

Standard Operating Procedure Guidelines

Department of Physics Michigan Technological University

All Laboratories

A Standard Operating Procedures (SOP) must be developed *for each experimental system* utilized in the lab. These lab-specific protocols are necessary in order to complete the Laboratory Safety Plan and safety documentation for each individual laboratory. The SOP should contain, at minimum, the following information:

- **A description of the system and its components (and its location, especially for groups with multiple labs)**
- **A list of the hazards present in the system and the control measure and equipment used to protect against those hazards. An example of a hazard would be “Laser Radiation,” while an example control would be “Wear laser safety glasses when the laser is powered on.”**
- **A list of general safety behaviour to be utilized when using the system. These are more general and include things like “The optical bench must be cleaned at the conclusion of an experiment” and “The door must be closed at all times when the laser is operational.”**
- **A list of training requirements for those who will be using the system.**
- **A list of emergency procedures and contact information.**

In order to help facilitate SOP development, an example template is included on the following page.

Chemical Laboratories

Some labs will fall under the definition of what OSHA considers a chemistry laboratory and is held to a more thorough standard. This standard applies to those labs wherein multiple chemicals or chemical procedures are in use, that has safety features that one would expect to see in a chemical laboratory (fume hood, eyewash, etc) and/or where the processes are laboratory scale (manipulated by one person and not production level). If your laboratory conducts experiments that may fall under this category, please check with Occupational Safety (7-2118) in order to make a proper determination.

Should your lab fall under this category, *there must be an SOP for each chemical experiment* that must contain all the above information, plus the following:

- The SOP must be specific to the particular chemicals being used (or at the least a common class of chemicals with similar hazards and reactivities), so each experiment (or group of chemically similar experiments) will require its own SOP.
- The SOP must be specific to the steps involved in the process, including the step-by-step instructions to be performed, the chemicals to be used, the hazards involved, the protective measures to be taken, and the emergency response instructions for any anticipated emergencies like spills, splashes, or fires.

Example Standard Operating Procedure (SOP)

Department of Physics Michigan Technological University

A. System Description:

Location: Fisher Hall, Room ###, Professor XXX YYY laboratory

Components: List of experimental apparatus, equipment and chemicals

B. Hazards and Controls:

<u>Hazards:</u>	<u>Controls:</u>
Hazards, such as cryogenic fluids, high voltage, flammable gas, etc.	Controls and protective gear that protect the user from the hazard.
Example: High Temperature	Example: The heat insulating frame of the furnace must be closed and locked during operation. High temperature safety gloves should be worn when handling any part of the furnace during or after operation.

C. Operational Safety Procedures

This section is general safety for using the equipment. For example, Laser Safety Light must be switched on before powering up the laser and off after powering down. Or, the fume hood must be on at all times when using the compressed gases.

D. Training Requirements

Listed here.

E. Emergency Procedures:

Listed here, including contact numbers

F. Experimental Procedure

The SOP does not require a step-by-step procedure (except for chemistry labs), but experimenters are encouraged to develop them.

Department of Physics

**GUIDE
TO
HAZARD SOURCES**

2009

CERTIFICATION OF
SAFETY-RELATED
PERSONAL PROTECTIVE EQUIPMENT
HAZARD ASSESSMENT

Department: _____

Date: _____

A workplace hazard analysis has been performed for all employees within this department as required by MIOSHA General Industry Safety Standards, Part 33, Personal Protective Equipment. Each employee required to utilize personal protective equipment and the specific type of equipment required has been documented and will be maintained on file within this department. It is understood that under the provisions of this safety standard and the MTU safety and health policies, this department must provide all necessary personal protective equipment (certain PPE, including safety shoes and prescription safety eyewear, is exempted from this requirement) and training in its selection, use and limitations.

Signature of
Department Head
or Representative: _____

Return this form to Occupational Safety and Health Services upon completion.

INSTRUCTIONS FOR HAZARD DETERMINATION

These instructions are provided to assist in performing the hazard analysis required by this regulation and the MTU safety and health program. The following steps will help minimize wasted effort and unnecessary required use of personal protective equipment, PPE. Activities where employees are currently using PPE simply for added protection beyond engineering controls or where the hazard is purely speculative need not be documented - with one exception. All respirator use and the reason for it must be documented. This is to ensure that proper fit testing and training are provided as required.

1. Identify those jobs that may involve hazards with a recognized potential for injury before performing the hazard analysis. Those jobs that are not exposed to hazards requiring PPE can be documented by simply filling out the top of the Personal Protective Equipment Hazard Assessment Forms.
2. Read the hazard and injury information carefully before starting. It is important to distinguish between minor hazards with little potential for injury and hazards with the potential for serious injury. For example, anyone performing paper work is exposed to the potential for paper cuts but it would be foolish to require cut resistant gloves to be worn during this work. On the other hand, the potential for serious eye injury is well recognized when working with strong caustics or acids in open containers. It is not acceptable, however, to assume that a hazard is eliminated solely as the result of working carefully.
3. After identifying all hazards with potential for serious injury (injury requiring first aid/ immediate medical care or delayed care for prolonged or repeated exposure), determine whether engineering controls (eg., guards and protective barriers or special ventilation equipment) or administrative controls (eg., designation of regulated areas restricting access during hazardous operations) will be or are being used to eliminate or control the hazard without the need for PPE. PPE can only be relied upon where these controls are not feasible.
4. Document actual hazards only. It is not necessary to speculate about hazards that might be present at some future time or under conditions that are not currently in existence. A new hazard analysis must be performed any time employee duties or work conditions change such that a hazard not previously evaluated is incurred.
5. Document actual respiratory exposures and why engineering or administrative controls are not feasible. This will form the basis for inclusion of employees in the MTU respiratory protection program. The use of respiratory protection for chemical exposures will require breathing zone air monitoring to establish actual exposure levels except for employees with emergency response duties. All employees involved in class III asbestos activities, as defined in the supplementary information included, will require respiratory protection and inclusion in our respiratory program.

Personal Protective Equipment Guide to Hazard Sources

SOURCE	TYPE OF HAZARD	PROTECTION
<i>IMPACT:</i> Chipping, grinding, machining, woodworking, sawing, masonry work, drilling, turning, chiseling, sanding, etc.	Flying fragments, objects, chips, turnings, particles, grinding fines.	Safety glasses, side shields, face shields.
<i>LIGHT OR RADIATION:</i> Welding, cutting, brazing, torch soldering.	Optical Radiation	Welding goggles /shields w/shades as outlined in MIOSHA Part 33
<i>HEAT:</i> Furnace operation.	High temperature, hot sparks, molten metal.	Faceshields (reflective), arm sleeves, gloves, coat, leggings.
<i>CHEMICALS:</i> Acid and chemical handling, fumes, degreasing, dipping, plating.	Splash, irritating mists, direct contact	Gloves, chemical goggles, faceshields, aprons, special shoes/boots.
<i>FALLING OBJECTS:</i> Working in areas where potential for falling objects exists or bumping hazards.	Steel receiving, heavy parts transfer, overhead conveyors for parts movement, or low ceilings or mechanisms	Hard hat, bump caps, safety shoes.
<i>SHARP OBJECTS:</i> Handling sharp edged parts, clearing turnings, objects which may pierce a foot or hand	Deburring, removing turnings, assembling sharp parts.	Special cut resistant gloves, penetration resistant shoes.
<i>ELECTRICAL:</i> Direct or indirect contact with electricity.	Electricity	Non-conductive safety shoes, hard hats, safety glasses, and gloves designed to reduce electrical shock and protect from sparks.
<i>LASER</i>	Optical	Laser Safety glasses/goggles

Personal Protective Equipment Types

Face and Eye Protection	Welding Helmets	Head Protection
<p>Spectacles w/ No side shield Half side shield Full side shield Detachable side shield Non-removable lens Lift front Headband temple</p> <p>Cover goggles w/ No ventilation Indirect ventilation Direct ventilation</p> <p>Cup goggles w/ Direct ventilation Indirect ventilation</p> <p>Face Shield</p> <p>(See MIOSHA, General Industry Safety Standard Part 33, Personal Protective Equipment, Table 1)</p>	<p>Burning Goggles</p> <p>Welding Helmets w/ Stationary window Lift front window Hand held</p> <p>(See MIOSHA, General Industry Safety Standard, Part 33, Personal Protective Equipment, Table 2)</p>	<p>Helmets by Type: Type 1: Full Brim 1.25" Wide Type 2: No brim, forward peak</p> <p>Helmets by Class:</p> <p>Class A - General service/voltage protection</p> <p>Class B - Utility service w/high voltage protection</p> <p>Class C - Special service no voltage protection</p> <p>Class D - Fire fighters full brim w/ear flaps and chin strap</p> <p>Hair enclosures</p>
Foot and Leg	Electrical Protection *	Fall Protection
<p>Safety shoes/boots w/ Impact resistant toe Metal insoles Metatarsal guards Chemical Resistant Electrical protection Wet slippery surfaces Cold weather protection</p> <p>Leggings Molten metal and welding</p>	<p>Insulating Blankets Matting Covers Line Hose Gloves sleeves Hot Stick</p> <p>*Must be capable of withstanding imposed voltage</p>	<p>Safety Belts *</p> <p>Safety Harnesses</p> <p>Lifelines</p> <p>Lanyards</p> <p>*No safety belts for fall protection after 1-1-98.</p>
Arm and Hand Protection	Body Protection	Laser Protection
<p>Types Gloves Hand pads Sleeves Wristlets</p>	<p>Types Vests Jackets Aprons Coveralls Full Body Suits</p>	

EYE AND FACE PROTECTION

Hazards:

A U.S. Bureau of Labor Statistics Study found that about 60 percent of workers who suffered eye injuries were not wearing eye protective equipment. When asked why, workers indicated that face protection was not normally used or practiced in their type of work, or it was not required for the type of work performed at the time of the accident.

Suitable eye protection must be provided where there is a potential for injury to the eye or face from flying particles, molten metal, liquid chemicals, acids or caustic liquids, chemical gases or vapors, potentially injurious light or heat radiation or a combination of these.

In assessing your workplace for possible eye hazards, look for potential of the following conditions:

- *Frontal and side impact
- *Electrical arc
- *Molten metal
- *Chemical splash
- *Injurious light radiation
- *Suspended particles
- *Extreme hot/cold splash
- *Laser Radiation

Selection:

Each eye, face, or face-and-eye protector is designed for a particular hazard. In selecting the protector, consideration should be given to the kind and degree of hazard, and the protector should be selected on that basis.

Protectors must meet the following minimum requirements:

- *Provide adequate protection against the specific hazards for which they are designed.
- *Be reasonably comfortable when worn under the designated conditions.
- *Fit snugly without interfering with the movements or vision of the wearer.
- *Be durable.
- *Be capable of being disinfected.
- *Be easily cleanable.
- *Be kept clean and in good repair.

Every face and eye protector must be distinctly marked to facilitate identification of the manufacturer.

Where choice of protectors is given, and the degree of protection required is not an important issue, worker comfort may be a deciding factor. The BLS survey referenced above showed that few workers ever complained about poor vision or discomfort with personal eye protection equipment.

Persons using correction spectacles and those who are required by MIOSHA to wear eye protection must wear face shields, goggles, or spectacles of one of the following types:

- *Spectacles with protective lenses providing optical correction;
- *Goggles worn over corrective spectacles without disturbing the adjustment of the spectacles; or
- *Goggles that incorporate corrective lenses mounted behind the protective lenses

Limitations or precautions indicated by the manufacturer must be shared with the user and strictly observed.

Eye protection is available in many types and styles in order to meet the wide range of demands for protection in the workplace.

Goggles come in a number of different styles: eyecups, flexible or cushioned goggles, plastic eyeshield goggles and foundrymen's goggles. Goggles are manufactured in several styles for specific uses such as protecting against dusts and splashes, and in chipper's, welder's and cutter's models.

Safety spectacles require special frames. Combinations of normal streetwear frames with safety lenses are not acceptable.

RESPIRATORY PROTECTION

Respirators will be provided by the employer when respirators are necessary to protect the health of the employee. The employer is responsible for providing respirators which "are applicable and suitable for the purposes intended". During the walk through survey of the area or job being evaluated the assessor should make note of any situations or specific tasks which would require the use of a respirator.

GENERAL LIST OF AREAS/JOBS REQUIRING THE USE OF A RESPIRATOR:

OSHA has determined 5 general circumstances for which the use of respirators is required:

1. Where exposure levels exceed the permissible exposure limit (PEL), during the time period necessary to install or implement feasible engineering and work practice controls.
2. In those maintenance and repair activities and during those brief or intermittent operations where exposures exceed the PEL and engineering and work

- practice controls are not feasible or are not required.
3. In regulated areas.
 4. Where the employer has implemented all feasible engineering and work practice controls and such controls are not sufficient to reduce exposures to or below the PEL.
 5. In emergencies.

ARM AND HAND PROTECTION

Hazards:

Examples of common injuries to arms and hands are burns, cuts, electric shock, amputation, and absorption of chemicals.

A recent Bureau of Labor Statistics study found that seven of ten workers were not wearing hand protection at the time of the injury. About 60 percent were employed in manufacturing processes. More than two out of every five workers were injured while operating, maintaining, or repairing fixed machinery or equipment.

Injuries were divided almost equally between the left and right hand with cuts being the most common injury. The index finger was injured most frequently.

Most commonly injured were meat cutters and assemblers, highest among the craft and kindred workers were repair people, machinists, mechanics, and carpenters.

Table saws and presses were two of the most common pieces of fixed machinery involved.

When workers were asked what condition(s) led to the injury, the most frequent reasons were:

- *Workers too fast a pace.
- *Unaware that hands were in a hazardous area.
- *Misjudged time/distance needed to avoid injury.

Another common reason identified by workers who had been injured was a sudden or unintended movement of work materials, tools, equipment or the hand itself.

When assessing your workplace for arm and hand hazards, look for the following potential hazards:

- *Skin absorption
- *Severe abrasions
- *Severe lacerations
- *Chemical burns
- *Thermal burns
- *Extreme cold
- *Puncture

Selection:

There is a wide assortment of gloves, hand pads, and wristlets available for protection against various hazardous situations.

You must determine what hand protection is needed by your employees. The work activities of the employees should be studied to determine the degree of dexterity required, the duration, frequency, and degree of exposure to hazards and the physical stresses that will be applied.

It is also important to know the performance characteristics of gloves relative to the specific hazard anticipated: e.g. exposure to chemicals, heat, or flames.

Before purchasing gloves, you should request information for the manufacturer to ensure the gloves meet the appropriate test standard(s) for the hazard(s) anticipated. For example, for protection against chemical hazards, the properties of the chemical(s) must be determined--particularly, the ability of the chemical(s) to pass through the skin and cause systemic effects. When selecting gloves for chemical use, consult the MSDS sheet prior to contacting glove manufacturer's. Glove manufacturer's generally provide charts for their products showing appropriate uses for different types of gloves. Keep in mind that all glove compounds are not the same and that the thickness of the material varies.

Gloves -- like other PPE--need to be selected to fit the job. Select gloves based on performance requirements, conditions, duration of the hazards.

Employees may need to use gloves--such as wire mesh, leather, and canvas--that have been tested and provide insulation from burns or cuts.

Certain occupations require special protection. For example, electricians and people working around electricity need special protection from shocks and burns. (*See Electrical Protective Equipment*)

ELECTRICAL PROTECTION

Hazards:

Personal protective equipment provided may need to be capable of protecting employees from electric shock. Looking for potential of electrical hazards must be a consideration throughout the hazard assessment and equipment selection process.

When assessing the workplace, consider both the type of work to be performed and the proximity of employees to potential electrical hazards. Some occupations will require special protection such as an electrician's need for protection from shocks and burns.

Selection:

MIOSHA's General Industry Safety Standard on Personal Protective Equipment, Part 33, contains specific requirements for the design, certification, inspection, use and storage of electrical protective equipment. Insulating blankets, matting, covers, line hose, gloves and sleeves made of rubber must be capable of withstanding imposed voltages.

Among other requirements, electrical protective equipment must be clearly marked as to the class of the equipment.

Employers must provide the appropriate equipment at no expense to the employee. Employees must use the electrical protective equipment that is capable of withstanding the voltages to which they may be subjected.

Rubber is considered the best material for insulating gloves and sleeves from electrical hazards. Rubber protective equipment for electrical workers must conform to the requirements established by ANSI standards as adopted in Part 33. A table listing the ANSI requirements for rubber insulating gloves, matting, insulating blankets covers, line hose, sleeves, as well as in-service care line hose and covers, insulating blankets, and insulating gloves and sleeves is included in MIOSHA Part 33 as Table 3.

TORSO PROTECTION

Hazards:

Many hazards can threaten the body and torso including heat, splashes from hot metals and liquids, impacts, cuts, acids, and radiation. A variety of protective clothing is available including vests, jackets, aprons, coveralls, and full body suits.

When assessing your workplace for torso hazards, look for these potential hazards:

- *Chemical contact
- *Splashes from dipping, plating, and other operations
- *Thermal burns
- *Extreme cold
- *Severe lacerations

Selection:

Wool and specially treated cotton fabric, is good for light-duty protective clothing. It can protect against cuts and bruises on jobs where employees handle heavy, sharp, or rough material.

Heat-resistant material, such as leather, is often used in protective clothing to guard against heat and flame. Rubber and rubberized fabrics neoprene, and plastics give protection against some acids and chemicals.

It is important to refer to the manufacturer's selection guides for the effectiveness of specific materials against specific chemicals.

Disposable suits of plastic-like or other similar synthetic material are particularly important for protection from dusty materials or materials that can splash. If the substance is extremely toxic, a completely enclosed chemical suit may be necessary.

Personal Protective Equipment Worksheet

Michigan Technological University

Department:

Location/Area of Assessment:

Job Classification:

Date(s):

Hazard(s) Assessed/Evaluated By:

Eye Hazards?

Frontal & Side Impact

Electrical Arc

Molten Metal

Chemical Splash

Injurious Light/Heat Radiation

Suspended Particles

Extreme Hot/Cold Splash

Other -

Other -

Face Hazards?

Projectile Impact

Chemical Splash

Hot/Cold Splash

Electrical Arc

Injurious Heat Radiation

Other-

Other-

Foot Hazards?

Falling Objects

Rolling Objects

Electrical Contact

Sole Puncture

Other-

Other-

Yes

No

Required Personal Protective Equipment - EYE

Yes

No

Required Personal Protective Equipment - FACE

Yes

No

Required Personal Protective Equipment - FOOT

Hand Hazards?	Yes	No	Required Personal Protective Equipment - HAND
Skin Absorption			
Severe Abrasions			
Severe Lacerations			
Chemical Burns			
Thermal Burns			
Extreme Cold			
Puncture			
Other -			
Other -			
Head Hazards?	Yes	No	Required Personal Protective Equipment - HEAD
Bump Contact			
Overhead Falling Objects			
Side Flying Projectiles			
Electrical Contact			
Hoods			
Hair Enclosures			
Special Electrical Hazards?	Yes	No	Required Personal Protective Equipment
Insulating Blanket			
Hood			
Line Hose			
Barrier			
Matting			
Cover			
Gloves			
Sleeves			
Fall Hazards?	Yes	No	Required Personal Protective Equipment
Safety Belts			
Lanyards			
Safety Harness			
Lifelines			
Other -			

