
STReSS LAB

Laboratory for Structural Testing of Resilient and Sustainable Systems



STReSS Laboratory Safety Plan

STReSS Laboratory

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EMERGENCY CONTACTS

IN THE EVENT OF AN EMERGENCY CALL NORTHEASTERN
UNIVERSITY'S PUBLIC SAFETY DIVISION AT x333

Contact List

Name	Title	Email/Phone
Brian Burns	Director, Compliance and Risk Services	b.burns@neu.edu 617.373.8668
Jack Price	Director, EH&S	j.price@neu.edu 617.373.2769
Kyle Coleman	Laboratory Manager, Civil and Environmental Engineering	Ky.coleman@neu.edu 617.855.9530
Jerry Hajjar	Lab Director, Chair of Civil and Environmental Engineering	Jf.Hajjar@neu.edu 617.373.3242

Section 1: Introduction

Purpose

This Laboratory Safety Plan describes policies, procedures, equipment, personal protective equipment, and work practices that are capable of protecting employees and visiting researchers from hazards in the STReSS laboratory.

A majority of the hazards in the lab are associated with construction activities such as specimen and test frame construction, instrumentation, and specimen removal and demolition. Operations during testing of large-scale structural specimen also present safety hazards. In addition, work tasks may involve the use of chemicals that users must procure, store, handle and dispose of in a safe manner.

Scope and application

This standard is applicable to student employees, technicians, supervisors, and researchers affiliated with Northeastern University, as well as visiting researchers associated with other institutions or agencies and their subcontractors.

The Laboratory Safety Plan applies for all activities in STReSS Laboratory aside from those conducted in the office space.

This includes all portions of the main Laboratory:

- Test area near actuators
- Strong-floors
- Strong-walls (and area behind)
- Staging areas
- Storage areas and outside work area
- Control room
- Hydraulic pump area
- Mechanical rooms, Machine shop/ area
- Driveway

Potential safety hazards

A wide variety of equipment and hazardous procedures are necessary to complete tasks in the STReSS Lab. Potential safety hazards may include the following:

- Hydraulic test equipment:
 - hydraulic actuators and material test frames
 - high pressure oil
 - high force testing
 - brittle material testing
 - large scale specimen testing

- Equipment and tools:
 - hand tools
 - welding and torching equipment
 - gas cylinder storage and use (acetylene, carbon dioxide, oxygen)
 - pneumatic and electric power tools
 - pallet jacks and portable lift equipment
- Ladders, scaffolding, work platforms, concrete shoring platforms and scissor lifts
- Cementitious material handling and casting
- Specimen instrumentation
- Working at elevated heights
- Loading dock vehicular traffic
- Overhead and hydraulic boom cranes
- Rigging and moving loads
- Compressed-air
- Electrical shock
- Unsafe workers
- Insufficient, cluttered, and/or shared work space

Job safety analysis

Identifying hazards and eliminating or controlling them as early as possible will help prevent injuries and illnesses. Job hazard analysis is a technique that focuses on job tasks as a way to identify hazards before they occur. It focuses on the relationship between the worker, the task, the tools, and the work environment. Ideally, after you identify uncontrolled hazards, you will take steps to eliminate or reduce them to an acceptable risk level. The Occupational Health & Safety Administration (OSHA) publication 3071 addresses job hazard analysis for employees, supervisors and management. A copy of this document can be found at <http://www.osha.gov/Publications/osha3071.pdf>.

STReSS Laboratory administrative personnel have performed a job hazard analysis identifying common shop tasks, attendant safety hazards, and appropriate action to mitigate such hazards; the results inform practices and procedures throughout this safety plan. A list of specific hazards is provided below for personnel familiarity. The hazards detailed must be communicated to all persons participating in the following tasks.

Job Task	Job Hazard	Preventative Actions
Crane operation, rigging, and/or moving load	Struck by moving or falling load Crushing injuries Damage to equipment	Never stand in a crush-point or under any suspended load Use required personal protection equipment (PPE) (i.e. hardhat, safety-toe boots, etc.) Use teamwork for rigging Verify rigging capacities and working loads Prepare a rigging plan
Specimen testing	Specimen failure (i.e., spalling concrete or bolt failure)	Place “Testing in Progress” signs for unauthorized personnel at every entrance including the testing area Before approaching a specimen, verify specimen integrity
Tensioning specimen to strong floor, strong walls, or crosshead	Smashing hand against surfaces while using a ratchet or wrench Ergonomics (strain) Equipment failure Potential for heat stroke when tensioning in the crosshead	Wear gloves and be aware of your surroundings Work slowly Take breaks if physical activity is too high
General working (walking and working throughout the lab area)	Tripping, slipping, or walking into objects	Place metal angle over cords and cables Immediately take care of any spills Practice good housekeeping
Working in a confined/enclosed space (crosshead)	Heat exhaustion Impact injuries Cuts	Take breaks Drink plenty of fluids Wear loose fitting clothes, hardhat, safety glasses, and gloves
Working at elevated heights	Potential to fall	Understand your limitations, be aware of your surroundings, use fall appropriate fall protection, notify staff if you are uncomfortable working at heights

STReSS Laboratory Safety Plan*Section 1: Introduction and responsibility levels*

Operating and working from scissors lifts or ladders	Potential to fall Impact injuries Crush-points	Never climb out of lift without using a fall arrest system Do not stand on railings Be aware of crush points between the lift's railing and other surfaces Work slowly, know your limitations
Lifting/moving materials	Strain to back or dropping materials on foot Potential for cuts	Know your limitations, do not lift over 100 pounds Understand where your destination is and what your travel path will be Use teamwork Wear gloves when handling metal or sharp materials
Specimen instrumentation	Skin and eye irritation Falling objects	Use latex gloves, safety glasses and hard hats Wash hands after using strain gauge glue.
Forklift operation	Impact injury, crushing, falling objects, and rolling vehicle	Only certified employees are allowed to operate the forklift Wear PPE, be aware of surroundings while operating or working around an operational forklift Do not stand in the operators blind spot
Working with or around hydraulic equipment	Cutting or burns from high-pressure oil Potential for slick spots on the floor	Cautiously work around actuators and other hydraulic equipment Wear all required PPE Never disconnect actuator hoses or components without the supervision of the site operations manager Never stop a hydraulic fluid leak, immediately notify staff or e-stop the pump Use absorbent pads or oil dry to collect spilled oil
Concrete/Grout handling (dry)	Skin, eye, respiratory hazards	Use latex gloves, dust masks, safety glasses

	Back strain	See manual lifting or lifting heavy materials
Concrete/Grout handling/casting	Skin and eye hazards Mechanical vibration	Use required PPE Minimize exposure to concrete vibrator Use gloves due to burn potential from concrete admixtures
Using STReSS tools	Mechanical injury Mechanical vibration Eye injury Mechanical failure injury Impact, cuts and hearing hazards	Wear PPE (i.e. hardhat, safety glasses, hearing protection, face shield, gloves, etc.) Take breaks to reduce exposure to vibrations Know the limitations of power tool to avoid mechanical failure Inspect and maintain the power tool Do not wear loose clothing when operating rotating machinery
Welding or torching	Explosion Burns Electrical shock	Wear all required PPE Keep area clear of any flammable materials or accelerants Know where all fire extinguishers are located Do not weld in wet or damp areas.
Proper housekeeping and storage of materials	Impact injury from falling objects Trip hazards Pallet stacking equipment failure Forklift operation	Do not lean unstable objects against other objects or working surfaces Do not leave tools and materials on elevated work platforms or specimens
Working with pneumatic equipment (i.e. tools and hoses)	Impact injury Eye injury	Wear all required PPE If hose becomes cut and begins to whip, do not try to catch or stop hose Immediately locate and shut off valve

Restricted use equipment

Outside researchers and their subcontractors may not independently operate the hydraulic equipment, overhead cranes, or forklift.

Major activities undertaken by outside researchers and equipment requirements must be contained in their approved Work Plan for the project. When officially trained, researchers may use the scissors lifts, welding equipment, torching equipment, mag-drill, Hilti core machine, and Hilti rotating hammer drill.

Operations requiring the use of this equipment must be coordinated with the Laboratory Director or Operations Manager.

Coordination with other standards and guidelines

Several standards and guidelines dictate the performance of activities in the STReSS Laboratory.

OSHA

Persons working in the STReSS Laboratory must observe OSHA rules for construction activities and for the handling, transport, and use of chemicals.

Further details on the OSHA standards for construction activities may be found at <http://www.osha.gov/>.

Details on the OSHA standards for the handling, transporting and use of chemicals may be found at <http://www.osha.gov/>.

RTK

The Massachusetts Right to Know (RTK) Law has rules concerning the use and handling of chemicals. Several pieces of equipment in the laboratory are large and/or are capable of generating unsafe conditions if used improperly. If authorized for their use, individuals are required to receive training prior to use of restricted equipment including the overhead cranes, the forklift, the scissors lift, and the MTS hydraulic system and actuators.

Northeastern University employee responsibilities

Employees who have significant responsibility for directing their own laboratory work are responsible for assuring that they and their supervisor identify and address potential hazards of specific projects before work starts.

All laboratory employees, however, are responsible for the following:

- attending safety training sessions;
- following safety guidelines applicable to the procedures being carried out;
- assuring that required safety precautions are in place before work starts, and;
- reporting hazardous conditions as they are discovered.

Performance is measurable by the supervisor's assessment of employees' adherence to topics covered in safety training.

Section 2: Standard operating procedures

Employee Participation

Because of the small employee size at the STReSS laboratory, all staff and student employees at the STReSS laboratory are members of the STReSS safety committee.

Prior to the start of certain tasks, a meeting will be held including all personnel involved. During this meeting, the supervisor and/or floor manager will discuss procedural steps required for the upcoming task with employees. Employees are trained on identifying situations or equipment hazards that could potentially cause damage or create an unsafe working condition, and will immediately notify a STReSS staff member to inspect and/or correct the situation.

Employees, under the direct supervision of a STReSS staff member, should be involved in the erection and inspection of fall protection systems, scaffolding and other elevated work platforms.

Employees are encouraged to take part in laboratory self-inspection walkthroughs and safety meetings. Any STReSS staff member is a liaison for student employees to voice their concerns to the safety committee regarding

- unsafe task procedures
- behavior observations regarding other employees
- lack of or non functional personal protection equipment
- unsafe tools or equipment
- general housekeeping concerns.

Employees are asked to maintain an open dialogue with STReSS staff regarding any safety concerns. Employee participation in meetings is crucial for creating a safe work environment.

Individuals are encouraged to ask questions regarding occupational safety, comment on safety concerns, and discuss relevant safety issues during this time. This is a good time for individuals to talk about correcting unsafe habits and procedures.

Accident and Incident procedure identification

Accident and incident identification. The STReSS Laboratory and its workers are vulnerable to the following types of accidents and incidents:

- Injury
- Potential to injure oneself and/or others
- Damage to a specimen and/or lab equipment
- Potential to damage a specimen and/or lab equipment

Immediate action. In the occurrence of one of the accidents and incidences listed above, work should be stopped immediately to assess damages and determine if there is a need for medical assistance. When an accident or incident involves bodily injury, refer to Section 7, *Situations requiring medical examinations and consultations*, for more detail. Then, a supervisor or manager should address the accident and/or incident with all members working in the area. They should determine the specific actions that caused the accident (or near miss), and they should discuss how the problem could have been avoided. Later in that same day, a supervisor or manager should then hold a brief meeting with all personnel to reflect and discuss the previous accident and/or incident. If injury was present, Section 7, *Workers' compensation procedures and forms* should be referred to.

Northeastern University employees (i.e. staff and student workers) will follow all workers' compensation procedures discussed in Section 7.

Volunteer workers (i.e. student volunteers and visiting workers) sign the Lab Use Assumption of Risk and Release of Liability Form located in Appendix A that does not provide University health and/or accident insurance for the volunteer or visitor. In the case of an injury to a volunteer worker or visitor, standard medical care should be administered, but the individual is responsible for providing valid medical insurance. Visiting researchers are encouraged to provide STReSS staff with a list of local clinics covered under their insurance policy.

Visiting researchers are not employees of the Northeastern University as stated in the Research Participation Agreement (RPA excerpts located in Appendix A); therefore, visiting researchers must be covered under their own Institutions' Workers' Compensation Plan, and should follow their plan's procedures accordingly. Visiting researchers are encouraged to provide STReSS staff with a list of local clinics covered under their University's workers' compensation policy. If a visiting researcher is injured onsite, the following action should be taken:

- In the event of a life-threatening illness or injury, dial 911
- Visiting researchers with urgent, but non-life-threatening, illnesses or injuries should go to the nearest medical clinic covered under their policy.
- The visiting researcher should follow his or her own University workers' compensation policy and procedures accordingly.

Accident and incident investigation/recordkeeping. Within 24 hours of the accident and/or incident, the direct supervisor, Site Operations Manager and the individual(s) directly involved and/or injured in the accident and/or incident need to discuss and fill out the STReSS Incident Report Form located in Appendix B. This form will be reviewed by the EHS to ensure that the investigation was done adequately.

All laboratory fires, explosions, and chemical spills, regardless of whether or not an injury occurred, require the additional completion of the Accident Investigation Worksheet located in Appendix C.

The Site Operations Manager will then conduct a site-wide procedural review for the purpose of updating operating practices and safety policy to reflect knowledge gained in the incident and to limit or eliminate future likelihood of occurrence. The Site Operations Manager will immediately communicate these updates to all laboratory personnel in the form of email bulletins, daily safety meetings and a revised safety plan. This communication includes adding all documented incidents to the weekly staff meeting agenda for discussion. A running total of each type of incident will be continuously added to the weekly staff meeting agendas for discussion of accident trends.

All documents pertaining to each incident will be copied and filed in the STReSS Laboratory Safety Log.

First aid and emergency information

At least one full-time STReSS staff persons have First Aid and CPR training. It is anticipated that at least one of these individuals will be at the Lab while significant activity is underway.

First aid kits are available in the STReSS Lab. Emergency information resides on the inside the lab entrance. This is a central location near the entry to the office area. Information includes phone numbers for EHS, Northeastern Health Services, Lahey Clinic Emergency Room, University Police and so on.

Northeastern University's no smoking policy

The Northeastern University prohibits smoking in all facilities of the Northeastern University Campus. Additionally, University smoking policy also prohibits smoking within 25 feet of building entrances. This prohibition includes the STReSS Laboratory.

Please note that smoking is not permitted anywhere in University buildings. Smoking in University buildings violates University policy and OSHA requirements. Penalties or fines may be imposed for violations.

General safety procedures

Northeastern University policies for Safety Procedures in laboratories are accessible at the home page of the Office of Environmental Health and Safety <http://www.ehs.neu.edu/>.

Sections especially applicable to the STReSS Laboratory include:

Lab safety

- Emergency Eyewash and Safety Shower Installation
- Eye Protection/Personal Protective Equipment
- Flammable and Combustible Liquid Quantities in NEU Laboratories

Fire safety

- Flammable and Combustible Liquid Quantities in NEU Laboratories
- Fire Safety at the University
- Portable Fire Extinguishers-Type and Placement

General safety

- Emergency Procedures
- Eye Protection/Personal Protective Equipment
- Extension Cords in University Buildings
- Foot Protection/Safety-Toe Shoes
- Portable Fire Extinguishers-Type and Placement
- Step Ladders-Care and Use
- Needlestick and Other Infections Exposure Procedures
- Bloodborne and Other Pathogens Exposure Control Plan
- Temperature Standard
- Northeastern University Campus Smoke-Free Indoor Air Policy
- Supervisors Injury/Illness Investigation Form

If you have any questions about these topics, please access the web page identified above and investigate further.

Bloodborne pathogen procedures

STReSS Laboratory research activities normally will not involve interaction with bloodborne pathogens. Unforeseeable personnel injury could potentially result in bloodborne pathogen exposure, and these cases should be managed in accordance with the guidelines below. New personnel will be trained in on topics related to bloodborne pathogens. The trainee will then fill out and sign a the Bloodborne Pathogen and Other Infectious Agents Record of Training Form located in Appendix D. This form will be submitted into the STReSS Laboratory Safety Log.

In the event human body fluids require clean up due to an injury, only trained personnel are allowed to clean up spills with approved clean up kits.

Lab personnel are responsible for keeping their immediate work area clean and sanitary. If there are needs beyond general housekeeping, report these concerns to a supervisor.

All equipment and working surfaces must be cleaned and decontaminated using sanitizing cleanser after contact with blood or other potentially infectious material.

If blood or other potentially infectious materials come in contact with anyone's eyes, nose, mouth, or on broken skin:

1. Immediately flood the exposed area with water and clean any wound with soap and water or a skin disinfectant if available.
2. Report the incident immediately to an employer.
3. Seek immediate medical attention at Lahey Clinic or the nearest medical care facility.

Chemical procedures

Several standard reference works supplement this Laboratory Safety Plan and are available in the STReSS Lab's office area.

Prudent practices in the laboratory manual

The laboratory-standard operating procedures found in Prudent Practices in the Laboratory: Handling and Disposal of Chemicals (National Research Council, 1995) <http://books.nap.edu/books/0309052297/html/R1.html#pagetop> are accepted and endorsed for general use at the Northeastern University. Each department's Research Safety Officer has print copies of this text, and the entire contents are accessible on the Web.

Hazard communication plan

The following is a communication plan to ensure proper competence of hazardous materials by all STReSS Laboratory employees and student workers. A list of potentially hazardous materials used in the STReSS Laboratory is provided below. The Material Safety Data Sheets (MSDS) for these materials are attached in Appendix E and also held in the STReSS Lab's office area.

Adhesives

- Araldite Standard Epoxy Adhesive
- Cyanoacrylate Adhesive – strain gauge glue
- Edgemate Hot Melt Adhesive (Pellets/Cartridges)
- Heavy Duty Construction Adhesive New VOC < 7%
- Hot Glue Sticks
- Loctite Epoxy Quick Set

Cementitious Material

- Lehigh Southwest Cement Company Portland Cement
- Hydrocal B-11 Gypsum Cement

Grease/Lubricant

- Mobil Almo 525
- Molykote
- Tapmatic Cutting Fluid
- WD-40
- JL-G Lubricant
- Knock'er Loose Penetrating Solvent
- Liquid Wrench Penetrating Oil

Hydraulic Fluid

- Enerpac HF Hydraulic Oil
- Enerpac LX Hydraulic Oil
- Mobil DTE 25

Sealant

- Great Stuff Gaps and Cracks Insulating Foam Sealant
- Dynaflex 230

Solvent

- Acetone

Welding

- Acetylene
- Argoshield gas
- Oxygen
- Nitrogen

Miscellaneous

- Abrasive Cut Off Wheel
- Carlon Electrical Products Medium Gray PVC Cement
- Glidden Evermore Paint
- Oatey Purple Primer
- Propane
- Rust-Oleum Professional High Performance Enamel Aerosol

The MSDS provides each chemical with product identification, chemical/physical characteristics, health hazard information, precautions for safe handling, control measures, etc. The personnel handling and using the chemical should understand the MSDS information for each chemical hazard.

All personnel must be made aware of potential risks regarding all of the hazardous materials used at the facility. Because the STReSS Laboratory uses a minimal amount of hazardous chemicals, each chemical should be individually discussed during training. The trainee will learn to properly handle, use, and dispose of each chemical. Trainees should be taught how to locate and properly wear personal protection equipment required for each hazardous chemical. Information regarding proper personal protection is provided in the “Exposure Controls and Personal Protection” section of the MSDS for each chemical. The most important aspects of training are to ensure employees are aware that they are exposed to hazardous chemicals, that they know how to read and use labels and material safety data sheets, and that as a consequence of learning this information they are following the appropriate protective measures.

Training will be documented for each individual using Form BA 725A in Appendix F and placed in the STReSS Laboratory Safety Log. This documentation will prove that the trainee has been successfully trained on all listed chemical hazards. As new chemicals are added to the laboratory, it is up to the employee and supervisor to update the individuals training log.

Laboratory-specific standard operating procedures

Personal protective equipment

Everyone working in the STReSS Lab must wear the appropriate safety and personal protective equipment (PPE) required for a particular operation.

Among other PPE items, the STReSS Lab provides goggles, hard hats, latex and leather gloves, leather shirt, welding helmets, lanyard and harness equipment, aluminum boot clips, and earplugs.

Two-person rule

The two-person rule is strictly enforced for all crane related activity with no exceptions. Two people must be involved throughout any use of either crane.

The two-person rule applies to working in and around the actuators whenever accumulated forces may be present. The second person may be in the Control Room monitoring the application of hydraulic pressure.

One interpretation of the two-person rule for the operation of power equipment requires that a second person be present in the Lab and aware of the activity of the other person, and be able to monitor the work at appropriate intervals. This rule also includes work at elevated heights.

Crush points

Crush points are areas where a person is likely to be caught between a moving object and a fixed or immobile object. Hands and fingers are especially vulnerable to crush points. A thumb caught between a moving hammer and an immobile board has found a typical crush point.

Crush points can be created when a power tool or torque wrench flares back on the user. Serious crush points can develop around the STReSS actuators when the actuators move in unexpected ways.

Anyone working in the STReSS Lab must be aware of the potential for crush points, and use caution when operating power equipment or working near the actuators.

Special communication procedures

When working from scissors lifts, scaffolding, the crosshead, and any other elevated location, communication is essential for safe and efficient work. The STReSS Laboratory is equipped with two-way radios and remote speaker/microphone accessories. These radios are to be used when working in an environment that limits communication. Radio communication is recommended for specimen tensioning and hook up, specimen installation and removal using the crane and/or crosshead, raising and lowering the crosshead, and any other situation that requires communication between walls or objects. Two-way radios are located in the control room.

Compressed gasses

Compressed gas storage in the STReSS facility includes flammable and non-flammable compressed gasses. Compressed gases are to be only used by a lab manager and/or personnel trained and approved by a lab manager. Cylinders are to be refilled only by a commercial gas service provider. Cylinders must be inspected upon each use and on a weekly basis when in storage for leaks or damage. Leaking or damaged cylinders must immediately be removed from service and returned to the provider.

Storage and separation. Cylinder storage and use locations must be kept clear of all weeds, grass, brush, and trash, as well as any other combustible materials, for a minimum distance of 15 ft (5m) from all cylinders. **Exception:** an approved noncombustible barrier, cabinet, or hood may be used instead. The STReSS Laboratory provides a specific location for flammable cylinders (i.e. Acetylene and Propane) that is separate from the location where oxidizers such as oxygen are stored.

Cylinder transportation. Only standard DOT cylinders will be used for transporting compressed gas. Personnel who are trained to use compressed gases may use standard cylinder carts to transport cylinders within the laboratory. Carts are preferred, but cylinders weighing 25 lbs (11 kg) or less may be hand-carried. Valve-protection caps and plugs must be in place during movement of cylinders. Lecture bottles and other cylinders without protective caps must be transported in standard shipping crates, or an equivalent container.

Gas cylinders must be transported between non-adjoining buildings by a person properly trained, licensed, and equipped to transport gas cylinders.

Cylinder position. Gas cylinders must be stored in a (valve end up) upright position, which includes conditions where the cylinder is inclined as much as 45 degrees from the vertical. Exceptions include cylinders designed for use in a horizontal position, and cylinders with non-liquefied compressed gas that have a water volume less than 5 L (0.18 cf or 1.3 gal).

Cylinder securing. Gas cylinders must be secured to prevent falling due to accidental contact or vibration. Cylinders must be secured in one of the following ways:

By a noncombustible, two-point restraint system (e.g., chains) that secures the cylinder at the top and bottom one-third portions. **Exception:** cylinders less than 3 ft (1 m) tall require only one restraining point.

By a noncombustible rack, framework, cabinet, approved strapping device, secured cylinder cart, or other assembly that prevents the cylinder from falling.

Cylinder valves, caps, and plugs. Gas cylinders designed to have valve-protection caps and valve-outlet caps and plugs must have these devices in place. **Exception:** when the cylinder is in use or being serviced.

Gas cylinder valves must have a handwheel, spindle key, or other approved control handle on the valve stem while the cylinder is in use. Cylinder valves should be

opened slowly. Cylinder valves seat in both the closed and open position and are likely to leak unless left in the fully open or fully closed position.

Unauthorized cylinder modification or use. All labels, markings, and tags provided on the gas cylinder by the manufacturer must be maintained in good condition. Gas cylinder parts must not be modified, tampered with, obstructed, removed, repaired, or painted by the gas user.

Empty cylinders. Notify STReSS staff when cylinders are empty. STReSS staff are only allowed to change empty cylinders. Gas cylinders should be left with residual pressure (i.e., typically 200 kPa or 30 psi) to prevent contamination of cylinder contents. Cylinders considered to be empty should be handled with the same precautions as cylinders filled with gas because so-called “empty” cylinders still contain residual gas and pressure. Empty gas cylinders must be labeled “Empty.”

Cylinder changing. Two people must be present during hazardous gas purge and cylinder change procedures. Reconnected gas fittings must be checked for leaks using a leak-detection fluid or other approved method.

Cylinder temperature control. Gas cylinders should be stored in the shade and must not be exposed to temperatures exceeding 125°F (50°C).

Air Compressor

The Saylor Beall air compressor located in the mechanical room supplies compressed air to three laboratory compressed air manifolds throughout the lab.

If the air compressor is not working at its normal operating capacity, notify the Floor Manager and/or Site Operations Manager. They will notify Facilities Management to inspect and service the air compressor. Facilities management is in charge of proper maintenance of the air compressor. Pneumatic operations have the potential to cause serious injury; therefore, follow the procedures below when working with pneumatic equipment:

- Shut hand-valve on manifold off and fill oil reservoir located on the regulator with Mobil Almo 525 air tool oil.
- Check maximum input pressure labeled on the piece of pneumatic equipment and set the pressure on the regulator accordingly.
- If a hose becomes cut and begins to whip, do not try to catch or stop hose. Immediately locate and turn off the shut-off valve.
- Pneumatic equipment training is covered in more detail in the *power tools* section below.

Elevated work

Who is covered. Employees working on platforms, specimens, and other objects must be provided with adequate fall protection whenever they are more than six feet above the adjacent ground, floor, or other work surfaces. Construction standards require fall protection when a worker is elevated six feet. In some cases, a standard guardrail and

footboard system can be installed to prevent falls. If this system is used, it shall comply with OSHA 29 CFR 1926.502(b). When a standard guardrail system is not feasible, an adequate fall arrest system must be provided for each exposed worker. Fall protection must follow the following OSHA standards:

- General Industry Standard
29 CFR 1910.21-.32
- Construction Industry Standard
29 CFR 1926.500 et. seq.

Required training. Any personnel exposed to fall hazards must take part in a training program for construction fall protection. Personnel must receive the following training when hired, whenever there is a change in assignment, or when necessary to correct a demonstrated lack of skill or understanding:

- When fall protection is required.
- How to properly fit and wear a full-body harness. (i.e. the sliding D-ring should be positioned midway up the back).
- Choosing proper anchorage point or tie off locations.
- Understand how to safely use two lanyards to move from one location to another. (i.e. clipping from one horizontal lifeline to another on the crosshead using two lanyards/snaphooks).
- Understand how the lanyard or connection device absorbs a fall.
- What fall protection devices are available and their limitations.
- The use, maintenance, and inspection requirements for fall protection devices.
- The fall protection plan and the role of each employee in implementing it.

Record keeping. Written certification of all required training must be documented using the form located in Appendix G and filed in the STReSS Laboratory Safety Log. Self-inspections of general conditions of an elevated workplace should be conducted before use.

Elevated work locations. A variety of elevated construction and maintenance activities occur throughout the STReSS Laboratory. It is the responsibility of all personnel to ensure proper fall protection is consistently used. Workers should be aware of acceptable and appropriate anchorage locations throughout the laboratory. If no permanent tie-off location is available, a trained supervisor should establish a temporary tie-off location to be used. The following are examples of elevated working areas that require a fall arrest system:

- Above and around specimens without OSHA approved guardrails.
- On and around storage racks where a scissors lift is not accessible.
- On and around any elevated structure or specimen in the staging area that does not meet OSHA guardrail standards.
- Other elevated working locations above 6 feet.

Ladders. The STReSS Laboratory is equipped with multiple extension ladders as well as a variety of stepladders. Safety hazards in the use of ladders can be substantially reduced by observing certain basic safety precautions as noted below:

- Ladders must be stored to prevent weathering, blistering, or cracking.
- All metal ladders must be legibly marked with signs reading "Caution - Do not use around electrical equipment."
- Portable straight and extension ladders must be equipped with slip-resistant shoes.
- Straight or extension ladders must be placed against a support at an angle such that the distance from the ladder base to the base of the support is one-fourth the working length of the ladder.
- Lash straight or extension ladders when used for access to high places.
- Face ladders when ascending or descending.
- Do not use a ladder as a scaffold.
- Do not place a ladder in front of a doorway, unless the door is blocked open, locked, or guarded.
- Do not place ladders on boxes or unstable bases to obtain additional height.
- Do not climb higher than the second step from the top of a ladder.
- Ladders with broken rungs or missing steps must not be used.
- Inspect all ladders before use.
- Report any defective ladders to your supervisor.
- Supervisors must ensure that any ladder reported as defective or unsafe is removed from service.

Scaffolding construction

The following general OSHA 29 CFR 1926.450 requirements need to be followed when planning and designing a scaffolding system:

- Each platform on all working levels of scaffolds shall be fully planked or decked between the front uprights and the guardrails.
- Front edge of all platforms shall not be more than 14 inches from the face of the work, unless guardrail systems are erected along the front edge and/or personal fall arrest systems are used.
- Supported scaffolds with a height to base width ratio of more than 4:1 shall be restrained from tipping by guying, tying, bracing, or equivalent means.
- Hook-on ladders or stair towers should be used as access points. Cross-bracing is not considered a means of access.
- All fabricated frame scaffolds will be constructed using the manufacturer's installation procedure.
- Fabricated frames and panels shall be properly braced and joined together vertically by coupling or stacking pins.

All scaffolding construction (i.e. erecting, disassembling, moving, operating, repairing, maintaining, or inspecting) should be done under the supervision and training of a “competent person.” Procedures should follow the OSHA 29 CFR 1926.450 requirements for scaffold construction. The following STReSS personnel are considered “competent” by OSHA’s definition:

http://www.osha.gov/SLTC/etools/scaffolding/erectors_dismantlers/e_d.html:

- Kyle Coleman, Lab Manager

They have the ability to identify existing and predictable hazards in working areas and possess the authority to correct them. These recognized “competent” people will be responsible for training each employee who is involved in erecting, disassembling, moving, operating, repairing, maintaining, or inspecting a scaffold to recognize any hazards associated with the work in question. Employee training shall include the following topics, as applicable:

- The nature of scaffold hazards
- The correct procedures for erecting, disassembling, moving, operating, repairing, inspecting, and maintaining the type of scaffold in question
- The design criteria, maximum intended load-carrying capacity and intended use of the scaffold
- Any other pertinent requirements of this subpart
- Proper handling of materials on the scaffold
- Understand the procedures to control or minimize those hazards

A “competent” person is required to execute a final inspection of all installed scaffolding before any activity is performed from it.

An outside shoring company will design shoring used in any concrete casting.

Forklift operation

The following STReSS personnel are certified and allowed to fully operate the laboratory’s forklift:

- Kyle Coleman, Lab Manager

The Northeastern University and the STReSS Laboratory do not provide an internal certification program; however, employees can develop safe operating skills and knowledge through Crown’s OSHA compliant certification program. Any employee who has not successfully completed this program is prohibited from operating the forklift. A certification card is issued to a graduate of the certification course to document the qualifications and training of an approved forklift operator. Certified employees must have the certification card on them at all times whenever operating the forklift. A Herc-U-Lift Safety Handbook is provided to all certified operators and is located in their cubical for reference. The manual overviews the training program as well as covers all operational procedures related to safe forklift operation. A trained forklift operator

- operates the forklift safely

STReSS Laboratory Safety Plan

Section 2: Standard operating procedures

- has read and understands the Operation Manual
- has read, understands and follows all warnings and instructions on the forklift
- has read and understands the applicable American, National and OSHA operation Standards and requirements
- places the forklift key in the yellow lockout/tag out station after operating the forklift
- inspect the forklift prior to operation and sign inspection record

The Crown training program recommends previous experience operating a forklift, and these training sessions will be addressed on an individual basis with the Lab Manager. The trainee, under constant supervision of a forklift certified STReSS Laboratory Manager, will practice simple operating procedures using the laboratory's forklift. The supervised training will be conducted as follows:

- The trainee will be introduced to STReSS Laboratory forklift and receive an overview of all of its operating controls, safety features, general driving procedures and any additional safety topics.
- The trainee will read the Crown Safety Handbook and discuss concepts with designated supervisor.
- The trainee will start and operate the basic controls of the forklift without lifting any actual load.
- Once trainee is comfortable with controls, he or she will drive forklift in and out of the loading area.
- Finally, trainee will be asked to pick-up a pallet and move it to a predetermined location.
- The supervisor and trainee should freely discuss any questions that arise.
- Additional practice should be arranged with the Site Operations Manager.
- Trainee will be restricted from loading/unloading delivery trucks.

Language barrier

All STReSS Laboratory personnel are fluent in English. Foreign-language student workers must be able to acknowledge and demonstrate understanding of safety policies and training directly or through the assistance of a bi-lingual intermediary to participate in any laboratory research activities.

Manual lifting

Factors associated with back disorders and other injuries:

- Reaching while lifting
- Poor posture--how one sits or stands
- Bad body mechanics--how one lifts, pushes, pulls, or carries objects
- Poor physical condition-losing the strength and endurance to perform physical tasks without strain
- Repetitive lifting of awkward items and equipment
- Twisting or bending while lifting

- Maintaining bent postures
- Heavy lifting
- Fatigue
- Poor footing such as slippery floors or constrained posture
- Lifting with forceful movement

Proper lifting techniques. The body is aligned and balanced. The head is kept upright and is not turned to either side more than about 30 degrees or tilted forward or backward more than about 15 degrees. When the worker is standing, the torso is not bent more than 10 to 20 degrees from the vertical position and the natural curves of the spine are maintained. The pelvis and shoulders should face straight ahead to avoid twisting the torso. The shoulders are relaxed and knees slightly bent. The arms hang normally at the side, with elbows close to the body. The elbows are not bent more than about 90 degrees and the palms face in toward each other and the center line of the body. The wrists are in line with the forearms and are not bent sideways, forward (towards the palm), or backward (towards the back of the hand.) When the worker is seated, the buttocks and feet are firmly supported.

Before performing any manual lifting, STReSS Laboratory personnel need to follow the recommendations below:

- Make sure you are warmed up and stretched out well.
- Know your limits! Only lift objects you are comfortable lifting.
- Plan the route to take when moving materials.
- Is it too far or hard to maneuver through?
- Move items close to your body and use your legs when lifting an item from a low location.
- Avoid twisting, especially when bending forward while lifting. Turn by moving the feet rather than twisting the torso.
- Keep your elbows close to your body and keep the load as close to your body as possible.
- Use scissors lifts to elevate employees and move them closer to the work area so overhead reaching is minimized.
- Lift within the power zone.
- The power zone for lifting is close to the body, between mid-thigh and mid-chest height. Comparable to the strike zone in baseball, this zone is where arms and back can lift the most with the least amount of effort.
- Enlist the aid of sufficient additional personnel to lift the weight.
- If possible or convenient break down loads into smaller units and carry one in each hand to equalize loads. Use buckets with handles, or similar devices, to carry loose items.
- Use provided hand trucks, pallet jacks, and mechanical lifting equipment to move the weight were applicable and in accordance with manufacturer's

instructions. Do not to exceed the weight rating of the trucks as clearly marked.

Routine activities in the laboratory that require special lifting provisions to avoid back injury are:

- Use a dolly cart when moving steel plate washers from the storage area to the testing or prep areas.
- Two people should be used to lift or carry long piece of treaded rod, angle iron, lumber and 12' EFCO.
- Only fill EFCO bolt buckets half-full.
- Actuator spacers should be stored on pallets so they can be easily moved with a pallet jack.

Temperature stress

Control of heat stress. Self-awareness is one of the key steps to reducing heat-related disorders. Employees and supervisors should terminate exposure to heat stress at the onset of the first symptoms. Supervisors should consider a worker's physical condition when determining heat stress conditions. Obesity, lack of conditioning, medical conditions, use of medications, pregnancy, and inadequate rest can increase susceptibility to heat stress. Additional industrial hygiene practices and administrative and engineering controls are listed below.

- Wear lightweight, light colored, loose clothing that allows free movement of cool dry air over the skin's surface to allow the removal of heat from the body by evaporation. Evaporation of sweat from the skin is the body's predominant heat removal system.
- Drink plenty of chilled hydrating fluids such as water or commercial hydrating fluids to prevent dehydration. Since thirst is not a sufficient indicator of fluid replacement, workers are encouraged to drink about 1 cup of cool water every 15 to 20 minutes during heat stress conditions.
- To increase evaporation and cooling of the skin, use general ventilation or fans for spot cooling.
- Work demands should be made lighter by taking frequent breaks in a cooler area, completing them over a longer time period, and setting the work pace with the least heat-tolerant worker in mind.
- Heavy workloads should be scheduled during cooler times of the day (i.e., early morning).
- Employees should report to Boynton Health Services if they feel they are suffering from the onset of a heat-related disorder. In emergencies, call 911.

Immediate response actions for heat stroke:

- Call 911 or campus emergency immediately.

- The victim's body temperature must be lowered as quickly as possible. Applying damp, cool towels, or ice packs to armpits, elbows, wrists back of neck, or backs of knees may help.
- Stay with the victim until medical help arrives.

Noise exposure

The hydraulic power supply area, located at the corner of the lab, is a noise exposure area. No unsupervised student employees or researchers are allowed into the mechanical pump area. Only trained STReSS staff as well as MTS service personnel will be allowed to access the pump room. Due to hydraulic pump noise of 65 db, authorized personnel must wear hearing protection if exposed to a running pump for more than 2 hours.

Hearing protection must be worn at all times while operating the following equipment:

- Any reciprocating saw
- Hilti rotating hammer drill
- Magnetic drill
- Pneumatic drills, impact wrench and jackhammers
- Right angle grinder or bench grinder

If the concrete saw, impact wrench and/or pneumatic jackhammers are being used in the laboratory testing or preparation areas, all other laboratory personnel need to wear hearing protection when working in these areas for more than 5 minutes due to the maximum exposure of 115 db noise.

When operating a jackhammer and/or the concrete saw for a long period of time, it is recommended that the operator wear ear plugs (32 db reduction) as well as ear muffs (30 db reduction) to ensure proper protection.

The STReSS Laboratory is occasionally exposed to loud noise hazards from the use of power tools and demolition equipment such as high-speed rotational saws, pneumatic tools, hydraulic equipment, etc. It is recommended that personnel wear hearing protection when working around equipment that has the potential to create loud noises. When noise hazards are in excess of 80 Dba, employees will be required to wear appropriate PPE which is discussed in more detail in Section 4. Employees should understand how to properly fit their hearing protection to ensure that noise levels are reduced to a safe level. Personnel are cautioned not to rely on their sense of hearing while hearing protection is in use. The following steps should be used when wearing hearing protection:

- Maintain visual awareness of your surroundings and the location of other personnel at all times.
- Supplement verbal communication with eye contact, hand signals and other visual cues.

- Spatial awareness relies in part on acoustic cues that can be masked by hearing protection; therefore, hardhats should be worn at all times to prevent head injury from unexpected contact.

Vehicle exposure safety

In general, all STReSS Laboratory personnel are not exposed to motor vehicle traffic while working; however, there are instances where employees will be exposed to loading dock vehicle traffic.

The STReSS Laboratory has a vehicle loading dock located in the corner of the building. The four types of vehicles using the STReSS Laboratory are:

- Tractor trailer
- Delivery vehicles
- Tandem axle roll off trucks
- Concrete delivery and pump trucks

All person(s) assisting with vehicle delivery need to wear reflective high visibility vests, safety-toe shoes, work clothing and hardhats. Only one person is allowed to direct the driver into and from the loading area. All personnel should stand on the east side of the loading area while the vehicle is in motion (i.e. driver's side when vehicle is backing into the facility). Wheel chocks will be placed on both sides of a stationary vehicle's tires after it is confirmed by the driver that the vehicle is parked. The driver should be notified that wheel chocks are being placed under his or her tires.

Tractor trailer traffic control. traffic control is needed when a tractor trailer is backing up to the loading area or loading/unloading payload. Two hand held stop/slow signs will be used to hold east and west bound traffic. These signs are located by the loading dock entrance.

Tandem axle roll off trucks. Stay clear of vehicle when Facilities Management is loading and unloading roll offs (minimum of 10 feet). These vehicles do not require wheel chocks.

When staff members need to travel locally to training sessions or material pickups/drop-offs, he or she is required to inform the Site Operations Manager on his/her means of transportation. The Site Operations Manager may recommend renting a vehicle through the Northeastern University Fleet Services depending on the distance and types of activities.

Whether a staff member is using a personal vehicle or a vehicle rented through Fleet Services, the operator must follow all relevant state traffic rules and have a valid driver's license.

Overview of training for STReSS Lab power equipment

Prior to using power, air, or hand tools, the scissors lift or forklift, each person must receive training on the proper use of the equipment. Training records are kept for University employees. Training is also required for outside researchers and any staff accompanying them.

Scissors Lifts

The STReSS Laboratory currently is not in possession of scissors lifts. All personnel must receive training from a trained full-time employee before operating a scissors lift. This training must include but is not limited to the following:

1. Complete overview of how the machine operates.
2. Pre-operational checks and site hazard identification.
3. Operational controls.
4. Proper exiting and entering of the vehicle at elevated heights.
5. Capacity/weight restrictions.
6. Appropriate uses and limitations.

Training must be properly documented using the STReSS Equipment and Tool Usage Agreement located in Appendix I and submitted into the STReSS Laboratory Safety Log.

Operational conditions. Scissors lift must be operated under the following conditions:

- All units must be inspected prior to each shift's use and must not be operated if found to be unsafe.
- The mid rail chain gate located at the rear of the scissors lift must be latched at all times while in operation.
- Be cognizant of hydraulic actuators and their components as well as telepresence towers while operating in and around the testing area.
- Check surroundings to ensure all obstructions are clear from moving parts.
- All personnel occupying the work platform must wear appropriate personal protection equipment such as hard hats.
- All units must be operated by trained personnel.

Vehicle identification. The following must be displayed on all work platforms in a permanent manner:

- Special warnings, cautions, or restrictions necessary for safe operation.
- Make, model, and manufacturer's name and address.
- Rated work load capacity.
- Maximum platform height.
- Instructions to study operating manual.
- Chart, schematic, or scale showing capacities of all combinations in their operating positions and cautions or restrictions, or both, regarding operation of all alternate configurations or combinations of alternate configurations.

Vehicle inspections.

- *Daily Inspection:* All units must be inspected prior to each shift's use. Inspections must include all items recommended by the manufacturer's manual.
- *Preventive Maintenance:* All units must receive preventive maintenance at intervals no longer than recommended in the manufacturer's manual. Annual inspections of the scissors lifts per manufactures' recommendations will be performed by STReSS staff.

Powered tools, fixed and portable

All power tools are only to be used by trained personnel. Power tools must be used in accordance with manufacturer's directions. Manuals for every piece of powered shop equipment are maintained in a visible, clearly marked location in the office area, and personnel must read this material and familiarize themselves with the safe and proper operation of each tool before use. Prior to operation, any power tool must be inspected for safe and functional operation. Servicing, including cleaning, lubrication, preventive maintenance, and adjustment of machine equipment and machine tools can help prevent performance and safety problems. Tools found deficient must be withdrawn from service, and the deficiency brought to the attention of the Floor Manager and Site Operations Manager. Only qualified technicians or qualified vendors are permitted to service equipment. Appropriate clothing must be worn during use, which includes sturdy, closed-toed shoes; jeans or other sturdy long pants; and no loose-fitting clothing, jewelry, or hair. OSHA-approved eye and ear protection is provided in accessible locations and must be worn while machines are in operation. Protective gloves are provided and recommended. Operational training and proper documentation via the STReSS Laboratory Safety Log must be completed and signed before an employee is allowed to use any such tool. The STReSS Equipment and Tool Usage Agreement for power tools is located in Appendix J.

Fixed power tools are limited to the following:

- Bench grinder
- Metal cut-off saws
- Upright drill press
- 12" compound miter saw

Construction tools (power and hand tools) are limited to the following:

- Concrete vibrator
- Corded drill
- Corded circular saw
- Cordless drill
- Cordless circular saw
- Cut-off saw
- Deep cut band saw
- Heat gun
- Hilti rotating hammer drill – see special usage agreement (Appendix K)
- Hot glue gun
- Hydraulic torque wrench – see special usage agreement (Appendix K)

- Mechanical torque equipment
- Magnetic drill – see special usage agreement (Appendix K)
- Negative air
- Pallet Jacks
- Pneumatic drills
- Pneumatic grinder kit
- Pneumatic impact wrench
- Pneumatic jackhammers
- Portable concrete and abrasive saw
- Pry bars – gooseneck wrenching, grizzly and pinch point
- Right-angle grinder
- Reciprocating saw (Sawzall)
- Sheet sander
- Shop vacuum
- Stud welder – see special usage agreement (Appendix K)
- Wrenches – striking, large combination and spud.

General safety rules for use/maintenance of power tools. The following general rules apply to the use and/or maintenance of machine tools and machine equipment, regardless of their location.

- Operate/maintain power tools in accordance with the manufacturer’s requirements, and the requirements of this section.
- Permit only qualified personnel or vendors to repair or otherwise service power tools.
- Obey the “Two-person rule” when using power tools.
- Ensure that all power tool guards are installed in place, in good working order, properly adjusted, and most importantly, used for their intended purpose. This includes the use of chip shields for any drilling or cutting operations.
- Equip all power tools with all required guarding, and prohibit (lock and tag) their operation unless such guarding is in place and fully functional.
- Wear (at a minimum) safety glasses with side shields while in the vicinity of operating power tools. This applies both to workers and to visitors. Wear face shields or goggles as required by work authorization for specific operations such as grinding
- Wear substantial closed-toe footwear of sturdy construction, made of leather or other heavy, solvent-resistant material. Wear approved safety-toe shoes when there is a risk of crushing or piercing. Prohibit personnel, including visitors, from entering the work area with sandals or open-toed shoes.
- Wear appropriate clothing.
- Wear hearing protection and/or respiratory protection as required by work authorization for operations that generate harmful noise, or airborne emissions.

- Do not use unapproved audio equipment such as iPods, cell phone, and Bluetooth headsets while operating machine or power tools. Such devices may distract the operator and prevent them from hearing sounds that could provide warning of an unusual operating condition or someone calling out for assistance.
- Tie back or otherwise secure long hair; cuff or roll up long sleeves, and remove or tape down loose jewelry when working with rotating machinery.
- Do not prepare or consume food or beverages in areas where hazardous materials (including oils, solvents, chemicals, cuttings, filings, and sawdust) are handled or generated.
- Where applicable, secure and clamp down work pieces in work-holding devices, preventing the work from being lifted or dislodged.
- Maintain good housekeeping. Work is not complete until cleanup is done. Debris, coolants, and lubricants put workers at risk of cuts or slipping, and can be a skin irritant. Clean up the work area with a broom, brush, and/or vacuum, and clean up all spills with absorbents and/or degreasers. Do not use compressed air to clean off work station.

Welding and torching

Everyone who uses the welding or torch equipment must be trained and use of the equipment must be approved by the Lab Manager. Training from the Lab Manager must be documented and submitted into the STReSS Laboratory Safety Log. Welding and torching equipment usage agreement sheets can be found in Appendix L. The two-man rule applies here; no welding or cutting may be performed alone in the building. Before you do any welding or torching, you must thoroughly clean your work area, and check to ensure no flammable and combustible materials are within 35 feet of the work area.

- Ensure hydraulic lines, cylinders, and other actuator system components are completely protected from sparks and hot materials.
- You must wear sturdy, cotton work clothes. Synthetic or polyester materials may never be worn. A leather jacket or sleeves are required. Gauntlet-type leather gloves must be worn.
- When torch cutting, protective eyewear for both workers must include a shield and lens or goggles with a number 5 lens shade.
- Welding protective eyewear must be worn at all times by both workers and must include a shield and lens with a lens shade of 10-12.
- Electronic lens shades may be used if the range adjusts from 5 to 12.
- Welding can produce hazardous fumes which you must avoid breathing. Use local exhaust or open door ventilation to keep fumes out of your breathing zone. The Floor Manager and Site Operations Manager must approve all electrodes and welding operations.

The next two sections cover rules for safe operation in two areas of the STReSS Lab that offer the highest potential for injury. Please review this material carefully. If you have any questions, see the Operations Manager.

Operating STReSS Lab hydraulic equipment

The equipment in the STReSS Lab is capable of generating large forces and producing sudden movements in the test specimen and test fixtures and is only operated by properly trained STReSS staff. MTS service personnel may be trained in equipment operation, but they must consult with STReSS staff before starting operations.

The large actuators in the Lab are hydraulic. A hydraulic pump running at an operating pressure of 3000 psi supplies the hydraulic fluid for the actuators.

The following rules apply to safe hydraulic equipment operation.

- If you have never used MTS equipment before, you must consult with the Operations Manager and receive training.
- Trained STReSS staff must always be present when activity uses the hydraulic equipment.
- Know where all crush points are around the actuators and keep body parts away from these areas.
- Do not unplug or step on any cables that run to MTS equipment. The Floor Manager and Site Operations Manager are the only people allowed to unplug or connect MTS equipment, specifically:
 - load unit cables
 - cables that connect to the emergency shut off button
 - cables that connect to the hydraulic power supply
 - actuator control cables

Failure to follow this rule may cause sudden actuator movements resulting in injury as well as specimen or equipment damage.

If you disconnect cables from the hydraulic actuators while hydraulic pressure is being applied to an actuator, the actuator may suddenly begin rapid and unexpected movements.

- Do not attempt to change any hydraulic hose or fitting attached to MTS equipment. Improper removal or installation procedures may result in personal injury or damage to sensitive hydraulic components.
- Notify the Floor Manager and/or Site Operations Manager immediately upon detecting any hydraulic fluid spills or leaks from hydraulic equipment.

If the Operations Manager is unavailable, push the “Stop” button located on the Pump Control Panel. The pump and control panel are located in the pump area. If there is hydraulic fluid on the floor, please place an ample amount of Oil Dri safety absorbent on the spill. The Oil Dri is located in the pump area.

- Do not use fingers or hands to try to stop a leak in a hydraulic hose or other hydraulic component. Substantial pressures may cause the oil to penetrate the skin, and can cause deep wounds or sever fingers.

Overhead crane and hoist operation

The STReSS Lab is equipped with an overhead crane with two wire-rope hoists. The main hoist is capable of lifting 40,000 pounds.

Currently, the full time STReSS Laboratory employees Kyle Coleman, Mike MacNeil, Jerry Hajjar have completed the Association of Crane & Rigging Professionals – Overhead Crane Operator Training.

Operating a crane is by use of a hand-held remote control device. However, this permits control from areas where it may be difficult or impossible for the operator to observe crane movement. The combination of the lifting capacity and improper crane movements can result in serious damage, injury or death.

Always observe the two-person rule when operating overhead equipment. Two people must be involved with any crane or hoist operation.

Hand signals shall be used unless the participants of the lift are equipped with telephones, radios or other equivalent means of communication. The operator must respond to hand signals from person directing the lift, except for emergency stop signal, which must be obeyed when given by any employee. The standard hand signals for controlling overhead and gantry cranes information poster is located on the west tool storage room door.

The following rules apply to safe crane operation.

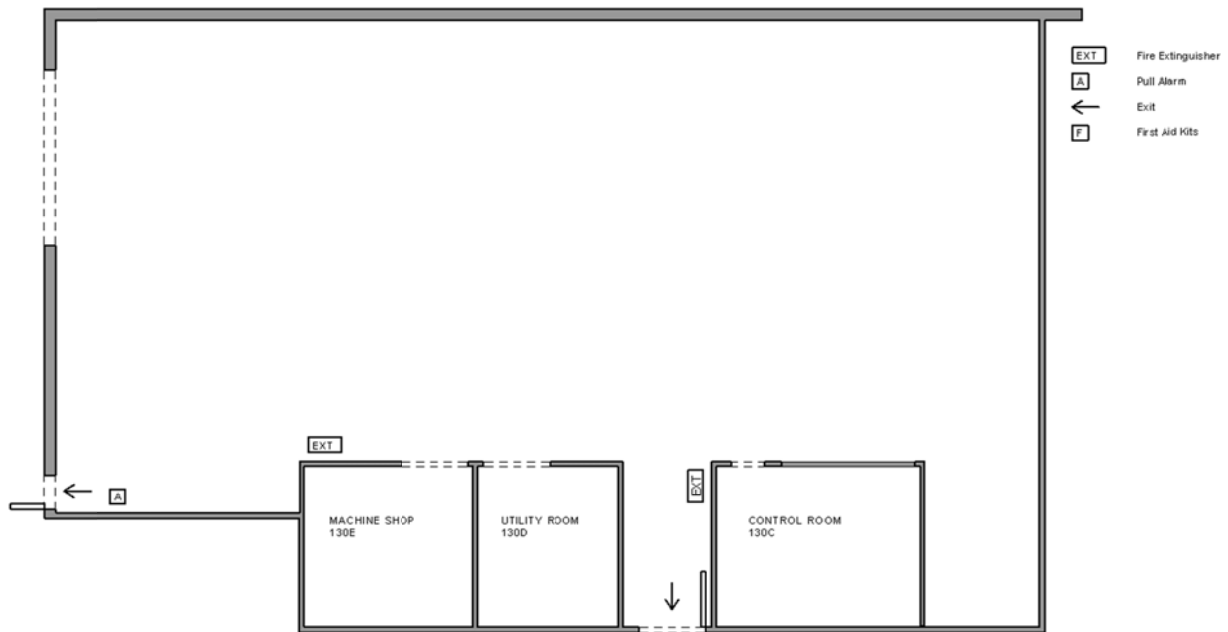
- Crane operation is limited to full-time STReSS personnel.
- If you have never used the crane or hoist before, you must consult with the Floor Manager or Site Operations Manager and receive training prior to use.
- Only one person may control the crane at a time.
- A rigging plan must be prepared and approved by the Floor Manager or Site Operations Manager for heavy lifts, tilt ups, or other complex rigging operations.
- Follow proper rigging procedures. If you are unsure, consult with the Floor Manager or Site Operations Manager.
- Always check the load rating of your lifting components. Be aware that the load rating reduces when lifting at an angle or using a choker.
- Always wear a hard hat when operating the crane. It is the operator's responsibility to inform other personnel in the vicinity to also wear a hard hat.
- Never operate the crane without a clear view of the crane hook and load.
- Pay attention to what you are doing (do not let your brain wander).
- Never stand directly under the load you are moving or pass directly over other personnel.

- If you are placing concrete and using a concrete bucket, you must cover all actuators, hydraulic manifolds, and critical instrumentation within 20 feet of the path of the concrete bucket with tarps.
- When moving large pieces of equipment or specimens, you must first consult with the Operations Manager.
- Always be aware of what is around you when moving equipment or specimens.
- Always use a shackle when connecting two straps.
Never loop or choker a strap through the eye of another strap.
- Do not use badly worn straps, chains, wire ropes or shackles when rigging.
Do not use nylon straps if colored strands are visible or there are obvious cuts.
Do not use wire-rope slings if there is any broken strands or kinks.
- Never use the crane as a loading device (i.e., applying an upward vertical force to free or wedge structural members).
- When operating the crane in the staging area, make sure the crane walkway platform is deployed in the up position. Failure to do so can result in damage to the crane, the access ladder, and/or the walkway.
- Operate the crane with extreme caution in the vicinity of hydraulic actuators.
- The overhead cranes must be inspected daily prior to use. In addition, they need monthly inspections in conjunction with maintenance activities, and a thorough annual inspection. Appendix M contains protocols for daily and monthly crane inspections.

General emergency procedures

Appendix U contains the STReSS Laboratory Building Emergency plan required by the University's Department of Emergency Management. In addition, the procedures in this section help you prepare for an emergency before one occurs. This map of the STReSS Laboratory shows you the location of:

- the two fire extinguishers (one is attached to the portable torching stand)
- the pull-down fire alarm, all the exit
- all STReSS Lab exits



Fire safety

The STReSS Lab and Office spaces have fire protection with overhead sprinklers.

You are not expected to fight a large fire.

- If you discover a large fire, manually activate the fire alarm.
- Immediately exit the building and close the doors behind you.
- Tell others in the area that there is a fire.
- Call 911.

Do not re-enter the Lab until response personnel tell you to do so.

Power outage

The STReSS Lab does not have an emergency generator backup. In the event of a power failure, the HPS will shut down. The condition of the specimen, however, may have become hazardous. Do not approach the specimen area. Make sure everyone in the building is safe, and exit when convenient.

To report a Lab power outage, call Facilities Management. The campus phone system works in the event of an electrical outage.

Lockout/tagout plan

Lockout/tagout refers to specific practices and procedures to safeguard employees from the unexpected energization or startup of machinery and equipment, or the release of hazardous energy during service or maintenance activities.

This procedure establishes the minimum requirements for the lockout of energy isolating devices whenever maintenance or servicing is done on machines or

equipment. It shall be used to ensure that the machine or equipment is stopped, isolated from all potentially hazardous energy sources, and locked out before employees perform any servicing or maintenance where the unexpected energization or start-up of the machine or equipment or release of stored energy could cause injury.

All employees are required to comply with the restrictions and limitations imposed upon them during the use of lockout. The authorized employees are required to perform the lockout in accordance with this procedure. The following people are authorized to perform lockout/tagout procedures:

1. Kyle Coleman

In coordination with STReSS staff, trained MTS service technicians and Facilities Management staff will be allowed to service equipment, which includes overhead crane, HPS and air compressor.

All employees upon observing a machine or piece of equipment that is locked out to perform servicing or maintenance shall not attempt to start, energize, or use that machine or equipment.

Locking out equipment for service. When the servicing or maintenance for a machine or a piece of equipment is needed, the following steps shall be taken.

1. Notify all affected employees that servicing or maintenance is required on a machine or equipment and that the machine or equipment must be shut down and locked out to perform the servicing or maintenance.
2. The authorized employee shall refer to the company procedure to identify the type and magnitude of the energy that the machine or equipment utilizes, shall understand the hazards of the energy, and shall know the methods to control the energy.
3. If the machine or equipment is operating, shut it down by the normal stopping procedure (depress the stop button, open switch, close valve, etc.).
4. De-activate the energy isolating device(s) so that the machine or equipment is isolated from the energy source(s).
5. Lock out the energy isolating device(s) with assigned individual lock(s).
6. Stored or residual energy (such as that in capacitors, springs, elevated machine members, rotating flywheels, hydraulic systems, and air, gas, steam, or water pressure, etc.) must be dissipated or restrained by methods such as grounding, repositioning, blocking, bleeding down, etc.
7. Ensure that the equipment is disconnected from the energy source(s) by first checking that no personnel are exposed, then verify the isolation of the equipment

by operating the push button or other normal operating control(s) or by testing to make certain the equipment will not operate.

Caution: Return operating control(s) to neutral or "off" position after verifying the isolation of the equipment.

8. The machine or equipment is now locked out.

Restoring equipment to service. When the servicing or maintenance is completed and the machine or equipment is ready to return to normal operating condition, the following steps shall be taken.

1. Check the machine or equipment and the immediate area around the machine to ensure that nonessential items have been removed and that the machine or equipment components are operationally intact.
2. Check the work area to ensure that all employees have been safely positioned or removed from the area.
3. Verify that the controls are in neutral.
4. Remove the lockout devices and reenergize the machine or equipment. Note: The removal of some forms of blocking may require reenergization of the machine before safe removal.
5. Notify affected employees that the servicing or maintenance is completed and the machine or equipment is ready for use.

Specific tasks/equipment that will see the lockout/tagout procedure:

- Overhead crane maintenance
- Hydraulic power supply / other hydraulic equipment
- Hydraulic pump maintenance
- Hydraulic cooling tower maintenance
- Air compressor maintenance

Hydraulic fluid spill

It is possible that a hydraulic fluid spill could occur during a system problem.

- The first action is to contact the Lab Manager.
- Isolate and contain the spill. Post or tape off the affected area and establish a controlled entry point to the area. Do not allow others into the area.
- Spread the absorbent Oil Dri in the area, this material is in the Pump room.
- Do not spread the fluid to other parts of the building. Use yellow slip resistant rubber boots located in the storage room when entering an affected area. Take off boots before walking out of the affected area.

- Discard any toweling or other material that contains fluid into drum marked oily rags and absorbent pads. Do not wash fluid down the drain or throw in regular trash bin. When drum is full notify Site Lab Manager to call Waste Management to collect drum.
- Discard any used or contaminated Oil-Dri into drum marked Used Oil-Dri. Do not throw in regular trash bin. When drum is full notify Site Lab Manager to call Waste Management to collect drum.

Other emergencies

Other emergencies are covered in Appendix U.

Section 3: Criteria for implementation of control measures

Personal protective equipment, hygiene practices, and administrative controls each play a role in a comprehensive laboratory safety program. Implementation of specific measures must be carried out on a case-by-case basis, using the following criteria for guidance in making decisions.

Personal protective equipment (PPE)

Personal protective equipment is necessary for work in the STReSS Lab.

This equipment includes safety-toed footwear, hard hats, fall protection, hearing protection, eye protection and suitable clothing for a heavy construction work environment. Specific information about clothing and other PPE is in Section 4.

Prohibited substances

Under the influence of alcohol or illegal drugs in a research laboratory are strictly prohibited, as such actions potentially endanger the health and safety of not only the user, but everyone in the building. Infractions will be met with serious disciplinary action.

Supervisors shall consider the hazards involved in their research, and designate areas, activities, and tasks that require specific types of personal protective equipment as described above.

Limits on Laboratory hours

Researchers must prioritize their research such that work with restricted equipment occurs only during the regular working hours of 8 a.m. to 5 p.m., Monday through Friday.

After-hours work on nights and weekends must be restricted to non-hazardous activities such as wiring, data analysis, and report writing.

Remedial action

The Lab Manager, in coordination with the Lab Director, will determine and implement appropriate action steps to resolve any unsafe situations in a timely manner. If remedial action is not taken, contact EHS (617.373.2769 or ehs@neu.edu). If necessary, all work will cease until the hazard has been remediated. The hazard will be discussed at the weekly meeting, and if the solution is currently temporary, a permanent solution will be determined and implemented. In some cases, additional planning due to budget constraints may be needed to improve a safety action or work task.

Analysis of each issue should address the following points:

- Consider potential severity of loss.
- Evaluate the probability of a loss occurrence.

- Weight various control alternatives and decide on the best one.
- Assess the likely degree of control to be achieved.
- Determine the cost of control.
- Justify the recommended control if major expenditures are involved.

These points inform appropriate safety policy revisions, which are immediately disseminated to all personnel via email or in-person. Follow-up actions are then scheduled as follows:

- Issue work orders for immediate correction of the safety issue if this can be done without major expenditure.
- Ensure that remedial action is taken in a timely fashion by adjusting workload prioritization.
- Monitor activity progress via in-person, phone or email requests for feedback.
- Check the effectiveness of implemented controls. Are people better protected now than they were before?
- Immediate feedback from actions taken to correct the situation will be incorporated into the Safety Plan.

Section 4: Safety gear equipment and proper clothing

Safety equipment

The STReSS Laboratory Operations Manager will coordinate with Facilities Management to ensure that eye wash and shower stations are checked annually.

While working with chemicals (e.g., adhesives for strain gages) individuals should operate the eye wash on a weekly basis to ensure the wash is functional.

A University contractor checks fire extinguishers annually.

Before a new employee is permitted to work at the STReSS Laboratory, they must take part in a safety training session with the Lab Manager. The session will cover the Safety Training Memorandum located in Appendix N. Hands on training of personal protection equipment will be performed during this session. The Safety Memorandum is then signed by the new-hire and the last page is copied and filed into the STReSS Laboratory Safety Log.

Safety gear and proper clothing

When working in hazardous surroundings, hard hats, safety-toe boots, work gloves, safety glasses, coveralls or work pants, and sleeved shirts are necessary items.

Hard hats must be worn by everyone working on the test floor and staging area.

Among other PPE items, the STReSS Lab provides goggles, hard hats, latex and leather gloves, leather shirt, welding helmets, lanyard and harness equipment, aluminum boot clips, earmuffs, and earplugs.

When working in the STReSS Lab, these items must be in possession at all times, and must be worn when involved in the following activities:

- Operating the crane and conducting activities adjacent to personnel operating the crane.
- Conducting activities involving the construction, removal, or demolition of a specimen or load frame.
- Conducting activities alongside the backside of either strong wall.
- Operating the forklift, or other hydraulic or electric lifts.
- Operating the scissors lifts.
- Conducting/observing experiments when in the testing area.
- Using any hand tool or power tool.
- Working along side specimens and/or work platforms.

You should check the safety harnesses, lanyards, gloves, shields, goggles, and other protective equipment prior to each day's use to ensure that they are in acceptable condition.

- Safety glasses are required at all times.
- Hearing protection, consisting of earplugs or earmuffs, is required when operating equipment that creates loud noises or when working in an area with noise levels above 80 dBA.
- A dust mask, respirator, or PAPR is required when working in dusty or vaporous conditions.
- Rubber gloves are available when working with wet concrete and other chemicals.
- A full-face shield is required when grinding.
- Gloves made of appropriate material are required to protect the hands and arms from thermal burns, cuts, or chemical exposure on the surface of the skin.
- When using welding or torching equipment, an approved upper-body leather jacket must be worn with leather welding gloves to prevent burns. Ear-plugs must be used to prevent sparks from entering your ear canal.
- When torching, you must use tinted goggles or face shield. When welding, you must wear a full-face welding helmet. See the section on *Welding and Torching* for more details.
- It is your responsibility to purchase safety-toe boots. Aluminum boot clips are available in the storage room.
- When a project requires work at heights above six feet, fall protection equipment must be worn and affixed to a secure tie-off point. Fall-protection gear consists of a full-body harness and a lanyard. Please see the Operations Manager for this equipment and information regarding proper tie-off.
- Shorts, skirts, dresses, tank tops, open-toe (sandals), and high-heel shoes are not considered proper apparel for working in the STReSS Laboratory.

Section 5: Employee information and training

Information

It is essential that Laboratory employees have access to information on the hazards of restricted equipment and procedures for working safely. Supervisors must ensure that laboratory employees are informed about and have access to the following information sources:

The contents of the OSHA Laboratory Safety Standard

"Occupational Exposure to Hazardous Chemicals in Laboratories" and its appendices (29 CFR 1910.1450).

The Northeastern University's Laboratory Safety Plan

A generic LSP located at http://www.ehs.neu.edu/laboratory_safety/ is available to all employees on the Office of Environmental Health and Safety's web site (www.ehs.neu.edu) and in the Learning Resource Centers of the various campus libraries. Individual department Laboratory Safety Plans are available within those departments.

Signs and symptoms associated with exposures to hazardous chemicals.

Laboratory Chemical Safety Summaries (LCSSs) are included on pages 235-413 of the 1995 edition of Prudent Practices. LCSSs are similar to Material Safety Data Sheets (MSDS), but are tailored to the hazards of laboratory use of those chemicals. The LCSSs include toxicity information, and signs and symptoms of exposure to the chemicals.

Material Safety Data Sheets (MSDSs)

Material Safety Data Sheets (MSDS) for these materials are attached in Appendix E and also held in the STReSS Lab's office area. Hard copies of MSDS for many laboratory chemicals are also available from EHS or departmental safety offices. Individual researchers are encouraged to keep hard copies in an easily accessible location for materials that are used in large quantities, used frequently, or are particularly toxic.

Information on chemical waste disposal and spill response

The Northeastern University guidebook, "Hazardous Chemical Waste Management, 5th Edition" provides detailed information on proper waste handling procedures.

Training

At the STReSS Lab, the most important aspect of training is to make everyone aware of the unique safety requirements the Lab imposes. This is due to the nature and significant capability of the hydraulic actuators and the environment in which they operate.

Likewise, the activities that support construction, testing, and demolition require that everyone working in the Lab be aware of the hazards accompanying these activities and follow what they learned in training as safe practice.

Each laboratory supervisor is responsible for ensuring that laboratory employees are provided with training about the hazards of restricted equipment and chemicals present in their laboratory work area, as well as methods to control exposure to such chemicals. Such training must be provided at the time of an employee's initial assignment to a work area where the hazards are present and prior to assignments involving new potential hazards.

Colleges and non-academic departments that engage in the laboratory use of hazardous chemicals are responsible for identifying employees who require training and for developing and delivering training programs for such employees.

EHS offers training covering general laboratory safety issues, hazardous waste management, and biohazardous materials handling. Departments are welcome to send employees to this 'base' training. However, laboratory supervisors must provide additional training on laboratory-specific hazards to ensure all the OSHA-required training topics are adequately addressed. Call EHS at 617.373.2769 to register trainees.

STReSS Laboratory Safety Training Memorandum

The STReSS Laboratory requires that all students, employees, and others who will be working for some length of time at the Lab take part in a Lab safety and awareness training session. In this session, the person reviews the contents of the Safety Training Memorandum (Appendix N) directly with STReSS staff, and then signs the Agreement Statement. The Agreement statement affirms that the person has read the Safety Memo and agrees to abide by its contents.

Section 6: Requirements for visiting researchers

This section describes the special safety considerations and planning that will ensure the safety of individuals and of the equipment as well as an orderly movement of projects through the STReSS Lab.

Required work plan information

The key element to safe and efficient use of the STReSS Lab is the project work plan. Researchers must develop a work plan and schedules for their STReSS project and submit them for review by STReSS staff. A project cannot begin until staff approves the work plan.

The work plan must include a list of tasks, adequate specimen and load frame drawings, calculations, schedule, lists of equipment and personnel to carry out the work tasks, an instrumentation plan, a rigging plan, and space requirements. A sample work plan is included in the STReSS Laboratory Researcher Resource Guide <http://nees.umn.edu/training/RES.pdf>.

Preliminary analysis of forces

Researchers shall perform preliminary analysis to determine maximum applied forces, reactions, and displacements for their specimen. STReSS staff needs to review force footprints for loads applied via the crosshead and strong floor.

Construction analysis and schedules

Researchers must perform a construction analysis to itemize the steps necessary to construct the specimen, to position it in the STReSS system, and to eventually demolish and remove it.

Realistic time requirements for each construction task are part of the analysis. This enables the NEES Consortium to properly schedule a project in the STReSS facilities.

Testing protocol review

In their work plan, researchers must provide a testing protocol that describes imposed displacements and loads via the crosshead and any ancillary actuators.

Information pertaining to the slaving of DOFs and ancillary actuators needs to be included. In their reviews, STReSS staff will pay particular attention to tests with load control protocols in which cracking or other softening activities of the specimen are anticipated. Safe practice requires planning for such outcomes.

Lab safety orientation and training sessions

After a proposal is accepted, the Principal Investigator needs to schedule a site visit to the STReSS facility to begin the Lab orientation process. In such a visit, a researcher can gain an understanding of the 6DOF system and laboratory resources.

The visit will organize around a tour as well as areas of hand-on training. Besides the test bay and staging areas, the facility tour will also briefly visit the Pump, Mechanical, Electrical, and Telecom rooms, and explain why they are restricted areas and off-limits. Staff will explain the special hazards of the hydraulic system. Staff will point out the facility's lockout tags and explain their purpose, as well as show the location of fire extinguishers, fire alarms, first-aid kits, exit doors and egress paths.

The control room tour will demonstrate the functions of hydraulic monitoring, data acquisition, and camera controls.

The tool and equipment tour will show what is available, and will include lists of approved contractors and equipment suppliers from the Operations Manager. When a project is underway at the time of the visit, staff will point out safety measures currently in use.

The STReSS Laboratory requires that all visiting researchers and research teams take part in a Lab safety and awareness training session. In this session, the Principal Investigator and team review the contents of the Safety Training Memorandum directly with STReSS staff, and then each signs the Agreement Statement. The Agreement statement affirms that the person has read the Safety Memo and agrees to abide by its contents.

Test preparation in the Lab

Prior to testing, the researcher should inspect instrument cable connections and hydraulic lines, and must protect any that are subject to damage during testing.

Do not run equipment over or into any cables.

Checks to make during testing

During testing, the researcher must periodically look for instruments that are subject to damage if a portion of the specimen fails or that can become out of range. Check if slip has occurred at any of the keel marked interfaces. Look for leaks in hydraulic components.

Practice good housekeeping

Keeping the Lab as clean and orderly as possible is part of good safety practice.

- Use the Lab's mobile workstations for operations in and near the test bay.
- Use the workstations and tool boxes to track tools and keep them off the floor.
- During construction, ensure regular clean up so debris does not accumulate.

Section 7: Medical consultation and examination

Employees who work with restricted equipment

All employees who work with restricted equipment or hazardous chemicals will have an opportunity to receive medical attention, including any follow-up visits that the examining physician determines to be necessary, under the following circumstances:

Signs or symptoms of exposure

Whenever an employee develops signs or symptoms associated with a hazardous substance to which the employee may have been exposed in the laboratory, the employee will be provided an opportunity to receive an appropriate medical examination.

Exposure monitoring

Where exposure monitoring reveals an exposure level routinely above the action level (or in the absence of an action level, the PEL) for an OSHA regulated substance for which there are exposure monitoring and medical surveillance requirements, medical surveillance will be established for the affected employee as prescribed by the particular standard.

Exposure incident

Whenever an event takes place in the work area such as a spill, leak, explosion or other occurrence resulting in the likelihood of a hazardous exposure, the affected employee will be provided an opportunity for a medical consultation. Such consultation will be for the purpose of determining the need for a medical examination.

Physical injury

Whenever an employee is physically hurt or injured on the job, the affected employee will be provided an opportunity for a medical consultation and/or examination. Physical injuries include but are not limited to cuts, burns, punctures and sprains.

Contact the Chemical Hygiene Officer whenever the need for medical consultation or examination occurs, or when there is uncertainty as to whether any of the above criteria have been met.

Situations requiring medical examinations and consultations

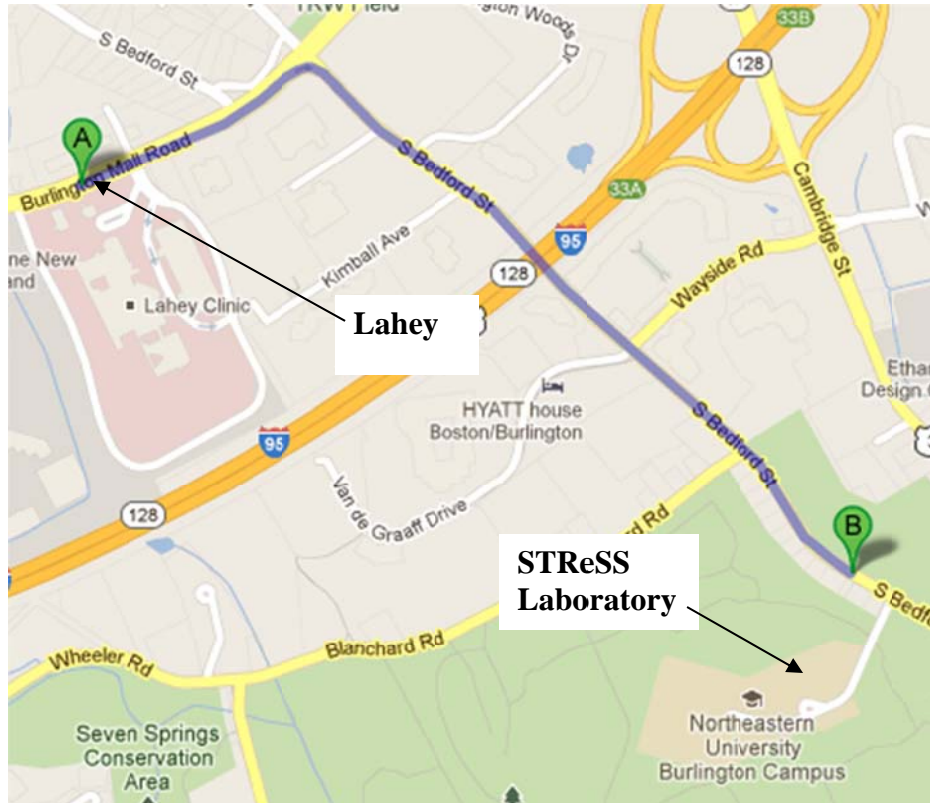
In the event of a life-threatening illness or injury, dial 911 and request an ambulance.

Employees with urgent, but non-life-threatening, illnesses or injuries should go to the nearest medical clinic. If off-hours medical attention is required, the employee should be taken to the emergency room at Lahey Clinic Emergency Room. All medical examinations and consultations will be performed by or under the direct supervision of a licensed physician and will be provided without cost to the employee, without loss of pay, and at a reasonable time and place.

Medical center/clinic information

41 Burlington Mall Road
Burlington, MA 01805
(781) 744-5100
lahey.org

Directions to the Lahey Clinic Medical Center Emergency Center:



Workers' compensation procedures and forms

This policy explains the procedures and provides the necessary reporting forms.

It is very important that even minor, job-related injuries or illnesses are reported. These statistics help the Department of Environmental Health and Safety track trends that may indicate occupational hazards that need evaluation.

To report an illness or injury, go to the Northeastern University Workers' Compensation Website.

The University's Policy for Reporting Workers' Compensation Related Injuries is also available.

As long as the illness or injury is not life threatening, the supervisor should provide the employee with the following:

- a brochure describing Workers' Compensation Information for the Northeastern University;
- a completed Employers' Authorization for Care form; and
- a Work Status Report for the physician to complete and return to the supervisor.

Within 24 hours, the supervisor should complete:

- a State of Massachusetts First Report of Injury form (Appendix O);
- a NEU Employee Incident Report form (Appendix P); and
- a NEU Supervisor Incident Investigation Report (Appendix Q)

Please note it is imperative to report any and all injuries sustained on NU premises. To do so, send an `injury_report_form` to the Office of Risk Management at 122 Saint Stephen's Street immediately following the injury.

Information provided to physician

The employee's supervisor or department will collect and transmit the following information to the examining physician:

- The identity of the hazardous substance(s) to which the employee may have been exposed;
- A description of the conditions under which the exposure occurred including quantitative exposure data, if available; and
- A description of the signs and symptoms of exposure that the employee is experiencing, if any.

Information provided to the Northeastern University

Supervisors should request that the examining physician provide them with a written report including the following:

- Any recommendation for further medical follow-up;
- The results of the medical examination and any associated tests;
- Any medical condition which may be revealed in the course of the examination which may place the employee at increased risk as a result of exposure to a hazardous chemical found in the workplace; and

- A statement that the employee has been informed by the physician of the results of the consultation or medical examination and any medical condition that may require further examination or treatment. The written opinion will not reveal specific findings of diagnoses unrelated to occupational exposure.

Section 8: Responsible personnel

The following individuals and groups have responsibilities for implementation of various aspects of the Northeastern University's Laboratory Safety Plan.

STReSS personnel

The following people hold specific job titles that are related to this document:

Laboratory Director: Jerry Hajjar

Lab Manager: Kyle Coleman

Research Safety Program Manager

The Northeastern University's Director of EHS is Jack Price.

j.price@neu.edu

617.373.2769

Department of Environmental Health and Safety

The Department of Environmental Health and Safety offers assistance in a wide range of health and safety issues. Phone: 617.373.2769.

Section 9: Record keeping, review and update of Laboratory Safety Plan

Record keeping

The Research Safety Officer (RSO) is responsible for keeping records on training and safety-related incidents in the Laboratory and for performing regular analysis on accidents and safety incidents.

Exposure evaluation

Any records of accidents or exposure evaluation carried out by individual departments (including continuous monitoring systems) will be kept within the department and also sent to the Department of Environmental Health and Safety. Results of exposure evaluations carried out by DEHS will be kept by DEHS and sent to the affected department. Raw data will be kept for one year and summary data for the term of employment plus 30 years.

Medical consultation and examination

Results of medical consultations and examinations will be kept by the Boynton Health Service for a length of time specified by the appropriate medical records standard. This time will be at least the term of employment plus 30 years as required by OSHA.

Equipment monitoring

Notebooks containing maintenance information, inspections, and a listing of individuals authorized to use the equipment are available for the following restricted pieces of equipment:

- MTS hydraulic system and actuators
- overhead crane and hoist
- rigging equipment
- forklift
- scissors lift
- welding equipment
- hydraulic lift & tensioning

Laboratory audits and reports

RSOs must coordinate and/or conduct formal audits of laboratories in their sphere of responsibility at least annually. A Laboratory Audit Checklist is available in Appendix R, and a template report form is available in Appendix S Checklists and reports should be kept for at least 5 years.

Self-audits and inspections

The Lab Manager is responsible for checking that all research areas are safe, that equipment is working as it should, and that all safety rules are followed. Responsibilities include annual audits and regular inspections.

Main responsibilities:

- Carry-out inspections (at least annually) of all laboratories and research areas.
- Check the physical lab set up for any health and safety issues, such as safe functioning of laboratory and safety equipment, and proper chemical storage and handling.
- Check that researchers are aware of and can access pertinent safety documents (e.g., the STReSS Laboratory Safety Plan) and that all training records are current.
- Monitor researchers as they perform lab procedures to ensure that they follow standard operating procedures accurately, use chemicals safely, keep their safety equipment working and accessible, manage wastes properly, and comply with any other related health and safety issues.
- Report audit findings to the appropriate PI/Lab Supervisors, and inform them of their responsibility to take action on any noted deficiencies.
- Take follow-up actions on any audits that reveal safety deficiencies.

Safety self-inspections

Lab supervisors will perform monthly safety and maintenance inspections of personal protection equipment, power tools, scissors lifts, ladders, and rigging. Issues noted during these inspections are to be corrected and documentation of the corrective action made should be administered. Whenever applicable, the Site Operations Manager will integrate the corrective action into the global safety policy.

Procedures regarding daily, monthly, and yearly crane inspection are addressed in the *Overhead crane and hoist operation* section as well as Appendix M.

Each employee is responsible for conducting a routine safety inspection before starting any task. Procedures for these inspections are addressed during specific task trainings. At any time, if an employee feels there is concern for safety, he or she should terminate the work task and notify the Lab Floor Manager or Site Operations Manager as soon as possible.

All concerns and/or corrections resulting from self-inspections should be discussed at the weekly staff meetings as well as daily safety meetings. No one should ever make assumptions regarding safety, as other people may not be aware that something is wrong or that they are being unsafe. It is everyone's responsibility to make safety a priority and to ensure that all safety practices are being adhered to.

Other formal inspections, such as the annual overhead crane inspection, are performed on a regular basis. All inspection documentation must be copied and filed in the STReSS Laboratory Safety Log.