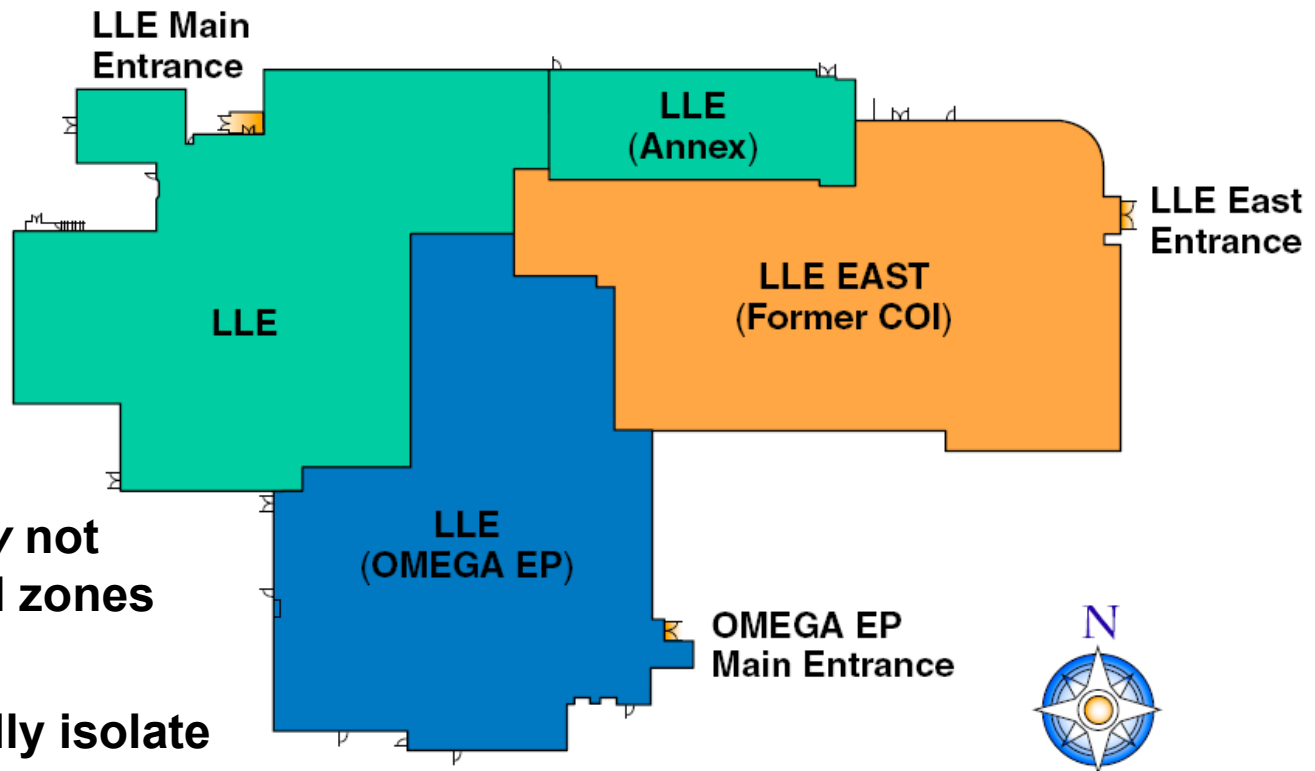


Close windows and doors



Fight fire only if you have been trained

LLE has three fire alarm zones



- Alarms *may* not sound in all zones
- Fire doors automatically isolate affected zones
- You are not required to exit if the zone you are in is not in an alarm state
- You may move into a zone that is not in an alarm state, *only* if it is along your most direct egress path

Fire Safety - Do your part!



Do:

- Use only electromagnetic safety latches to hold fire doors open
- Maintain 18" clearance around fire sprinkler heads
- Maintain clear access
 - $\geq 48''$ through hallways, around doors
 - $\geq 36''$ around electrical panels, fire extinguishers, and fire alarm pull stations
- Minimize storage of flammable materials
- Inform a Safety Officer of faulty safety equipment (exit light, fire extinguisher, etc..)



These boxes are too close to the sprinkler, limiting effective coverage



Fire Safety

Do not:

- Prop fire doors open
- Store items on electrical raceways
- Attach items to, or drape items over, fire sprinklers or pipes
- Park within 15 feet of a fire hydrant

Mag. Latch OK



Door prop NOT OK



Raceway storage NOT OK

Fire Safety – Personal Appliances



Personal appliances can pose fire risk; others may generate smoke setting off the building alarm system.

Not allowed:

- **Halogen lights**
- **Personal space heaters**
- **Microwaves***
- **Toasters***
- **Coffee makers***

Allowed:

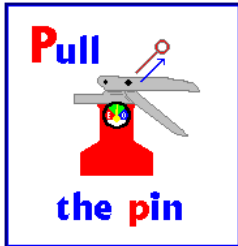
- **Refrigerators**
- **Fans**
- **Desk lamps**
- **Decorative lighting**

***For these or additional items not listed, check with the Safety Office**

UR has designated LLE as a “Fight Building”

- LLE personnel are **NOT** required to fight a fire
- **Trained** personnel **MAY** fight a fire after:
 - Activating the building fire alarm
 - Assisting persons in immediate danger
 - Assessing the risks (*follow your instincts!*)
 - Is there heavy smoke or strong odor?
 - Is fire small and contained?
 - Is there an unobstructed exit?
- **Evacuate immediately** if:
 - the fire spreads beyond the point of origin
 - the fire could block your exit
 - one fire extinguisher is insufficient

Learn how to use a fire extinguisher



Pull the pin.
This will allow you to discharge the extinguisher.



Aim at the base of the fire.
You must hit the fuel, not the flames



Squeeze the top handle or lever
Start using the extinguisher from a safe distance, then move forward.



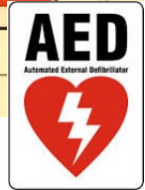
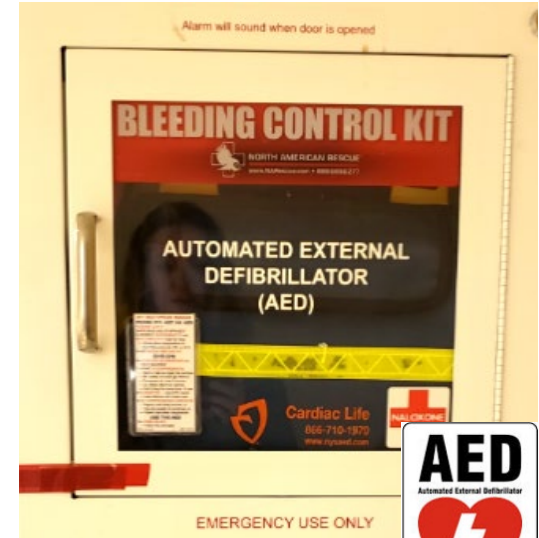
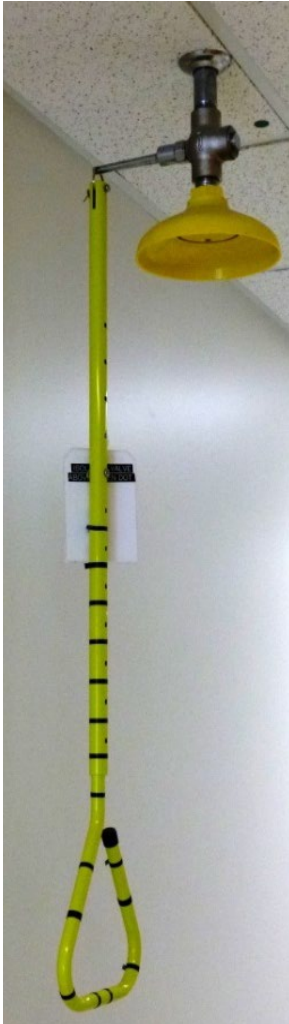
Sweep from side to side
Once the fire is out, monitor the area in case it re-ignites.

Source: <http://ehs.okstate.edu>

TYPES OF FIRES		TYPES OF EXTINGUISHERS	
CLASS A	ORDINARY COMBUSTIBLES: wood, paper, rubber, fabrics and many plastics		CLASS A
CLASS B	FLAMMABLE LIQUIDS & GASES: gasoline, oils, paint, lacquer and tar		CLASS A:B
CLASS C	FIRES INVOLVING LIVE ELECTRICAL EQUIPMENT		CLASS A:B:C
CLASS D	COMBUSTIBLE METALS OR COMBUSTIBLE METAL ALLOYS (NO picture symbol)		CLASS A:C
CLASS K	FIRES IN COOKING APPLIANCES THAT INVOLVE COMBUSTIBLE COOKING MEDIA vegetable or animal oils and fats		CLASS B:C
			CLASS D
			CLASS A:K

Source: <http://www.fireservicepro.com>

Learn where to find and how to use emergency equipment



Alarms inside individual labs indicate the potential for an oxygen deficient atmosphere



If alarm sounds:

- Exit the area *immediately*
- Call 9-1-1 if anyone is unable to exit the space
- Call a responsible person listed on the door sign to report the issue

LLE Personnel are not permitted to enter an oxygen deficient atmosphere

Medical emergencies require a rapid response

- During working hours (M-F, 8:15am – 5:15pm)
 - Call an LLE receptionist to report it. The receptionist will notify the LLE's First-Responders
 - If no response, call 911
- Off-hours (nights, weekends)
 - Call 911
 - UR Public Safety will automatically be dispatched to assist with building entry
- Report all workplace injuries* to LLE Human Resources (HR); (Dave VanWey, Steve Stagnitto)
 - HR will prepare and submit a [UR Employee Incident Report](#)

* see [UR Policy 271](#) – Workers' Compensation Insurance

Voluntary First Responder
Training is offered twice a year

Emergency Numbers
During working hours:
5-5101
After hours:
9-911



*Please note the location of the phone
in any lab which you are working

Remain calm when seeking emergency assistance



Provide detailed information to avoid delays:

- Your exact location (e.g., “OMEGA Target Bay, top deck, South-West side”)
- Your name and phone number
- Description of the emergency (e.g., hand injury, breathing difficulty, chest pain, ...)
- Enlist help; give simple, clear instructions, e.g.,
 “Amy – notify the receptionist”, “Joe – get a first-aid kit”
- Stay with the injured person until more qualified help takes over
- Begin first-aid if you know how



Know where the LLE's 5 AEDs are located



- First aid kits are in all restrooms and next to each AED (locations identified on the [LLE Building Map](#))
- Be familiar with the contents
- Notify a safety officer if supplies are missing or deficient

Know how to respond to a Medical Emergency



- **Secure area hazards** or move the patient to a safe location
- **Avoid exposing yourself to hazards** such as fire, laser beams, radiation, electricity, chemicals, or body fluids
- **Wear PPE.** First-aid cabinets contain gloves, face mask, goggles, and a resuscitation mask to protect the care givers
- Cleanroom garments are not required when responding to emergencies

If you contact body fluids (blood, saliva, ...), promptly call the Occupational & Environmental Medicine (OEM) **Blood Exposure Hotline 585-275-1164**

Medical Emergency follow-up

- If in doubt about a patient's safety, or if a patient exhibits any of the following, call for an ambulance:
 - Altered mental status
 - Potential threat to self or others
 - Unable to verbalize rational reasons for refusing care
 - Encourage the patient to seek medical evaluation and treatment
 - The patient may refuse medical treatment if he/she is mentally competent
 - Report all workplace injuries* to LLE Human Resources (HR); (Dave VanWey, Steve Stagnitto)
 - HR will prepare and submit a [UR Employee Incident Report](#)
- * see [UR Policy 271](#) – Workers' Compensation Insurance

Failure to promptly report a workplace injury can jeopardize the patient's right to receive Workers' Compensation Benefits

What would you do if you observe, or are the victim of a robbery or an assault?



Prepare for the unexpected!

- **STAY AWARE** of your surroundings. Alertness is your best defense
- **TRAVEL WITH OTHERS.** There is safety in numbers
- **LIMIT** use of personal electronic devices when in public
- **DO NOT ARGUE** with a suspect or force a confrontation
- **STAY CALM** and observe everything taking place
- **NOTE** the suspect's direction and means of travel; do not chase or follow!
- **HAVE A PLAN!** what you might do - think about alternatives
- As soon as it is safe to do so, call UR Public Safety from a Blue Light Emergency Phone (275-3333). Off campus, call 911

LET IT GO! Property can be replaced, but *you are one of a kind*

LLE building infrastructure policies

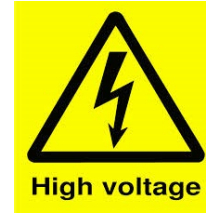
LLE staff (other than facility personnel) are NOT permitted to:

- **Modify any laboratory infrastructure including but not limited to:**
 - **Electrical power distribution and permanent fixtures**
 - **Water, chilled water, and house gas (compressed air & nitrogen) distribution**
 - **Permanent infrastructure, including walls, doors, floors, fume hoods, etc.**
- **Open circuit panels or enable/reset/disable circuit breakers, except when part of written and approved procedures**



Don't open circuit panels or enable/reset/disable circuit breakers

LLE electrical safety policies



- **High-voltage definition: 50 volts or greater**
 - **Do not repair any high-voltage equipment. Contact an Electrician or the LLE Electronics shop if repairs are needed**
- **Extension cord safety:**
 - Do not exceed the manufacturer's load rating
 - Do not “daisy-chain” cords (connect in series)
- **Equipment used at LLE must be Underwriters Laboratory (UL) certified, or approved by the Electrical Safety Officer**
- **Orange outlets provide “clean” power for instruments. Don't connect pumps, motors, etc..**
- **High-voltage diagnostics Lockout/Tagout guidelines are documented in S-SA-M-060**



Access to LLE is restricted to provide physical, personal and facility security



- **Building access is controlled by card readers and receptionists**
- **Visitors must sign in with a receptionist, wear visitor badges, and wait for an LLE staff member to escort them to their destination**
- **LLE Staff must sign in and out at a reception desk when in the facility during non-working hours (Friday 5:15pm - Monday 8:15am)**
- **Never allow people to enter LLE to use the phone, bathroom, get a drink, etc. unless they are personally known or escorted by you.**
- **Before you leave the building, make sure the path to your vehicle is safe. Wait inside the building if you observe unusual vehicles or suspicious activities.**

**Call UR Public Safety (585) 275-3333
to request an escort to your car**

Be observant



Do not allow unfamiliar people to enter LLE when the receptionist desk is not staffed.

If someone you do not recognize tries to follow you inside, refuse entry and insist they use their UR ID card to gain entry.

If you grant entry to someone who is here for a legitimate purpose, YOU are responsible for staying with them until you hand them off to the person they came to see.

Since UR Medicine Imaging opened at 200 East River Road, many patients have come to LLE mistakenly. Redirect people to the Imaging Center when appropriate.

Report instances of suspected unauthorized building entry or any suspicious activity to UR/LLE Facility Security Officer

All persons are required to wear UR/LLE issued ID or visitors badge, where it is readily visible, while in the building

Guest and Visitor access



- **Non-US citizen visitors must be preapproved by the Director's office (see [LLE Instruction 5100](#))**
 - **LLE host must contact the Executive Assistant to the LLE Director 60 days before planned visit**
 - **This rule applies to vendors and contractors**
 - **UR faculty and UR students are exempt from this rule, but must sign in at the reception desk and be hosted by an LLE employee**
- **Tours >4 people must be scheduled with the Director's office**
- **Photos are allowed in viewing galleries**
- **Responsible Supervisor must authorize visitor access in technical areas (labs, cleanrooms, shops, Omega Laser Facility)**
- **LLE Employees, and students with LLE badge access, may bring family members who are U.S. Citizens into LLE viewing galleries on evenings & weekends (technical areas are prohibited)**
 - **LLE hosts and their guests must sign-in to the after hours log**
 - **The LLE host is responsible for, and must remain with their guests at all times**

Questions? Contact Facility Security Officer (FSO) Grant Mark

Carefully control information you have access to, and items assigned by LLE/UR



- **University ID badge**
 - If you misplace your ID badge, report it immediately to FSO Grant Mark (274-0744) and the ID Card office (273-2000)
- **Computer accounts & passwords**
- **Confidential information**
- **Radiation badges**
- **Keys**
- **Mobile devices**

The University enforces strict policies regarding handling of confidential information. University IT Policies are found [here](#), including:

- [Data Security Classifications Policy](#)
- [Mobile Computing Device Security Standards](#)

Individuals are personally responsible for appropriate use of these things. Improper use may result in termination.

LLE's Computer and network policies are designed to prevent costly problems



LLE's Information Technology (IT) group has identified key things you should know about accessing or using computer or network resources:

- 1. Never connect or disconnect cables from a computer or network device without explicit permission from IT. Limit your activities to specific cables, devices, and network ports you are authorized to work on.**
- 2. Do not change the network settings on any LLE network device w/o IT approval.**
- 3. Laptops that connect to ANY University network must be up to date with security patches and have University approved anti-virus protection.**
- 4. Treat all email as suspicious until proven otherwise. Don't click links or open attachments unless you recognize the sender and understand why they sent you a link / attachment.**

Computer and Network Safety (cont.)



- 5. Do not leave desktop computers powered off without contacting IT.**
- 6. Save important LLE files on network shares, not on your computer.**
- 7. Mobile devices (phones, tablets, laptops, etc..) that access any LLE resources (mail, files, etc..) must be password protected by a strong screen lock (Password, Biometric, Long PIN).**
- 8. Passwords or passphrases used for LLE accounts should not be used for other accounts (personal or business). IT recommends the use of a password manager/vault, such as Keeper, Bitwarden or KeePass.**
- 9. Never open a computer chassis without assistance from IT.**
- 10. Log off or lock your computer screen when you are away from your desk.**
- 11. Disconnect VPN when access to the LLE computer network is not needed**

If you have any questions about ANY of these rules, contact IT for answers and/or clarification

Controlled Unclassified Information (CUI)



- **Controlled Unclassified Information (CUI) is unclassified information that requires safeguarding pursuant to and consistent with applicable laws, regulations, and government-wide policies. CUI does not include classified information.**
- **What are some examples of CUI at LLE?**
 - Personally Identifiable Information (PII)
 - Export Controlled hardware and software (EC)
 - Unclassified Controlled Nuclear information (UCNI)
- **CUI classification should not be used to**
 - Conceal violations of the law, inefficiency, or administrative errors
 - Prevent embarrassment to a person, organization, or agency
 - Prevent open competition
 - Control information that does not require protection under a law or regulation

Export Control (CUI/EC)



- **LLE reviews new software and/or hardware to determine if it is subject to any Export control restrictions.**
- **Any identified restrictions and the required necessary safeguards are discussed with the relevant individuals holding or using the item(s)**
- **Transferring Export-controlled information in any form (e.g., physical delivery, verbal communication, email, software, etc.) may be “deemed” an export.**
- **The Federal agencies that enforce the laws and regulations governing the export of physical items, technical data, and information important to the US are:**
 - International Traffic in Arms Regulations (ITAR) – covers Defense related items, administered by the US Department of State
 - Export Administration Regulations (EAR) – covers dual use items (used for both defense and civilian purposes), administered by the US Department of Commerce

Significant penalties apply to persons and entities that commit export control violations.

Controlled Information and Export Control



- **LLE's compliance is managed by the Export Control and Intellectual Property Committee (ECIPC). The ECIPC works in conjunction with the Campus ORPA Export Control Office and the Office of Council.**
- **If you manage items or information that may be controlled, or have any related questions, please contact:**
- **Pat McKenty (ECIPC Chair)**
 - **Email: pmck@lle.rochester.edu**
 - **Phone: 585-275-3865**

If in doubt, ASK!

The UR Ergonomics Program reduces the incidence of work-related musculoskeletal disorders



- **Musculoskeletal Disorders (MSDs) are injuries involving muscles, nerves, tendons, ligaments, cartilage, joints and spinal disk**
- **MSDs can be caused or aggravated by**
 - Repetitive motion
 - Poor posture & inadequate back support
 - Improper lifting techniques
- **The UR Environmental Health & Safety Occupational Safety group will assist with**
 - Worksite evaluations
 - Employee and supervisor training
 - Implementation of ergonomic control strategies

For more information, visit:

<http://www.safety.rochester.edu/ih/ergonomic/ergonomics.html>

AlertUR emergency notification system disseminates critical safety information to the University community



What is considered critical?

- In-progress police emergencies on University property and/or an imminent danger to the community
- Civil disturbances, acts of terrorism, fires that impact operations, release of hazardous materials and medical emergencies, which pose a severe threat to personal safety and/or cause a major disruption to University operations
- Warnings about natural disasters, health emergencies, and other dangerous occurrences connected to the University

To register, or change notification options, go to:

<https://alert.rochester.edu>

Safety is everyone's responsibility

- **Hazards** exist throughout the workplace and change over time
- Restrict your activities to those for which you are trained, qualified, and **Authorized**
- **Stop Work** if an abnormal event occurs or if an activity seems unsafe and **report** it *immediately*.
- **Be Prepared**. Know how to respond in an emergency
- **Prevent Unauthorized Access** to LLE
- Understand **Computer and Network Policies**
- **Prevent unauthorized dissemination** of controlled items

This is the last slide of Part I



- If you work in any LLE laboratory area or supervise laboratory activity, proceed to the next slide
- If you visit laboratories infrequently and only with an escort, you do NOT need to complete Part II

You must complete the [G_001_quiz](#) to satisfy your training requirement

Part II – Laboratory Safety

**Persons who perform or supervise laboratory work
MUST understand and comply with the information
presented in the following section**

Outline



Part II – Laboratory Safety

- **Buddy system**
- **Personal Protective Equipment (PPE)**
- **Lockout/Tagout**
- **Incident reporting and investigation**
- **Contractors & Guests**
- **Safe work practices**

Part II Summary



- **A Buddy must be present when working in potentially hazardous situations**
- **Understand the limitations of Personal Protective Equipment (PPE). Know what PPE is required for tasks assigned to you, and for the areas in which you work**
- **Summaries of several incident reports are presented to highlight lessons learned**
- **Guest workers are only permitted to perform pre-approved tasks**
- **Lockout/Tagout protects workers from unexpected hazardous energy release**
- **Incident investigations prevent recurrent problems**
- **Housekeeping can help mitigate hazards and prevent the spread of contamination**
- **Permits are required to perform energized work, hot work, or to enter a confined space**

Ensure that new and existing equipment is both safe to operate and operated safely



Anything, no matter how carefully designed and built, can be operated in a manner that renders it unsafe

- No equipment or diagnostic will be operated until requirements set forth in [LLE Instruction 7700](#) are satisfied
- Only qualified operators may operate Omega facility equipment, with authorization from the appropriate Shot Director or Laser Facility Manager
- Equipment will be installed by qualified personnel only, with authorization and coordination from the Laser Facility Manager, Engineering Group Leaders, and Facilities Engineering

Consider safety at all times

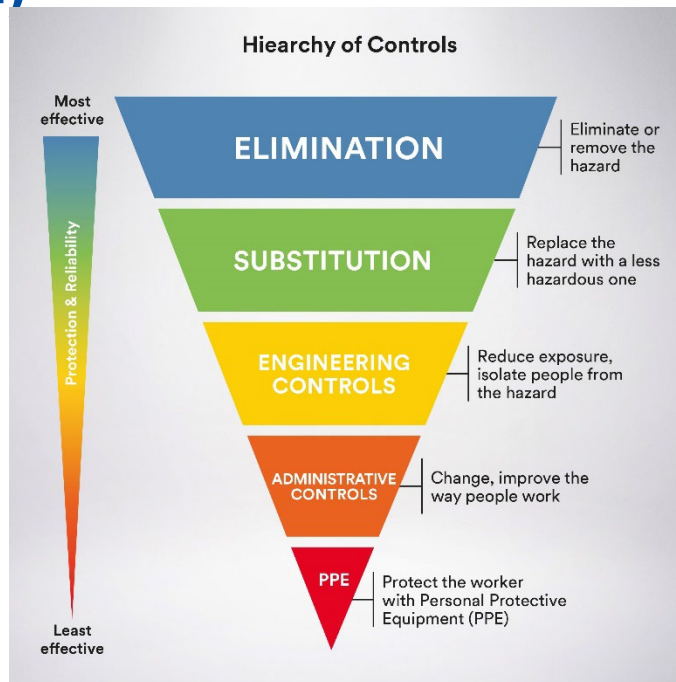
- **Good design practices** identify and eliminate hazards where possible, then minimize remaining hazards to an acceptable level (e.g., use \leq Class 3R laser for alignment)
- **Risks are mitigated to the maximum extent practical** by:
 - Eliminating the hazard
 - Engineering controls (interlocks, guards, pressure relief devices, ...)
 - Procedures and training
 - Administrative controls (restrict access, buddy system, ...)
 - Personal protective equipment (PPE)
- **Never alter, remove, or defeat Safety Features**
 - E.g., software and hardware interlocks, guards on moving machinery, electrical and laser enclosures. They may only be altered in special situations with review and approval from the relevant safety officer.
- **Keep documentation (procedures, schematics, drawings, etc.) accurate**
 - Stop and correct documents that are unclear or inaccurate
 - Obtain authorization before deviating from documents

LLE requires use of the Buddy System



- “Buddy System” means working with a partner when
 - Using potentially hazardous equipment or processes or
 - Working in a potentially hazardous environment
- Buddies are responsible for
 - Being available to assist in an emergency
 - Verifying that safe work practices are used
 - Remaining in contact with partner, and knowing they are OK
- **Workers must submit written plans for off-hours laboratory work to their Supervisor and obtain written approval prior to starting.**
 - Review:
 - Planned work hours
 - Activities being performed
 - Worker training and qualification
 - Buddy System implementation
- Sign in/out at the receptionist desk when working off-hours (Friday 5:15pm – Monday 8:15am)

Introduction to Personal Protective Equipment (PPE)



Training about the proper use of PPE is covered in other training modules

PPE is your LAST form of protection



- **When safety barriers fail, PPE is critical**
- **PPE is effective only when properly maintained and used**
- **Wear PPE correctly**
- **Many types of PPE are designed to withstand a single catastrophic event (e.g., hard hats, impact-resistant eyewear, fall arresters)**
 - **If such an event occurs, or if the PPE appears to be damaged, remove it from service immediately!**
- **Some PPE is designed for single-use to prevent spread of contamination (e.g., disposable gloves, mask, lab coat, ear plugs)**
 - **Discard single-use PPE after use**

Know the capabilities and limitations of the PPE you use, and use it accordingly

PPE is provided by LLE



- Many areas within LLE have signs indicating the specific type of PPE required.
- Each worker must know/understand what PPE is required **prior to starting** a task. Contact the work-area supervisor or a Safety Officer if there is any question about what PPE is needed
- Types of PPE include
 - Safety eyewear. Laser, chemical, and mechanical eyewear must meet ANSI Z87.1 impact resistance standard
 - Face shield (must be used with safety eyewear)
 - Hard hat
 - Respiratory protection (medical evaluation & fit testing required)
 - Gloves, lab coat
 - Safety shoes (required when moving items \geq 50 lbs = 22 kg)
 - Hearing protection
 - Fall protection

The user is responsible for inspecting PPE before every use

- Inspect PPE for wear and damage before each use
- Keep PPE clean and in good working order
- Verify the PPE selected affords the required protection
- Immediately remove damaged PPE from service; return it to the work area supervisor who will dispose of it and replace it
- Return PPE to the point of origin. Do NOT transfer PPE from one laboratory to another
 - For example: do not “upgrade” your laser safety eyewear from another lab, the wavelengths may not be compatible



**Avoid sharing PPE. Obtain your own PPE when possible.
Disinfect all shared PPE before use with 70% alcohol wipes or eq.**

OSHA specifies conditions requiring safety eyewear and/or face protection



“... when exposed to eye or face hazards from flying particles, molten metal, liquid chemicals, acids or caustic liquids, chemical gases or vapors, or potentially injurious light radiation” OSHA 1910.133(a)(1)

LLE requires safety eyewear in the following situations:

- **When required by signs or by the work area supervisor**
- **At all times in the following areas:**
 - **Omega Facility areas (e.g., Laser Bays, Target Bays, LaCave)**
 - **Any room where Class 3B or Class 4 lasers with free-space beam propagation are in operation**
 - **Machine shop, all chemistry labs, and mechanical rooms**
- **All persons working or passing within 20 feet of:**
 - **Activities that can generate particulate, debris, or projectiles**
 - **Chemical processes areas**
 - **Compressed gas and vacuum system operation**

All safety eyewear used at LLE must have side protectors and satisfy ANSI Z87.1 impact resistance standards

Electrical Safety Overview (LOTO and HV)

Lockout /Tagout (LOTO) ensures the safety of personnel who could be injured by the unexpected operation of equipment or release of energy while servicing or maintaining equipment

LLE's LOTO policy dictates:

- Locks shall be used to secure energy-isolating devices, unless it is infeasible, in which case a tag may be used
- The person who installs a LOTO device must also remove it*

See: [LLE Instruction 6300](#)

***Before a LOTO device is removed by someone other than the installer, management must attempt to contact the installer to determine the state of the equipment. The Chief Safety Officer must be informed of these situations.**



Lockout/Tagout (cont.)



- **Never use equipment that has a known or suspected safety deficiency**
 - **Stop using it immediately and contact the area supervisor or a Safety Officer to lock it out**
 - **Have it professionally repaired before returning it to service**
- **The LOTO must remain in place until**
 - **Repairs are complete and/or the equipment is deemed safe to operate**
 - **Or, a qualified individual is assigned to perform troubleshooting**
- **If equipment that you need is LOTO, contact the LOTO supervisor to determine the proper course of action to return an item to service**
- **Do not perform repairs for which you are not specifically trained and authorized**

Authorized Workers who perform lockout/tagout operations must complete [G 011 - LLE LOTO training](#)

An example of unacceptable practices (#1)



A belt guard was on the floor beside a vacuum pump during a safety inspection. No one was present, so the guard was reinstalled. On a follow-up visit, the guard was on the floor again. Student's explanation: "The motor doesn't start, so we spin the pulley by hand to start it"

The student knew that the equipment was defective. Rather than having it repaired, he used it with safety guards removed. What should have occurred?

- 1. Stop using the equipment immediately**
- 2. Lockout the defective item**
- 3. Contact a supervisor or a Safety Officer to arrange repairs**
- 4. Replace the item or have it professionally serviced**
- 5. The Safety Officer who replaced the guard should have locked out the equipment, then followed up with the user.**

LLE's Electrically Energized Work policy



Definitions

High-voltage: $\geq 50V$ potential relative to earth ground

Electrically Energized: High-voltage conductors are exposed

- Work on Electrically Energized equipment is permitted *only when essential*, and after an *Energized Work Permit* has been approved (see *E_003 – Energized Work Policy*):
 - If disabling power will affect critical safety systems
 - When necessary to evaluate operation of electrical equipment
 - **In all other situations, high voltage equipment MUST be LOTO before servicing**

ONLY qualified electrical workers (see [E 001 – Electrical Safety Training](#)) may work on high-voltage equipment or perform Electrically Energized Work

Hot Work requires a permit



Hot Work ¹ - Any operation that produces heat, sparks or flame

- **Persons conducting any task that includes hot work must complete [G 006 – Hot Work Training](#)**
- **Hot work permits are required for specific jobs, are site-specific, and of finite duration**
- **Purpose-designed hot-work areas (e.g., welding stations) can be approved for long-term use, and do not require task-specific hot work permits**

1) [UR EH&S Policy FS010](#) “Hot work procedures”.

http://www.safety.rochester.edu/fire/pdf/policyprocedure/FS_HotWorkProcedures.pdf

Incidents



Definition: A safety incident is any event that causes or *could have caused* personnel injury, significant equipment damage, or exceeding environmental release limits for hazardous or radioactive material

When a safety incident occurs, *immediately*:

- **Determine if an “ALL STOP” or “STOP WORK” is needed, and implement accordingly**
- **Have qualified personnel secure affected equipment in a safe state (de-energize, and lockout/tagout)**
- **Report the event to the area supervisor, Group Leader, Safety Manager, and Chief Safety Officer**

Example – LLE Incident Report 226: Electrical Shock event



This example demonstrates why it is important to promptly investigate a safety incident.

A worker received an electric shock while working on equipment that was under development

- An incident investigation was NOT conducted at the time of the event
- Nearly one year later, the worker reported that the root-cause still had not been eliminated. A subsequent investigation identified other installations having the same deficiency.

***PROMPTLY* report and investigate safety deficiencies and events; delaying an investigation leaves others at risk of a repeated event.**

Visitor and Contractor Safety



- **An LLE escort must accompany visitors and short term contractors working in laboratories or technical areas, e.g.,**
 - **Repair/service technicians (e.g., laser, crane, ...)**
 - **Vendors and other persons requiring access to laboratories**
 - **Instrument specialists & technicians**
- **LLE site-specific training may be required for long term contractors**
 - **Contract employees are managed by the work area supervisor**
 - **Facilities contractors are managed by the Administrative Division**
- **LLE Host personnel are responsible for ensuring that guests:**
 - **receive site-specific safety training and supervision**
 - **follow LLE Safety and Access policies**
 - **are appropriately escorted/supervised**

Guest Workers are NOT permitted to perform the activities listed below *



* Exceptions must be approved by LLE management

- **Act as Lead Worker for lockout/tagout (LOTO); They MUST participate in LOTO using group/gang locks when appropriate**
- **Service energized equipment**
- **Use ladders > 6 feet (1.8 m) tall, aerial lifts, or perform activities requiring fall protection**
- **Operate hoists or cranes, or perform rigging operations**
- **Install permanent cables, fibers, hoses, etc..**
- **Use cryogenics (e.g., liquid N₂)**
- **Chemical processes**
- **Modify, or authorize changes to equipment, software, or procedures**
- **Allow people to enter LLE buildings**
- **Activities requiring a respirator**
- **Hot work**
- **Fight fires (unless trained by home institution. Fire extinguisher only.)**
- **Machine shop work**

Good housekeeping can eliminate many hazards



- **Clutter can result in**
 - **Trip/fall hazards**
 - **Fire hazards**
 - **Lost productivity (e.g., personnel injuries, searching for items)**
- **Good housekeeping minimizes the spread of contamination**
 - **Metal shavings**
 - **Lead**
 - **Beryllium dust**
 - **Tritium**
 - **Chemicals**
- **Discard outdated books, catalogs, papers, boxes, packing materials**
- **Salvage, repair or discard equipment that is no longer useable**
- **Properly dispose of outdated and unnecessary chemicals**

Eliminate contamination at the source to prevent it from spreading



- **Areas near, and connected to, the target chamber (TC) (target bays, LaCave, TIMs, GCC, etc.) are the most likely areas to find Beryllium dust and tritium contamination**
- **Persons who handle items that have been exposed to the TC, or work in areas around the TC must:**
 - **be LLE qualified/authorized**
 - **treat items as if they are contaminated when removed from the TC**
 - **ensure items are below contamination limits before they are released to “general” work areas**
 - **wash hands after working in contaminated areas or after working with equipment that may have been contaminated**

Secondary exposure occurs when persons are indirectly exposed to contamination



Examples:

- **A worker opens a door while wearing contaminated gloves, transferring chemicals to the door handle. The worker is not affected, but people who touch the handle without gloves may be.**
- **The beryllium filter in a diagnostic is shattered during a target shot. The diagnostic is transferred to a workbench for repairs. Particulate dislodged during repairs may become airborne, or may be left behind on the workbench. Prevent spread of contamination:**
 - **Bag the diagnostic prior to moving it from the TIM to a beryllium workstation**
 - **Clean the TIM before installing another diagnostic**
 - **Work in a Be hood to trap airborne particulate in the HEPA filter**
 - **Clean the interior of the Be hood after work is complete**

What should have been done differently?

Excerpts from Incident Report 178



A student scratched his neck with a chemically-contaminated glove. He initially felt tingling; by the next day, he developed a first degree chemical burn.

Lessons learned

- **Promptly wash skin if contact with any contaminant is suspected**
- **Be aware of your surroundings, including activities of nearby workers**
- **When using gloves as a chemical barrier:**
 - **Rinse gloves before removing**
 - **Learn and use proper technique to remove gloves**
 - **Remove gloves before handling non-contaminated items**
 - **Properly dispose of single-use gloves**

General recommendations

- **Periodically review location and condition of eye wash stations, safety showers, first-aid kits, and emergency contact info on nearby telephones**
- **Separate contaminated and non-contaminated items**
- **Review emergency response procedures for your work area**

Part II Summary



- **The Buddy System must be used when working in potentially hazardous situations**
- **Understand the limitations of PPE. Know what PPE is required for the tasks assigned to you and for the areas in which you work**
- **Summaries of several incident reports are presented to highlight lessons learned**
- **Guest workers are only permitted to perform pre-approved tasks**
- **Lockout/Tagout protects workers from unexpected hazardous energy release**
- **Incident investigations prevent recurrent problems**
- **Housekeeping can help mitigate hazards and prevent the spread of contamination**
- **Permits are required to perform energized work, hot work, or to enter a confined space**

You must complete the [G_001_quiz](#) to satisfy your training requirement