CARLETON LABORATORY
Columbia University | Engineering

# User Policy & Training Manual

Robert A. W. Carleton Strength of Materials Laboratory
Columbia University in the City of New York

Revised February 2026

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# Location

## Contact Information

Robert A. W. Carleton Strength of Materials Laboratory
500 West 120th Street, MC4709
161 Engineering Terrace
New York, NY 10027

Phone: +1.212.854.3158
Fax: +1.212.854.4084
Email: carleton@civil.columbia.edu

Operating Hours: 9:00 am to 5:00 pm, Monday through Friday, excluding University Holidays.

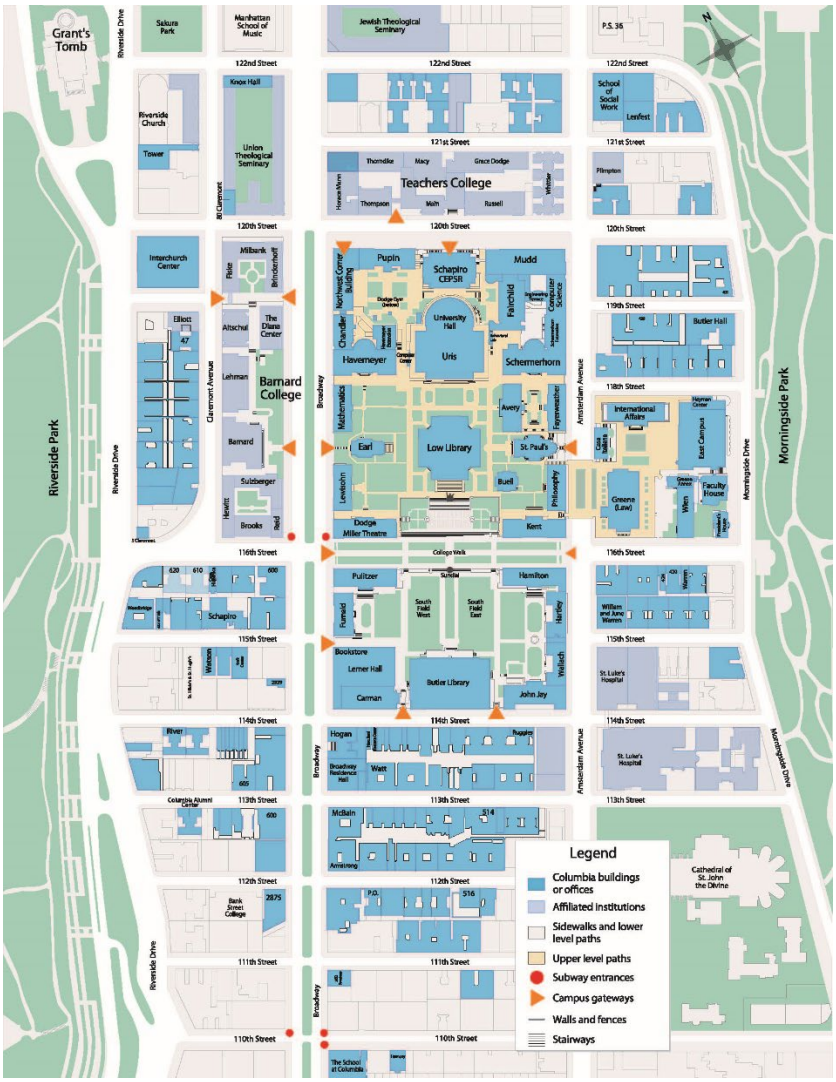



*Figure 1: Campus Map*

## Directions

The main entrance of the Carleton Laboratory (Lab, Laboratory) is on the first floor of the Engineering Terrace Building, Room 161.

From the street, the Lab can be reached via the Seeley W. Mudd Building entrance on 120th Street, between Broadway and Amsterdam Avenue. Once in the elevator lobby, walk through the automatic double doors, and turn left immediately after the doors to find the main entrance to the Carleton Laboratory.

From campus, the Lab may be accessed via the Seeley W. Mudd Building entrance (4th Floor entrance) in the northeast corner of the quad. Take the elevator down to the 1st floor. Turn left, walk through the automatic double doors, and turn left immediately after the doors to find the main entrance to the Carleton Laboratory.

## Loading Dock

The Carleton Lab loading dock is located between 119th and 120th Street on the western side of Amsterdam Avenue, immediately south of the bus stop. The loading dock is a short dock with a vertical clearance of 11'-10" (3.6m) with a dock height of 40" (1.0m) and will not accommodate full-size box trucks.

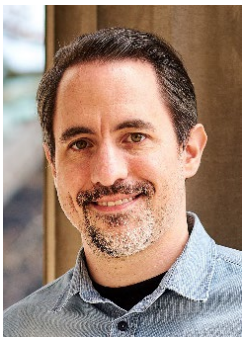
Trucks that do not clear dock dimensions must park curbside immediately south of the loading dock to be serviced by the forklift, if necessary.

Call one hour in advance to announce all delivery to allow Staff to ready the dock for delivery.

IMPORTANT: This loading dock is operated on an ad-hoc basis. Lab Staff will receive only announced deliveries made to researchers of the Carleton Laboratory during operating hours. No third party deliveries will be accepted. Deliveries for other departments must be managed by the respective consignee. Dock access should be arranged through the SEAS Facilities Manager.

# Directory of Staff

Officers



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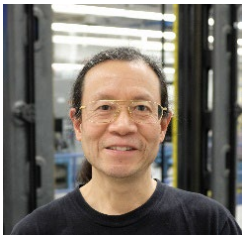

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155 Engineering Terrace
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Fax: +1.212.854.4084
E-Mail:

# Directory of Laboratories

**Centrifuge Laboratory**
B53 Engineering Terrace
Phone: +1.212.854.0107

**Graduate Researcher Office**
271 Engineering Terrace
Phone: +1.212.853.0414

**Heffner Laboratory**
B54 Engineering Terrace
Phone: +1.212.854.6036

**Library**
265 Engineering Terrace
Phone: +1.212.854.5896

**Locker Room**
157 Engineering Terrace
Phone: +1.212.854.3153

**Main Testing Floor**
159 Engineering Terrace
Phone: +1.212.854.4461

**Machine Shop**
155 Engineering Terrace
Phone: +1.212.854.4461

**SMaRT Laboratory**
264 Engineering Terrace
Phone: +1.212.854.1059

**Mindlin Laboratory**
153 Engineering Terrace
Phone: +1.212.854.6662

**Shake Table Laboratory**
159 Engineering Terrace
Phone: +1.212.854.3442

# Access Policy

## General Policy

Access will be granted at the sole discretion of Lab Management for activities deemed to be supported by the Carleton Lab.

Access to the Lab does not necessarily grant you access to dedicated work space, storage, use of the Concrete Materials Lab, use of the Machine Shop, or any other space or equipment within the Lab. Users from Departments outside of CEEM will only be granted access to Carleton Lab equipment that is included in the Lab's Recharge Center License (i.e., any equipment accessed via FOM), unless they are participating in a formal independent study research program with CEEM faculty. CEEM users should contact Lab Management to discuss space needs.

Access to Carleton Lab is controlled by Columbia University's proximo access system as well as closed-circuit cameras. It is a violation of policy to swipe in unauthorized persons, which will result in disciplinary action and loss of Laboratory access.

Access authorization must be granted explicitly by Lab Management. Access granted by other individuals or mere admittance via the proximo access system on the main door do not equate to authorized access. Access will be rescinded if any of the required RASCAL Trainings expire.

Anyone entering the Lab must have access as authorized by Lab Management. Authorization is granted through the access application system described herein. Persons without such access are required to report to the Laboratory Management office (161 Engineering Terrace).

## Access Permission Levels

All users are required to receive a Carleton Lab sticker in order to complete the access authorization process. Stickers appear as follows:

- Faculty + Staff: 

- General & Research: 

-

## Faculty & Staff

Access level provided to CEEM Faculty and Staff as well as employees on payroll with the Lab, under supervision of Laboratory Management. Per regulatory requirements Faculty are subject to the same training and certification requirements as other users.

## Research Access

Research Access is defined as any access to the Laboratory to perform independent work utilizing Laboratory-owned equipment that is not directly associated with a CEEM laboratory class. Research includes undergraduate and graduate formal independent research, and Ph.D. research. Standard research access entitles a user to access the Laboratory Monday to Friday between the hours of 9AM and 5PM. The following requirements must be fulfilled:

- Legitimate academic need to use the Laboratory, as determined by Lab Management.
- Faculty sponsor: all students and student groups must have a Faculty advisor/sponsor.

- Registration in the FOM Lab Management system with a valid Chartstring.
- The user must be sufficiently conversant in English to follow written and oral instructions from Staff and fellow users and communicate effectively in case of potential incidents and emergency situations.
- Completion of the following three RASCAL Trainings: Carleton Laboratory Site-Specific Training, Shop Safety Training, and Lab Safety, Chemical Hygiene, and Hazardous Waste Management Initial Training (or Refresher Training if the Initial Training has been completed).
- For 24/7 access, users must hold a valid FDNY issued C-14 Certificate of Fitness, which must be in possession of the user when they are in the Lab.

### General Access

Undergraduate and graduate students taking a CEEM class that contains a laboratory teaching component in the Lab, CEEM student club participants, and SEAS-sponsored tour group leaders should apply for General Access via the Carleton Laboratory website after meeting the following requirements:

- Legitimate academic need to use Laboratory, as determined by Lab Management.
- Faculty sponsor: all students and student groups must have a Faculty advisor/sponsor.
- The user must be sufficiently conversant in English to follow written and oral instructions from Staff and fellow users and communicate effectively in case of potential incidents and emergency situations.
- Completion of the following three RASCAL Trainings: Carleton Laboratory Site-Specific Training, Shop Safety Training, and Lab Safety, Chemical Hygiene, and Hazardous Waste Management Initial Training (or Refresher Training if the Initial Training has been completed).

No instruments/equipment that are owned by the Lab and are part of the Recharge Center License may be used independently by the user; all work requiring the use of instruments/equipment must be directly supervised by university Faculty, Lab Staff, or teaching assistants that are trained on the specific instrument/equipment. If you need to independently use the aforementioned equipment, apply for Research Access.

### Visitors

Visitors must fulfill the following requirements to be considered for access to the Carleton Laboratory:

- Legitimate academic need to use Laboratory, as determined by Lab Management.
- Faculty sponsor: all visitors must have a Faculty sponsor.
- Visitor Appointment: all visitors must have a University appointment in order to be allowed perform experimental work in the Laboratory.
    - Visitors with Salaried Appointment (non-zero $ appointment) will be considered for access.
    - Visitors with Zero-Salary Appointment: only specific cases will be considered for access.
        - Faculty from outside academic institutions spending sabbatical at Columbia University
        - Undergraduate and graduate researchers participating in a University recognized academic exchange/internship program

- Other Zero-Salary Appointments, including Visiting Student Interns, will not be considered for lab access

The Laboratory reserves the right to deny visitor access privileges at the discretion of the Director, Associate Director, or Lab Management in the absence of the Director.

High School-level students may be sponsored by Faculty and allowed access to the Laboratory if and only if sponsored through a University-recognized internship/exchange program. Additionally, their arrival must be announced and coordinated with the School, Department, and Laboratory at least two months prior to arrival.

Training requirements for all visitors are equivalent to Research level access. All visitors must be sufficiently conversant in English to follow written and oral instructions from Staff and fellow users and communicate effectively, e.g., in case of potential incidents and emergency situations. Absolutely no work may be performed by the visitor until all training requirements are fulfilled; visitors without appropriate training may not enter the Laboratory.

Visitors without a University appointment will not be considered for Laboratory access.

Visitors will not be allocated desk space in 271 Engineering Terrace.

### Guests

Guests are different from Visitors in that they are not granted Laboratory access and may only be in the Lab if they are under direct supervision (i.e., be in direct line of sight) of their host, who must have Research Access. Guests may not conduct any laboratory work, but may observe their host conducting work. If a guest is found unattended or performing work in the Lab, both the guest and the host are considered in breach of policy and will be reprimanded per the Laboratory Disciplinary Policy.

## Certifications & How to Apply for Access

Machine Shop Safety Training – required for all persons.

Laboratory Safety/Chemical Hygiene/Hazardous Waste/Laboratory Fire Safety Training – required for all persons.

Carleton Laboratory Site-Specific Training, Shop Safety Training – required for all persons

Certificate of Fitness (C-14) - required for all persons requesting access outside of Laboratory business hours. Students using only office space within the Laboratory (marked blue) must not obtain a certificate of fitness but are strictly limited to these spaces outside of Laboratory operating hours.

Access Application – fill out online application for the appropriate level of access and upload your training certificates

Carleton Lab Sticker – after filling out the application, go to the Management office to receive your “Carleton Lab” sticker.

## Access Issues

Users who have lost access are encouraged to review this access policy to determine if their access status may have changed.

Should the access policy not clarify the situation, users are to contact Lab Management to resolve the issue.

## Access Revocation

Access will be rescinded if any of the required RASCAL Trainings expire. All required trainings must be valid for the entire academic year during which access is requested. It is the duty of the user to maintain training compliance.

## Visits and Tours

Individuals without Lab access wishing to access the Lab to conduct business related to the Lab may announce themselves via the doorbell at the main entrance. Once they have entered the Lab, they must register with the Lab Management office (161 Engineering Terrace). Visitors/Guests may not conduct Lab work without appropriate training and authorization.

Any individuals or groups interested in receiving a tour of the Laboratory should contact the Lab Management directly.

Recurring tours using third-party tour guides may be arranged by contacting Lab Management. Tour guides are expected to apply for General Access. The Lab reserves the right to refuse tour access without prior notice due to privacy, disclosure, or safety reasons.

# Safety Trainings

## Carleton Laboratory Site-Specific Training

This training (see Appendix A) introduces Carleton Lab users to the policies and procedures pertaining to safety, hazard communication, equipment use, and emergency response. It also provides an outline to user amenities, equipment-specific training protocols, equipment reservation, machine shop use, fabrication requests, and guidance to obtaining all necessary trainings to work safely in the Lab.

This training program is required of all Laboratory users.

At the conclusion of this course you must take a short quiz to verify that you have completed the course and understands its contents. Upon passing the quiz, you should save the training transcript as a proof of course completion and upload to the Lab access application. A refresher course must be taken every 2 years

Please go to the Rascal Training Center to take the Carleton Laboratory Site-Specific Training course. The training course can be found: Training Center > Safety Courses > Carleton Laboratory Site-Specific Training.

## Shop Safety Training

Hand and power tools are routinely used in various machine shops at Columbia University. When not used properly they can cause serious and sometimes fatal accidents and injuries. Due to the presence of heavy machinery in the Lab, all Lab users are required to complete this training. Understanding of potential hazards and observing proper safety guidelines can help to reduce accidents and injuries.

This training program is required of all Laboratory users and provides a basic overview of hazards associated with the use of hand and power tools that are found in academic machine shops. The training covers types of hazards, general shop safety rules, ways to keep the shop clean, usage of safe work practices and use of proper personal protective equipment for the task. This training, however, is not a substitute for a machine specific safety training that must be provided by Laboratory Staff before you use any machine in the shop. The course also meets the training requirements of various OSHA Standards and University policy (see Appendix B).

At the conclusion of this course you must take a short quiz to verify that you have completed the course and understands its contents. Upon passing the quiz, you should save the certificate PDF as a proof of course completion and upload to the Lab access application. A refresher course must be taken every 2 years

Please go to the Rascal Training Center to take the Machine Shop Safety training course. The training course can be found: Training Center > Safety Courses > Shop Safety Training.

## Laboratory Safety/Chemical Hygiene/Hazardous Waste/Laboratory Fire Safety Training

Environmental Health & Safety policy (see Appendix C) requires that all persons with Access attend an initial training session and perform a refresher training every two years thereafter. Due to the presence of chemicals in the Laboratory, any user with Research or General level access is required to take this training. A refresher course must be taken every 2 years.

## Certificate of Fitness (C-14) Training

Carleton Laboratory is required to have a C-14 Certificate of Fitness holder present at any time when the Laboratory is in operation. This is a simple certification by the FDNY that verifies an understanding of basic fire safety in a laboratory environment. All officers of the Laboratory hold C-14 certifications, so all activities performed during normal operating hours of the Lab do not require any individual user to be certified.

Any researcher who works in the Carleton Laboratory (including Burmister Laboratory) outside of normal operating hours (9:00am to 5:00pm M-F) must obtain a C-14 Certificate of Fitness. The certification process is sponsored by Columbia University, so the application process is free to all students, Faculty, and Staff. Please see the EH&S Website for further information on the C-14 Certificate of Fitness.

## Other Trainings

Laboratory users may be working with specific chemicals or hazards which require their own safety trainings. Other commonly required trainings include:

- Chemical Storage and Segregation 101 (TC2100) - Required to purchase chemicals - the user requesting chemical purchases is responsible for safe storage in conjunction with Lab Staff.
- Safe Management and Use of Compressed Gases (TC5450) – Required to use compressed gas cylinders.
- Laser Safety Initial and Refresher Training (TC1600) - Required to use instruments/machines containing lasers.
- Liquid Nitrogen Transfer (TC7700) – Required to transfer or use instruments requiring liquid nitrogen
- Electric Safety for the Lab (TC7913)

Environmental Health and Safety provides a list of and administers these safety trainings. Users requiring hazard specific safety trainings should contact Lab Management to confirm that the Carleton Lab is capable of accommodating said additional hazard with appropriate engineering controls and PPE. Upon approval, Lab Management will refer the user to EH&S to receive the appropriate trainings and forward all training certificates to Lab Management.

If for any reason a Lab user feels that they require safety training of any kind that is not currently provided by EH&S, the user should contact Lab Management.

## Machine-Specific Training

### FOM Lab Management System

All Research Access users must register using FOM Lab Management Software in order to be trained to operate any Lab equipment independently. Training and access control is managed utilizing FOM at the discretion of Lab Management. Once a user is trained on a machine, they will be granted access through FOM.

### Machine Tools

All users are required to receive machine-specific training prior to the operation of most machine tools. Users are not entitled to be trained on any machine shop tools, training and independent usage are at the discretion of Lab Staff with special consideration in regards to safety and competence of the user on

the specific tool/equipment. Machine shop equipment may only be operated by trained CEEM students, Staff, or Faculty. Absolutely no other persons are allowed to operate said machines. As an alternative, the Carleton Laboratory offers “Machine Shop Fabrication” services for non-CEEM and CEEM projects, performing the work at a standardized hourly “Machine Shop Fabrication” rate.

The following machine tools require machine specific training; other machine tools may also require training:

- Haas CNC mill
- Clausing CNC mill
- Bridgeport mill
- Clausing Colchester lathe
- Browne & Sharpe grinder
- DoAll vertical bandsaw
- Baileigh horizontal bandsaw
- Clausing drill press
- Clausing Ibarmia drill presses
- Micro Precision drill press
- Diversitech downdraft benches
- Flott drilling and tapping center
- All welders
- All grinders
- All sanders
- Bridge cranes

Users wishing to obtain machine-specific training on any of the above machine tools should contact Lab Management or Staff directly. Upon completion of the training, users will receive a written training certification from the trainer, which is to be given to Lab Management for registration.

Users are expected to understand how to responsibly operate any tool that they use. Should a user have any questions about the operation of any tool, whether or not it is listed above, the user should consult the Senior Fabrication Engineer. Use of any machine tool without proper training is not only a Class III Violation (see Disciplinary Policy), but risks injury to both the user and other Laboratory users.

### Testing Equipment

All users are required to receive machine-specific training prior to the operation of most testing equipment. Users are not entitled to be trained on any testing equipment, training and independent usage are at the discretion of Lab Staff with special consideration in regards to safety and competence of the user on the specific equipment. Absolutely no other persons are allowed to perform testing on these machines. As an alternative, the Carleton Laboratory offers “Staffed Testing” services for projects, performing the work at a standardized hourly “Staffed Testing” rate. Operation of Faculty-Owned equipment (marked with a green asset tag) is at the discretion of the owner.

The following testing equipment requires machine specific training, other testing equipment may also require training:

- Atlas Solar Simulator

- Freeze-Thaw Machine
- Instron 1500 HDX 300k UTM
- Instron 5984 34k UTM
- Instron 600DX 135k UTM
- Instron MT2 Torsion Tester
- Keyence IM-7001 Image Dimension Measuring System
- Keyence VHX-5000 Microscope
- LECO Hydrogen Analyzer
- MTS 220k UTM
- MTS 22k UTM
- MTS 50k Axial-Torsion UTM
- MTS 7k UTM
- MTS 858 3k UTM
- Q-Fog Weathering Chamber
- Rockwell Hardness Tester
- SPECTROMAXXx Spark OES
- TA Instruments DMA 850
- TA Instruments Isothermal Calorimeter
- TA Instruments Q50 TGA
- TA Instruments Vertical Dilatometer

Users wishing to maintain machine-specific training on any of the above testing equipment should contact Lab Management or Staff directly. Upon completion of the training, users will receive a training certification, which is to be given to Lab Management.

Users are expected to understand how to responsibly operate any testing equipment that they use. There are many pieces of testing equipment that are not listed above that, when not used properly, can provide unreliable results, can be damaged, and can present harm to the user. Users are to always consult Lab Staff or officers before using any piece of equipment for the first time. Should a user have any questions about the operation of any machine, whether or not it is listed above, the user should consult the Lab Staff or officers. If a user has not used a piece of equipment in over a year, they will be required to demonstrate proficiency/undergo refresher training before using the equipment independently.

The following testing equipment is to be operated by Lab Staff only:

- Geotechnical Centrifuge
- MTS Shake Table
- Southwark-Emery 600k UTM

Improper operation of this equipment may present a significant hazard to the user and their environment, and may cause considerable damage to the equipment.

# Safety Policy

## Rules of Conduct

Guests must register with Lab Management. “Browsing” of the Lab is dangerous and is not permitted.

No person is allowed outside of white lines without a Carleton Lab sticker, unless authorized by Lab Staff.

No Laboratory property may be removed from the premises unless authorized by Lab Management.

The entire Lab is an active forklift and crane area. Persons without rigging training must always yield to cranes and the forklift.

Open shoes, loose clothing, shorts, and short skirts are prohibited in active Lab spaces.

Eating and drinking is strictly prohibited in active Lab space.

Active machinery may only be approached under the express permission of the operator.

## Proper Attire

Open shoes, loose clothing, shorts, and short skirts are prohibited in active Lab space. Any user wearing prohibited attire will be instructed to leave the Laboratory immediately.

Attire must satisfy the following requirements for the entire Laboratory area:

- Closed-toed flat shoes
    - Sandals and flip-flops are prohibited.
    - Open heels (high heels) are prohibited.
- Long pants or long skirts
    - Legs must be covered to protect the user against hot particles and chemical spills.
    - Shorts and short skirts are prohibited.
- Form-fitting clothing
    - Baggy/loose shirts and pants are prohibited
    - Shawls, necklaces, loose jewelry and neckties are prohibited, unless tucked into clothing
- Natural fiber clothing is required if performing hot work such as grinding, welding, brazing, etc. Synthetic fibers are prohibited, as they can be highly flammable.
- Long hair is to be tied back or otherwise contained.
- Over-the-neck ID card holders/lanyards must be secured in a pocket and may not dangle. Only tear-away safe holders/lanyards are allowed.
    - If you are unsure if your tag-holder satisfies this requirement, do not use it until authorized by Lab Management
    - The ID tag holders sold in the Columbia University Bookstore do not satisfy OSHA requirements.

The only exception to these rules is a visit or tour of the Lab space, where the visitor does not leave the white lines.

### Jumpsuits

Jumpsuits are to be worn by users at their own discretion and/or training instruction to provide protection against cuts and abrasions and to protect a user's body and clothing from Lab hazards and materials. Jumpsuits are provided at no cost by the Lab and are suitable when working with materials or fixtures that are dirty or could cut or a scrape a user or their clothing. No reservations are necessary and jump suits can be taken on a first-come first-serve basis from the hangers on the north wall of the locker

room. Used jump suits are to be placed in the appropriately labeled bins directly next to the hangers for laundry service.

### Lab Coats

Lab coats are to be worn by all users when they are handling or in proximity to someone handling chemicals. Lab coats are provided at no cost by the Lab. No reservations are necessary and lab coats can be taken on a first-come first-serve basis from the hangers on the north wall of the locker room. Used lab coats are to be placed in the appropriately labeled bins directly next to the hangers for laundry service.

The provided lab coats are made of a polyester/cotton blend. They are not flame resistant and while they provide general chemical resistance, they do not provide specific chemical resistance. Any user requiring flame resistant chemical protection or a specific chemical resistant protection should contact Lab Management.

### Hard Hats

Hard hats are to be worn by all users working on the main test floor when cranes are being used or rigged or when other hazardous falling objects may be present. The Lab provides ANSI Z89 compliant hard hats to all users at no cost. Hard hats are color coded as follows:

- White – Visitors (first-come first-serve)
- Baby Blue – Students (first-come first serve)
- Royal Blue – Researchers (see Lab Management to reserve a hat)
- Dark Blue – Faculty (see Lab Management to reserve a hat)
- Gray – Student Lab Assistants (see Lab Management to reserve a hat)
- Black – Lab Staff and Officers

### Other PPE

Beyond the proper attire, and when engineering and administrative controls are either infeasible or do not completely eliminate hazards, proper PPE is necessary to ensure user safety when working with various machines and materials. In accordance with OSHA regulations, the Lab offers PPE at no cost to users.

Eye protection, laser safety goggles, N-95 respiratory protection (both disposal facemasks and half-face cartridge respirators), and various types of gloves are available in multiple locations throughout the Laboratory. The Lab Management is the designated PPE Responsible Party and should be consulted regarding the selection, use and maintenance of all PPE.

PPE may not be used as a substitute for engineering controls including fume hoods, glove boxes, process enclosures, etc., or for good work practices and personal hygiene. PPE complements such hazard control measures.

## Floor Markings

Floor markings are often provided through lines affixed to the floor. However, a line of colored cones, colored chain, or a colored adhesive floor mat serves the same function as a floor line.

**White** – Main traffic routes through Lab; keep area clear of obstructions; beware of moving vehicles. Persons without safety training or proper attire are to remain in these areas unless authorized by Lab Staff (see Figure 2).


*Figure 2: White Floor Lines*

**Yellow** – This area contains a physical hazard, entry with express permission by Laboratory Staff only (see Figure 3).


*Figure 3: Yellow Floor Lines*

**Blue** – Enter only with clean clothes and shoes, and do not bring tools, chemicals into space. Food and drink are allowed in this area (see Figure 4).


*Figure 4: Blue Floor Lines*

## Exits

### 100 Level – Main Level

The first floor of the Laboratory contains three exits. The main exit is the same door as the main entrance, located in the west of the Laboratory (see Figure 5). The north wall of the locker room also contains an exit to Mudd. There is also an emergency exit in the southeast corner of the Laboratory near the machine shop (see Figure 5).

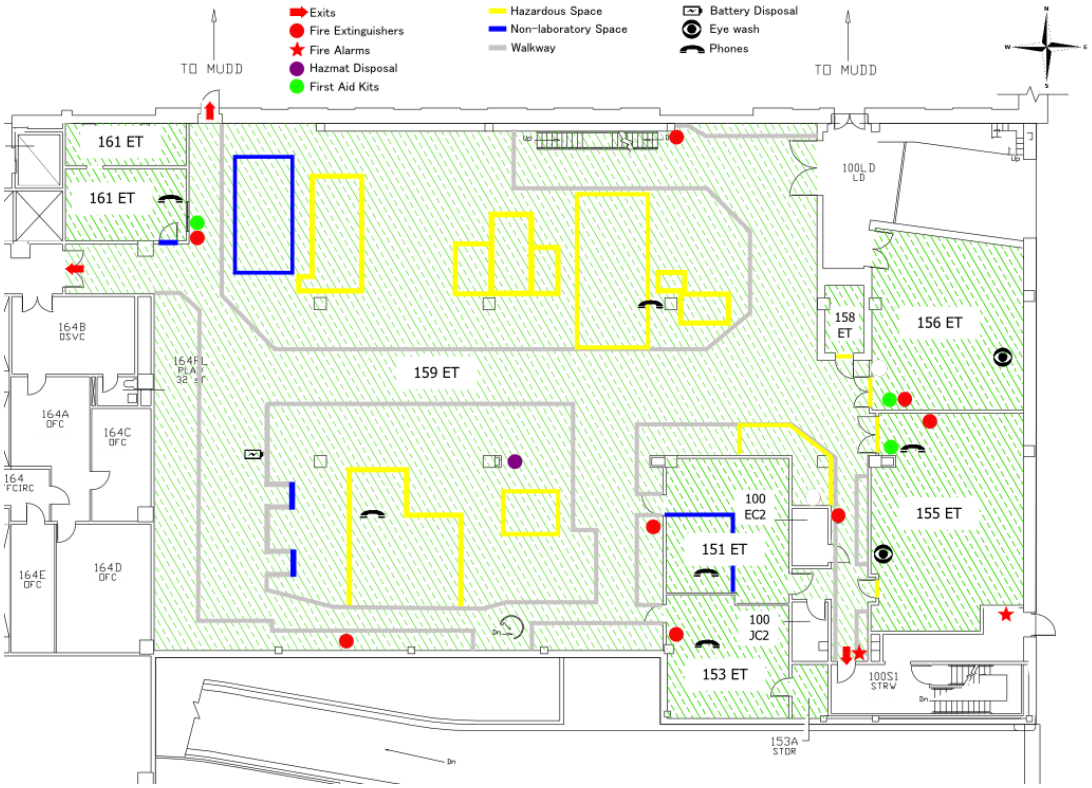


*Figure 5: 100 Level Floor Plan*

The large double doors in the northeast corner of the Lab (Figure 6) are not an exit. These doors and all of the surrounding doors have different access restrictions than the main entrance to the Laboratory and it is possible to get locked in the loading dock should a Lab user attempt to use these doors as an exit.


*Figure 6: The Loading Dock Entrance (Not an Exit)*

## 200 Level - Mezzanine

The second floor of the Lab has two exits, both located on the south wall of the Lab (see Figure 7).

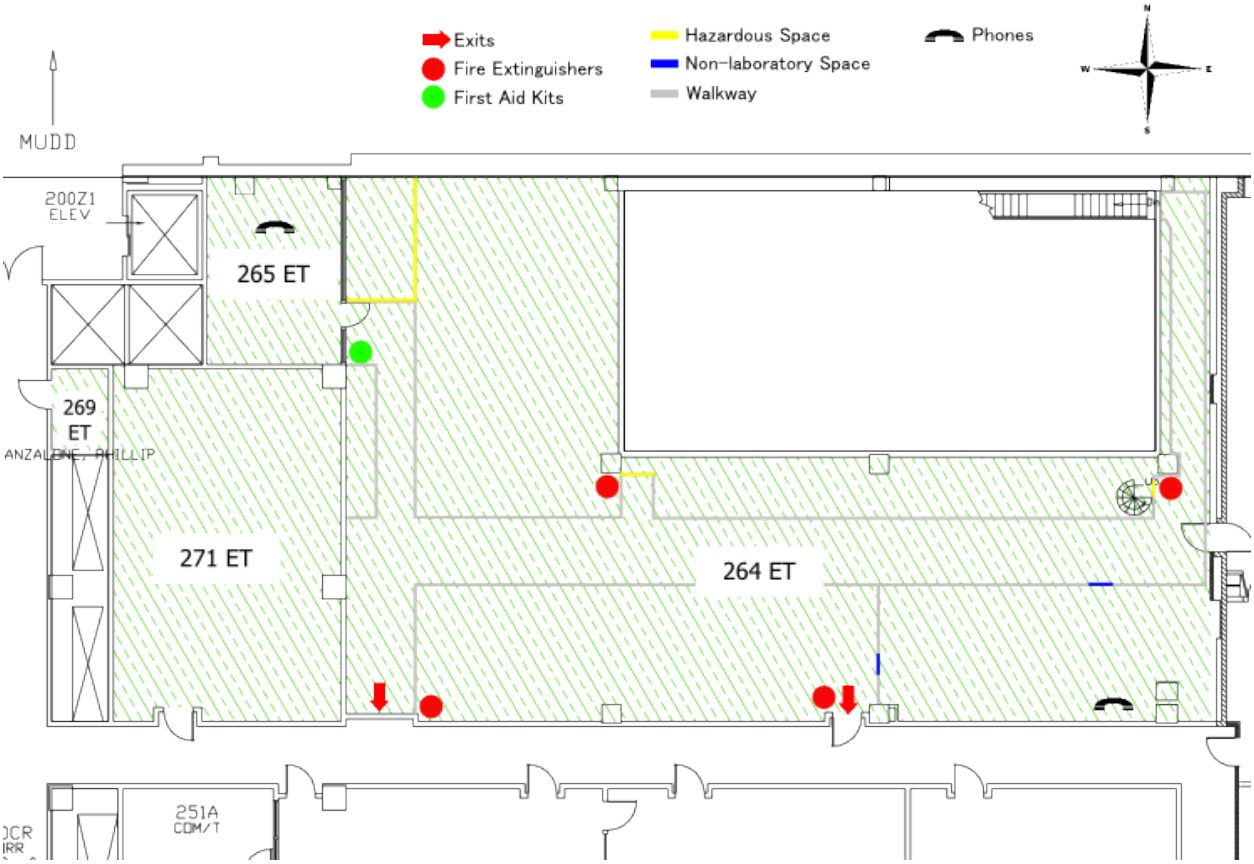


*Figure 7: 200 Level Floor Plan*

## B00 Level - Basement

The basement of the Lab has one direct exit from the space at the southeast corner, which leads to a storage area and should only be used in case of emergency, follow the exit signs to the "S" stairwell to exit to Amsterdam Avenue. Two staircases provide access to the first floor, where users can exit the Lab. These staircases are a standard staircase in the north of the basement and a spiral staircase in the south of the basement (see Figure 8). Persons with limited mobility may have trouble negotiating the tight spiral staircase and should opt for the standard staircase to the north.

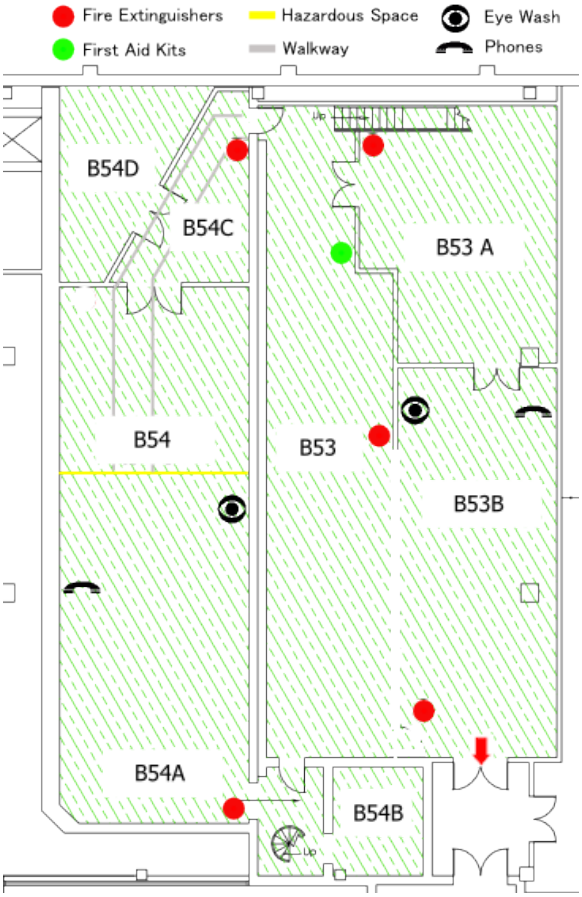


*Figure 8: B00 Level Floor Plan*

## 700 Level – Burmister Lab

Burmister Lab has one exit; the main entrance serves as the exit (see Figure 9).

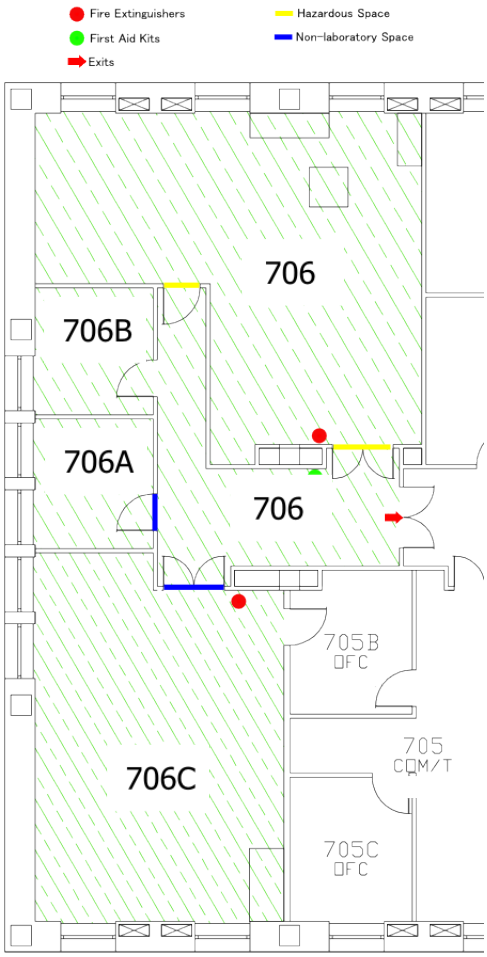


*Figure 9: 700 Level Floor Plan*

## Muster Point

In case of an emergency requiring Laboratory evacuation, all Lab users should convene on the sidewalk in front of the 500 West 120th Street entrance to the Mudd building, indicated by a black star in Figure 10.

Should this area be inaccessible due to emergency conditions or any other reason, all Lab users shall convene on 120$^{th}$ St directly in front of the Northwest Corner Building, illustrated by a gray star in Figure 10.

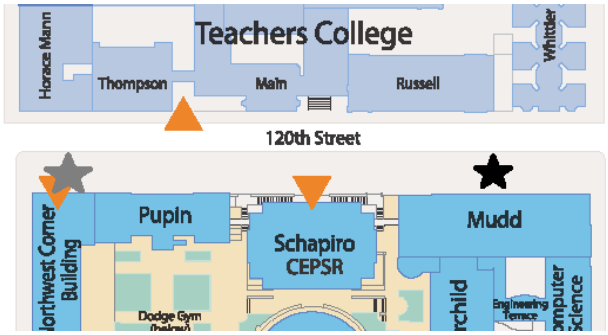


*Figure 10: Rally Point*

## Ceiling Lights

**Red** – Fire equipment such as fire extinguishers, fire blankets, and/or fire alarm pull stations

**Green** – First aid kit

**Blue** – Campus phone location, dial 99 in case of medical, fire, or police emergency

## Strobe Lights

**Amber** – active forklift and/or crane, yield to horizontal/vertical transportation and rigging at all times.

**Green** – hazardous test in progress, enter area only with express Staff permission. Tests may be automated, so Staff may not be present.

**White** – fire alarm, evacuate building immediately, close but do not lock all doors on the way out. Fire policy is addressed in the Event Response section of this Manual.

## Audible Warnings

**Siren (high pitch)** – rapid burst signal when remote control crane is activated. Operator may also blow siren to signal users to clear area.

**Buzzer (low pitch)** – signal used to warn persons of active testing

- One blow – prepare for test, clear area
- Two blows – area clear, test commencing – blown before each test
- Three blows – test completed, area safe

**Eye-piercing Siren** – fire alarm, evacuate building immediately, close but do not lock all doors on the way out. Fire policy is addressed in the Event Response section of this Manual.

Important: The Engineering Terrace building is equipped with a NYC Code Fire Alarm System. All personnel must evacuate, even if the alarm stops ringing. Close but do not lock all doors on your way to the exit.

## Forklift Safety

In the Lab pedestrians must yield to the forklift (see Figure 11). Due to the limited line of sight of the forklift operator in many loading and lifting situations, you must assume that the forklift operator cannot see you. If the driver is forced to make a sudden stop or turn, the load may dislodge from the forklift, topple, and crush bystanders.


*Figure 11: Forklift*

Never walk directly in front of, behind, or beside the forklift when it is in motion. The forklift steers from the rear, so walking next to the driver is hazardous, as the forklift may swing out and run over feet or pin/crush incautious pedestrians.

## Rigging Safety

The Lab is equipped with a number of remote-controlled gantry cranes (see Figure 12). Be aware of their presence at all times. The hi-bay area contains three trambeam cranes that can move within the entire hi-bay space and parts of the mezzanine.

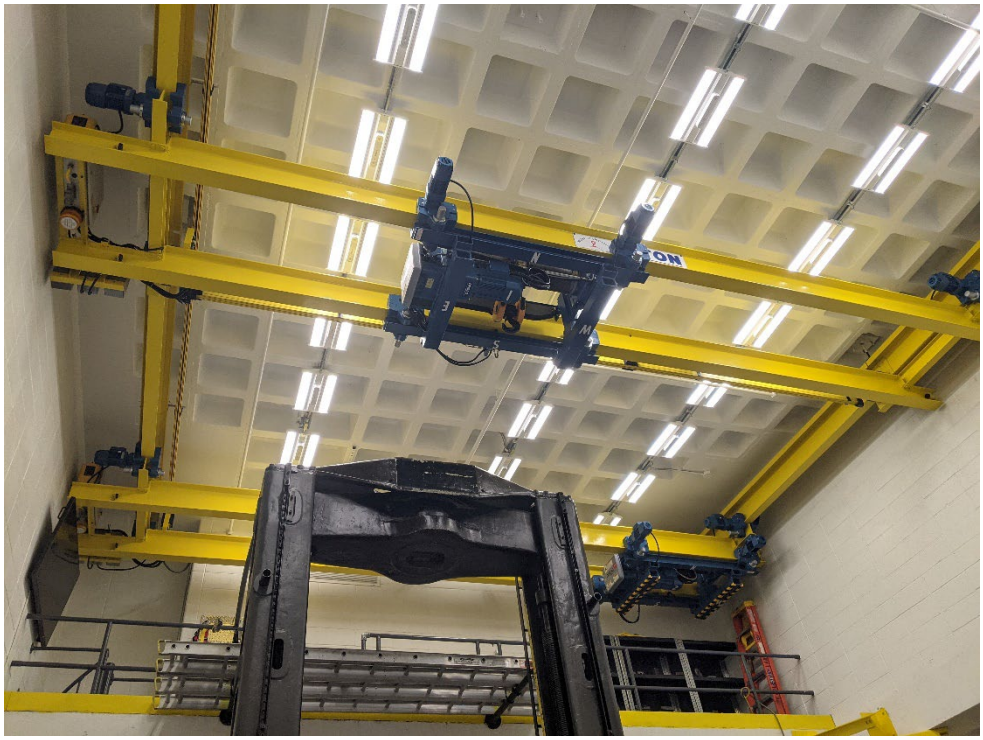

*Figure 12: Bridge Crane*

Never step under a crane, be it loaded or unloaded.

Never step on a load that is hanging from a crane.

Always look up and check for the position of cranes before entering the high-bay area. A flashing amber strobe indicates that the crane is active. Hard hats must be worn by all persons in the high bay once the crane becomes active. Due to the nature of the space and the fact that the cranes are remote controlled, the operator may be standing out of sight. Unless direct eye and voice contact has been made with the operator, never cross the path of an active crane. The crane operator owns the space once the crane becomes active; all other users must yield to their operation.

Crane operators are trained to communicate in cardinal directions. Use the compass on the high bay wall as the standard coordinate system. If communicating with the operator, use cardinal directions; directions such as left, right, forward, back, etc. will cause confusion and potentially cause significant injury.

The Lab also has a number of removable floor panels. Beware of these when walking. Never cross an area that is cordoned off with yellow cones. This is a warning that hazards lie beyond this point. Ask the Lab Staff for a safe path in case a normal route is obstructed.

Beware of the following hazards:

- Crushing hazard due to falling load – never put any part of your body underneath a load being rigged. Especially take notice of your hands and feet.
- Crushing hazard due to traveling load – never enter a space between the crane and an immovable obstruction. The crane may travel in your direction and crush you with the load.
- Falling hazard due to traveling load – never step between a precipice and a load. The crane may travel in your direction and push you over the edge of the precipice.

## Machine Safety

Active machinery should be approached only with the permission of the operator of the machine. Appropriate Personal Protective Equipment (PPE) – i.e. earplugs, safety goggles, face shield, etc. – must be worn.

Only authorized persons are allowed to use the machinery in the Laboratory and in the machine shop. Machines may be used only by Staff and users who have been properly trained by Lab personnel. Long hair must be tied back, loose clothing, and neckties are strictly prohibited. Universal Testing Machines, the Shake Table, Machine Shop Equipment, and any other machine that poses a safety hazard may only be operated during normal business hours when Staff are present. Access is controlled to these machines via locked doors and the FOM Lab Management System

Only trained and authorized persons are allowed to use Laboratory testing machinery and equipment. Requests for machine specific training should be directed to Lab Staff via FOM. Once trained, testing equipment can be reserved via FOM.

## Fire Safety

The Lab operates under and adheres to the Environmental Health & Safety Manual – Fire Safety (Appendix D.)

### Fire Extinguishers

Fire extinguishers are located throughout the Laboratory (Figure #2). The location of fire extinguishers is designated by red ceiling lights.

The Lab contains two different types of fire extinguishers:

Type BC extinguishers (see Figure 13) are $CO_2$ based. They are to be used for electrical fires, oil fires, and on people.


*Figure 13: BC Fire Extinguisher with the typical large cone spray nozzle*

Type ABC extinguishers (see Figure 14) are dry chemical based. They are to be used for liquids, wood, paper, textiles, rubber, and oil.


*Figure 14: ABC Fire Extinguisher with the typical small spray nozzle*

### Fire Blankets

The welding booth immediately across from the Machine Shop (155 Engineering Terrace) is equipped with a fire blanket (see Figure 5). Fire blankets are designed to combat emergencies involving persons on fire, and can also be used for other emergency response. See the EH&S fire policy (Appendix D) for further information.

## Active Shooter

The Laboratory operates under and abides by the community response guidelines of Public Safety (Appendix E).

## Chemical Safety

The Laboratory operates under and abides by the chemical spills policy of the Environmental Health & Safety Manual – Chemical Hygiene Plan (Appendix C) as well as the Environmental Health & Safety Chemical Spills and Explosions Procedure (Appendix F).

All wet chemistry work must be approved by Lab Staff before work commences by filling out and email the Wet Chemical Procedure form to carleton@civil.columbia.edu. Once approved, the form must be printed and posted adjacent to the work space while the procedure is being performed.

When requesting a purchase of chemicals, the requestor must provide a plan to store said chemicals. Any user requesting the purchase chemicals must complete the Chemical Storage and Segregation 101 RASCAL training.

Acids are to be stored in the blue acids cabinet located in the southeast corner of the Lab. Acids are to be separated as organic or inorganic as labelled within the acids cabinet and stored in the provided secondary containment.

Flammables are to be stored in the yellow flammables cabinet located directly southwest of the machine shop.

Refrigerated non-flammable chemicals are to be stored in the refrigerator marked “CHEMICALS ONLY – NO FOOD” in Room 151. Food is not to be stored in this refrigerator.

Refrigerated flammables are to be stored in the flammables-certified refrigerator in the southwest corner of the Lab.

Chemicals stored in the Lab are property of the individual or group that purchased the chemicals. Lab users must label their chemicals with their name and the date the chemical was received in a manner that does not interfere with any existing labeling. Use of chemicals belonging to another user is strictly prohibited and, in some cases, illegal. Users wishing to use Lab-owned chemicals should contact Lab Management. Unlabeled chemicals will be disposed of at the discretion of Lab Management.

Users are responsible for the disposal of their individual-owned chemicals and samples prior to the conclusion of projects to avoid legacy wastes and unknown materials. Lab Management shall properly dispose of any chemicals or samples belonging to users who no longer have access to the Lab.

## Environmental Safety

The Lab operates under and adheres to the Environmental Health & Safety Manual – Environmental Safety (Appendix G).

The Lab recycles waste whenever possible. Green-lidded paper recycling bins are positioned throughout the Laboratory.

The following are acceptable green recycling:

- White, colored and glossy paper (Staples OK, but not spiral bindings.)
- Mail and envelopes
- Wrapping paper (Remove ribbon and tape.)

- Smooth cardboard (Shoe boxes, tubes from paper towel and toilet paper rolls, cardboard from product packaging. For food boxes, remove inside and outside plastic wrappers.)
- Paper bags
- Cardboard egg cartons and trays
- Newspapers, magazines and catalogs
- Phone books, soft-cover books (Paperbacks, comic books, etc.)
- Corrugated cardboard (If flattened boxes are large, place them next to the recycling bin.)

The following are trash:

- Hardcover books (Recyclable, if the cover is removed.)
- Used napkins, paper towels or tissues
- Soiled paper cups or plates
- Heavily soiled paper
- Plastic- or wax-coated paper or cardboard (Candy wrappers, take-out containers, etc.)

Blue-lidded bins for can and plastic recycling can be found near the entrance of the Laboratory.

The following are acceptable blue recycling:

- Glass bottles and jars (Glassware from laboratories is recyclable under a separate program.)
- Metal cans (Tuna cans, empty aerosol cans, empty and dried-out paint cans with lids removed, for example.)
- Aluminum foil wrap and trays
- Household metal (Wire coat hangers, pots, pans, for example.)
- Plastic bottles, jugs, caps, lids, food containers (yogurt, take out), non-food containers, packaging, and houseware (tupperware, flower pots)
- Beverage cartons and drink boxes (Milk and juice.)

The following are trash:

- Any glass items other than glass bottles and jars (Mirrors, light bulbs, ceramics, and glassware, for example.)
- Any plastic items other than plastic bottles, jugs and containers (plastic toys, cups, bags and wrap, for example.)
- Styrofoam (Cups, egg cartons, trays, for example.)

Scrap metal is to be disposed of in the gray scrap metal dumpster located directly south of the Southwark-Emery 600k Universal Testing Machine. The dumpster is marked with the label of Figure 15.


*Figure 15: Scrap Metal Dumpster Label*

Hazardous materials are to be disposed of according to the Environmental Health & Safety Manual – Environmental Safety, including all labeling, collection compatibility and container management requirements. The HazMat disposal area can be seen on the map of Figure 5 and is show in Figure 16.


*Figure 16: HazMat Disposal Area*

Used oil and oily materials are to be disposed in the oil drums appropriately labelled by Laboratory Management just north of the HazMat disposal area (see Figure 17.) A liquid waste drum is available for oil waste, labeled “WASTE OIL” and sporting a red fire-proof funnel. An oily solids drum is located immediately adjacent to this drum. All oil-drenched solids such as oily rags and oily HazMat pickup grains must be disposed in this drum. The drum and/or funnel must be mechanically closed after waste

is dumped.


*Figure 17: Oil Disposal Drums, showing fire-proof funnel in the foreground*

Sharps, including all used and unused needles and other materials identified in the University's Bloodborne Pathogens Exposure Control Plan (http://www.ehs.columbia.edu/ExposureControlPlan.pdf) are to be disposed in the pink sharps disposal bins located throughout the Laboratory (see Figure 18). Lids must be closed after sharps are dumped.


*Figure 18: Sharps Disposal Container*

Alkaline and lithium (household) batteries are to be disposed of in the battery disposal bin south of the Management office. All battery terminals are to be insulated before disposal. This can be accomplished by terminal guards or tape. Multiple batteries may be placed in one bag, as long as all battery contacts remain isolated. Any batteries leaking electrolytic material shall be treated as HazMat and disposed of accordingly. Lead-acid batteries are to be disposed as hazardous material.

## Concrete Laboratory

Wet cementitious materials cannot be poured down the drain; this includes washing of tools and containers with cementitious residue. This is reflected in the signs of Figure 19. Any items with cementitious residue must be washed over the slop buckets until the residue is removed. These buckets are routinely serviced by Lab Staff when full.


*Figure 19: Concrete Materials Laboratory Sink*

If the slop buckets (see Figure 20) are full, notify Lab Staff immediately.


*Figure 20: Slop Buckets*

Cleaning materials in the Concrete Lab are to remain in the Concrete Lab. Outside cleaning materials are not to be brought into the Concrete Lab.

Tools for use in the Concrete Lab are identifiable by yellow markings on their handles and are to be stored and used only in the Concrete Lab. External tools and equipment are not to be brought in without explicit permission from the Lab Staff.

## Equipment Lockout-Tagout

Under 29 CFR 1910.147 and 29 CFR 1910.333, the Lab implements and enforces a lockout-tagout policy. Equipment being maintained and serviced may have the appropriate lockout or tagout devices (see Figure 21) affixed to energy-isolating devices in said equipment when operation of the equipment may pose a threat to the user, other Lab users, Lab personnel or the equipment itself.


*Figure 21: Lockout-Tagout Station in the Machine Shop*

Lockout-tagout devices are only to be removed by the Lab personnel who installed the device. Removal by any other individual is a violation of federal code and Lab procedure. Such violations are considered Class IV Violations (see Disciplinary policy).

## Machine Reservation System

No testing equipment may be used without a reservation. Reservations are managed by the FOM Lab Management System. The use of any testing equipment without a reservation is prohibited and is considered a Class III Violation (see Disciplinary Policy.)

To reserve or access equipment not listed on the Lab website or FOM, users are to contact the Lab Staff.

# Incident Response

All permanent Laboratory Staff are trained and certified in first-aid, CPR, and AED.

## Minor Injury

In the event of a minor injury, such as a minor cut, bruise, etc., see Lab Management immediately. Should Lab Management not be present, there are several first aid kits throughout the Laboratory. These are mounted on the wall and are designated by green ceiling drop lights as well as wall mounted first aid signs.

All injuries, be they minor or major, must be reported to Lab Management.

## Major Injury

In the event of a major injury, see Lab Management immediately. Lab Management are trained in first aid, CPR, and AED and will be able to act as first responders to a major injury. Should Lab Management not be present, contact Public Safety by calling 99 from any Lab phone or +1.212.854.5555 from any external phone. Do not call 911, as 911 operators are not familiar with the Columbia University campus and buildings and will not be able to route emergency personnel to your location.

# Disciplinary Policy

## General Policy

Carleton Lab is an active heavy civil engineering testing Lab. This lab is not only subject to the standard safety regulations for chemical ls, as mandated by EH&S and FDNY, but also further safety regulations that are common in manufacturing facilities and construction sites.

Carleton Laboratory Management is responsible for the safety of all persons working in the Laboratory and is authorized by University policy to stop work, suspend access, and initiate formal disciplinary proceedings against any person on Laboratory premises. It is the responsibility of every user to familiarize himself/herself with the pertinent safety regulations of the Laboratory, as clearly posted at the entrances and noted in the various training modules, to follow all such rules, regulations and requirements and to conduct themselves and their activities in a safe manner. The failure to attain appropriate trainings is in itself a violation of Laboratory policy. Laboratory Management shall act fairly, per the guidelines outlined in this policy. All judgments are final.

Repeated offenses will be met with escalated disciplinary action, as outlined in this policy.

No University affiliation grants any user immunity from this policy.

The Laboratory disciplinary policy is enforced by Laboratory Management to ensure a safe and functional working environment for its users. The disciplinary policy is to be enforced by Lab Management at its discretion. Disciplinary violations have been separated into separate classes. Specific incidents are to be assigned a class by Lab Management. Any specific incident which cannot be classified will be dealt with by Lab Management on an ad-hoc basis.

## Definitions

- Aggregation – disciplinary actions are added to each other.
- Escalation – subsequent violation to be met with the next higher (+1) level of disciplinary action.
- De-Escalation – subsequent violation to be met with the next lower (-1) level of disciplinary action.
- Probation – period of time for which the user is subject to a +1 escalation for all violation classes.
- Suspension – period of time for which the user may not enter the Carleton Laboratory premises. Exceptions must have advanced written approval by Management and must be justified with extenuating circumstances.
- Expulsion – indefinite suspension of user from Carleton Laboratory premises.

## Aggregation

Disciplinary action in response to multiple violations cited in the same instance will aggregate but not escalate.

## Escalation

Repeated offenses in different instances shall escalate for every instance that a violation is cited at the discretion of Lab Management.

### De-Escalation

If a user was previously cited in a violation class but is not cited for further offenses within a year, the escalation of the original offense shall rescind at the discretion of Lab Management.

> *Example: If a user performs a Class II violation on 1 January 2013 and another Class II violation on 7 March 2013, the second violation will be considered a 2nd offense. If the user is reprimanded for another Class II violation on 15 February 2014, that offense is again considered a 2nd offense since the initial violation from 1 January 2013 rescinded on 1 January 2014, de-escalating the user to Class II 1st offense status.*

### Probation

At its sole discretion, Management may impose a probationary period on a user. During the probationary period, all violation classes are escalated by one step (+1).

## Class I Violations

**Definition –** A lack of sufficient training and/or certification to be present in the Laboratory.

**Violations**

- Working in the Laboratory without a Carleton Lab Sticker.
- Working in the Laboratory outside of operating hours without a C-14 holder's direct supervision.
- Working in the Laboratory when explicitly told not to by Laboratory Staff.

**Disciplinary Action**

- 1st offense: Verbal Warning, Order to Vacate Premises Until Trained
- 2th offense: 1 Month Suspension

## Class II Violations

**Definition –** Actions which potentially endanger the offender and create an unsafe working environment

**Violations**

- Eating and drinking outside of blue marked areas
- Improper Laboratory attire: shorts, open shoes
- Improper PPE: safety goggles, face shields, proper gloves, ear protection, dust masks, respirators.
- Failing to label chemical or HazMat containers
- Light misuse of tools and machines: ex., using screwdriver as chisel

**Disciplinary Action**

- 1st offense: Verbal Warning
- 2th offense: Written Warning
- 3rd offense: 1 Day Suspension
- 4th offense: 1 Week Suspension

## Class III Violations

**Definition** – Actions which create a significant and immediate hazard to the offender, and potentially other users. Actions which can potentially damage Laboratory property. Willful disregard of posted policy.

**Violations**

- Providing Lab access to unauthorized persons
- Using machine shop or testing equipment without authorization
- Using equipment without previous online reservation
- Heavy misuse of tools and machines: grinding aluminum or other flammables
- Removing Laboratory property from premises without prior permission
- Propping open doors without prior authorization outside of operating hours
- Improper disposal of hazardous materials: pouring chemicals down drain, etc.
- Failing to evacuate Laboratory during a fire alarm

**Disciplinary Action**

- 1st offense: 1 Day Suspension
- 2th offense: 1 Week Suspension
- 3rd offense: 1 Month Suspension
- 4th offense: Expulsion

## Class IV Violations

**Definition** – Egregious violations, which cause damage to the Laboratory, its users, and the University as a whole

**Violations**

- Working in the Laboratory under the influence of drugs and/or alcohol
- Removing a lockout/tagout tag without authorization of the tag owner
- Petit larceny of Laboratory property (<$1,000)

**Disciplinary Action**

- 1st offense: 1 Semester Suspension + Report to Disciplinary Committee
- 2th offense: Expulsion + Report to Disciplinary Committee

## Class V Violations

**Definition** – Egregious violations, which cause willful damage to the Laboratory, its users, and the University as a whole

**Violations**

- Grand larceny of Laboratory property (>$1,000)
- Gaining unauthorized access to the Lab while under access suspension

**Disciplinary Action**

- 1st offense: Expulsion + Report to Disciplinary Committee/Law Enforcement

## Visitor Violations

**Definition** – Use of the Lab by a visitor without direct supervision by a Research Access level user

**Violations**

- Use of the Lab by a visitor either alone or with a supervisor that does not have at minimum Research Access level and is a graduate student or higher

**Disciplinary Action**

- 1st offense: 3 week suspension for both visitor and assigned supervisor
- 2nd offense: Expulsion + Report to Disciplinary Committee for both visitor and assigned supervisor

## Appendix A – Carleton Laboratory Site-Specific Training

The most up to date version of the training should be accessed via RASCAL: TC2600 - Carleton Laboratory Site-Specific Training.

## Appendix B – Environmental Health & Safety Academic Machine Shop Safety Policy

The most up to date version of the Machine Shop Safety Policy should be accessed via https://research.columbia.edu/shop-safety.

## Appendix C - Environmental Health & Safety Chemical Hygiene Plan

The most up to date version of the Chemical Hygiene Plan should be accessed via https://research.columbia.edu/health-and-safety-manual.

## Appendix D – Environmental Health & Safety Fire Safety Manual

The most up to date version of the Fire Safety Manual should be accessed via https://research.columbia.edu/health-and-safety-manual.

## Appendix E – Public Safety Community Response Guidelines – Active Shooter Incident

The most up to date version of the Active Shooter Incident procedures should be accessed via https://preparedness.columbia.edu/content/active-shooter.

## Appendix F - Environmental Health & Safety Chemical Spills and Explosions Procedure

The most up to date version of the Chemical Spills and Explosions Procedure should be accessed via https://research.columbia.edu/chemical-spills-and-explosions.

## Appendix G - Environmental Health & Safety Environmental Safety Manual

The most up to date version of the Environmental Safety Manual should be accessed via https://research.columbia.edu/health-and-safety-manual.