

Hazard Control & PPE Selection Guide



Environmental Health and Safety
4202 E. Fowler Ave. OPM 100
Tampa, FL 33620
(813) 974-4036
<http://www.usf.edu/ehs/>
Revised May 2022

Introduction.....	3.....
Chemical Hazards.....	4.....
Chemical Safety Levels (CSLs).....	8.....
Biological Hazards.....	12.....
Physical Hazards.....	14.....
Radiological Hazards.....	17.....
Laser Hazards.....	18.....
Laser System Non-Beam Hazards.....	18.....
Nanomaterial Hazards.....	20.....
Shop Hazards.....

Naser Sy08ShNaH52 (az)3.5 (ar)1.2 (d)2.4 (s)]T-0.001 Tc 49 >>BDC -0.001 Tc

This guide is a resource for Principal Investigators and Shop/Studio Supervisors to evaluate and control hazards and choose Personal Protective Equipment (PPE) that is appropriate for work.

Hazardous materials, such as chemicals, biological agents, and radioactive materials, can enter the body in four different ways:

- Absorption through the skin
- Inhalation
- Ingestion (eating and drinking)
- Injection (needles or sharp pieces of glass, metal, or plastic)

Whether exposure will lead to illness or injury depends on:

- Exposure frequency
- Exposure duration
- Individual factors (age, sex, and genetics)

First, assess the risk by asking these questions:

- What are the hazards?
- What is the worst that could happen?
- What can be done to prevent this from happening?
- What should be done if something goes

•

and/or water	Lung damage from
reactive liquids	inhalation
in any quantity	Poisoning through
CSL 4	skin

time sensitive,

Assessment of the risk of chemical exposure may be accomplished using the concept of Chemical Safety Levels (CSLs) or Safety Levels (BSLs), which have been well established in laboratories where there is a risk from a biological hazard, Chemical Safety Levels help to establish safety guidelines depending on the types of hazards present. The tables below illustrate how chemicals can be divided into Safety Levels. Refer Appendix 1 to see what precautions to take depending on the Chemical Safety Level present in your lab. For some, the Chemical Safety Level designation is dependent not just on the type of chemical present, but also on the quantity, concentration, and how it is used.

Chemical Safety Level 4 (High Risk)	
Hazard Description	Examples
<p><i>Health</i></p> <p>Regulated, confirmed, probable, or suspected human carcinogens, mutagens, or teratogens Toxicity: LD₅₀ < 50mg/kg, LC₅₀ < 2g dust or 200ppm vapor OEL < 1ppm Irreversible toxicities require use of designated areas Lachrymators, potent irritants, or stench</p> <p>Highly toxic compounds</p> <p>Cryogenic materials Environmental Hazard</p>	<p>Acrylamide, benzene, benzidine, ethylene oxide, formaldehyde, chromium Acrolein, bromine, sodium azide, potassium cyanide, lead, phosgene (GHS: H304; H334; H373)</p> <p>acetic anhydride, capsaicin, ethanethiol (GHS: H290; H314; H318; H302; H312; H315; H317; H319; H332; H335)</p> <p>acrolein, abrin, bromine, diacetoxyscirpenol, diazomethane, dimethylmercury, shigatoxin, sodium azide, sodium cyanide, toluene diisocyanate, ethidium bromide, hydrofluoric acid (GHS: H300; H301; H310; H311; H330; H331)</p> <p>Argon, Helium, Hydrogen, Nitrogen, Oxygen, Methane Iodine, Zinc sulfate, Copper sulfate (GHS: H400; H420)</p>
<p><i>Corrosivity</i></p> <p>Highly corrosive chemicals</p>	<p>Hydrogen fluoride, hydrofluoric acid, sodium hydroxide</p>
<p><i>Reactivity</i></p>	

Light sensitive: Hy.98 368 (ig)1o(i)-11 (ht)-t6it 12.6 re W n BT 10.98 -0 0 10.98 189.24



Chemical Safety Level 2 (Low Risk)	Chemical Safety Level 1 (Minimal Risk)
<p><i>Health</i> Toxicity is known and 10ppm < OELs < 500ppm Specific target organs or irreversible effects suspected Water soluble alcohols (Lower alcohols) Solid salts Compressed gases are simple asphyxiants</p>	<p><i>Health</i> No suspected human carcinogens All chemicals have known toxicities and OELs > 500ppm Consumer products in consumer packaging, unopened Instrumental labs</p>
<p><i>Corrosivity</i> Low concentration acids or bases pH less than 2 or greater than 10.5</p>	<p><i>Corrosivity</i> Chemicals with hazardous characteristics are not present or are in small capped vials, sampled with a pipette or syringe 2 < pH < 10.5</p>
<p><i>Reactivity</i> All chemicals being used are compatible. Limited quantities (<1L, or 0.5kg) of CSL 3 chemicals. No CSL 4 chemicals.</p>	<p><i>Reactivity</i> No chemical changes expected in the process Normally stable, does not react with water, can become unstable at high temperature and pressure</p>
<p><i>Flammability</i> Flashpoint near ambient Expected concentration < 10% LEL Examples: gasoline, antifreeze</p>	<p><i>Flammability</i> Slightly combustible, will burn in air when exposed at 150°C (315.5°C) for 5 minutes Noncombustible, will not burn in air when exposed at 150°C (315.5°C) for 5 minutes Flashpoint above ambient temperature (140) Examples: Lysol, 6% Hydrogen peroxide (hair bleaching)</p>

Check if applicable	Activity	Potential Hazard	Engineering Controls	Administrative Controls	Recommended PPE
	Working with human blood, body fluids, tissues, or bloodborne pathogens (BBP), animal specimens (preserved and unpreserved), or recombinant DNA Work with agents that are not known to consistently cause diseases in healthy adults. (BSL1)	Exposure to infectious material or preservatives. Eye or skin irritation.	Lab bench, sink	<ul style="list-style-type: none"> • Peerreviewed written procedure (SOP) • Job-specific training • EH&S Lab & Research Safety Training • Biosafety Core Course 	

Co,ces-0.6 (g)]TJ 0 Tc 656w 2.831 0 Td ()Tj EMC ET /P <37MC

				Medical surveillance policies Autoclave must be available	
--	--	--	--	--	--

Indigenous or exotic agents (BSL3)

Exposure to infectious material
May cause serious or potentially lethal disease through the inhalation route exposure

Bio Safety Cabinets or other physical containments devices used for all manipulations of agents that can cause splashes or aerosols of infectious materials.

Facility s-r-2.52.1 (m)1.2 (e)0.7 (n)-5 (t)-3.8 (s)-2.5 (c)2.2 (0t)-3.8 (s)-2.5 (c)2.2 (3.8 Td [(ex<M

Check if applicable	Activity	Potential Hazard	Engineering Controls	Administrative Controls	Recommended PPE
	Working with cryogenics	Major skin, tissue, or eye damage	Store and work with material in a laboratory or laboratory support areas with adequate air exchanges.	<ul style="list-style-type: none"> • Peerreviewed written procedure (SOP) • Safety Data Sheets (SDS) • Jobspecific training • EH&S Lab Safety training • Oxygen monitor if greater than 60 gallons of liquid nitrogen 	<ul style="list-style-type: none"> • Safety glasses or goggles for large volumes • Heavyimpermeable insulated gloves; labcoat • Consider a faceshield
	Working with very cold equipment or dry ice	Frostbite, Hypothermia	<ul style="list-style-type: none"> • Work with material or equipment in a laboratory or laboratory support areas with adequate air exchanges. • Allow dry ice to sublimate in certified fume hood or glovebox 	<ul style="list-style-type: none"> • Peerreviewed written procedure (SOP) • Safety Data Sheets (SDS) • Jobspecific training • EH&S Lab Safety training • Do not store dry ice in cold rooms 	<ul style="list-style-type: none"> • Safety glasses or goggles for large volumes • Insulated gloves (possibly warm clothing) • uC -6.330 1 Tf 0efic training

	Glassware, needles, sharp metal or plastic edges	Laceration, injection, exposure	Use rubber mats in sinks to protect glassware Use "safer" sharps	<ul style="list-style-type: none"> Peer-reviewed written procedure (SOP) Job-specific training Use plastic disposables 	<ul style="list-style-type: none"> Heavy rubber gloves for glassware washing Cut-resistant gloves when handling sharps Lab coat
	Working with electrical equipment (exposed electrical conductors, high voltage circuits, energized equipment)	Electrical shock		<ul style="list-style-type: none"> Develop & follow task-specific SOPs Signs and postings notifying others of the hazard present Inspect power cords prior to use 	<ul style="list-style-type: none"> Safety glasses Protective gloves
	Harmful dusts, fumes, mists or vapors	Inhalation, lung damage, eye irritation	<ul style="list-style-type: none"> Work with material or equipment in a laboratory or laboratory support areas with adequate air exchanges Local exhaust ventilation 	<ul style="list-style-type: none"> Peer-reviewed written procedure (SOP) Job-specific training EH&S Lab Safety training or EH&S Shop Safety or EH&S Safety and Compliance in the Arts 	<ul style="list-style-type: none"> Safety goggles Respirator after consultation with EH&S Industrial Hygiene
	Manipulation of large objects (lifting)	Back injury Crush injury	<ul style="list-style-type: none"> Use carts and mechanical hoists Install conveyor belts and m(a)-2.9 		

				for use	
	Laser high voltage supplies	Electrocution	Use properly grounded equipment and tools	<ul style="list-style-type: none"> • Peerreviewed written procedure (SOP) • Job-specific training • USF Laser Safety Training • Make sure area is dry • Connect to power last • Warning signs • Limited access and exposure time 	Remove metal watches and jewelry
	Laser systems used to cut or etc materials. These lasers may have potential to generate a fire hazard. Laser beam may generate air contaminants.	Adverse health effects due to toxicity from inhalation explosion, fire	Ventilation/exhaust at laser work area, follow fire safety – access to fire extinguisher	SOP, Resea Tw 0 -13'	



	pellets. Moderate potential for release into air during handling.			exposures by using job rotation schedules	
	Generation or manipulation r7 (t)1.5eu2 qh				

Check if applicable	Activity	Potential Hazard	Engineering Controls	Administrative Controls	Recommended PPE
	Machinery (wood and/or metalworking)	Entrapment and/or entanglement hazard. Damage to eyes due to flying debris	Use machine guarding and locate emergency stop	• PPE (R)2 (t1dE.4 (€	

Clay modeling,
sculpting

- Laceration hazard
- Metal poisoning
- Respiratory system damage
- Skin irritation
- Potential eye damage due to flying debris

Vent kilns to the outside

- Peerreviewed written procedure (SOP)
- Job-specific training
- EH&S training

- Eye protection (for flying debris or shaded) or splash goggles
- Apron
- Light chemical resistant gloves (disposable nitrile, latex) See the chemical glove compatibility chart to choose appropriate chemical resistant gloves

specific to 1.98 555.72 c.e1.7 (r)

Activity	Potential Hazard	Engineering Controls	Administrative Controls	Recommended PPE

Table 8-1 is designed to help you determine a chemical safety level (CSL) appropriate to the chemical activities in a laboratory. This CSL provides general guidance for best chemical safety practices appropriate to the chemical hazards of the laboratory.

In order to use this table, start with the “Conceptual Hazard Level” row and work across the row, thinking about the type of hazards present in the lab room, lab group, or process and match the hazard to the Chemical Safety Level, across the top of the table. Compare the tentative Chemical Safety Level to the “Chemicals Used” row, to confirm proper assignment. Once the Chemical Safety Level is assigned, go down the table to identify the various safety measures appropriate to the lab room, lab group or process. Remember that these recommendations may be over-ridden by local factors; document the reasons for these variations as they occur.

Table 8-1 Suggested Approach for Establishing Chemical Safety Levels				
Scope of Assessment Possibilities	Laboratory hazards equivalent to typical household	Laboratory hazards equivalent to teaching lab settings (restricted hazardous chemical inventory;	Moderate or varying laboratory hazards within a narrow range (open hazardous chemical	Novel hazards or severe established hazards (high hazard chemicals or processes with well
Driving Consideration				

Table 8-1 Suggested Approach for Establishing Chemical Safety Levels				
Scope of Assessment Possibilities				
Driving Consideration				

