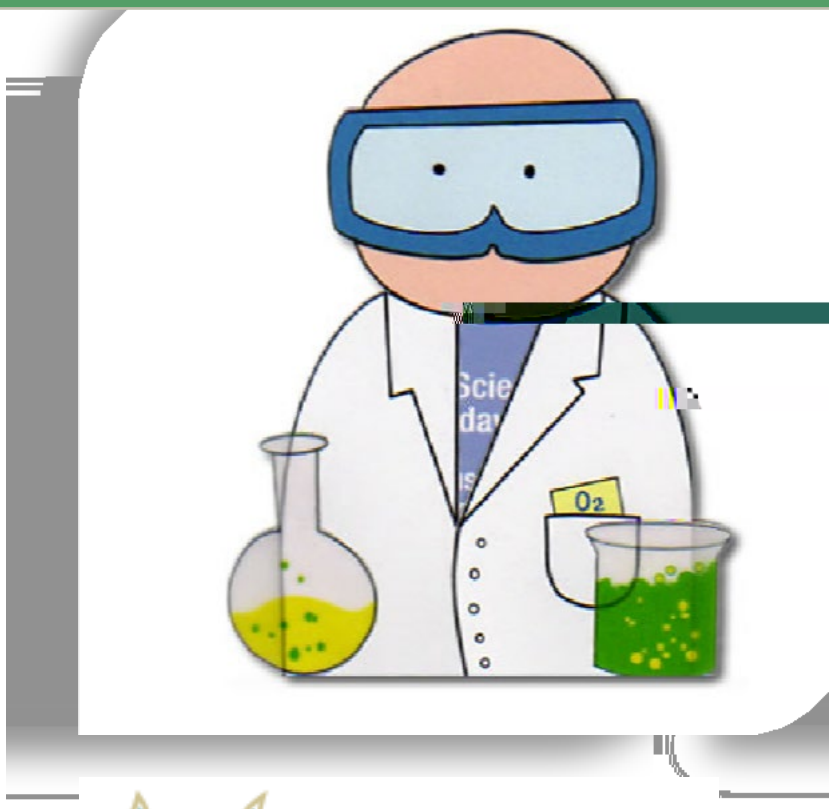
Hazard Control & PPE Selection Guid



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This guide is a resource for Principal Investigators and Lab/Studio Supervisors to evaluate and control hazards and choose Personal Protective Equipment (PPE) that is appropriate for their 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, access 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 reactive liquids in any quantity CSL 4	Lung damage from inhalation Poisoning through skin

time sensitive,

Assessment of the risk of chemical exposure may be accomplished using the concept of Chemical Safety Levels (CSLs). Similar to Biosafety 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 Chemical Safety Levels. Refer Appendix 1 to see what precautions to take depending on the Chemical Safety Level present in your lab. For some chemicals, the Chemical Safety Level designation is dependent not just on the type of chemical present, but also on the quantity present, concentration, and how it is used.

Chemical Safety Level 4 (High Risk)	
Hazard Description	Examples
Health Regulated, confirmed, probable, or suspected human carcinogens, mutagens, or teratogens Toxicity: LD_{50}<50mg/kg, LC_{50}<2g dust or 200ppm vapor OEL < 1ppm Irreversible toxicities require use of designated areas	Acrylamide, benzene, benzidine, ethylene oxide, formaldehyde, chromium Acrolein, bromine, sodium azide, potassium cyanide, lead, phosgene (GHS: H304; H334; H340-H373)
Lachrymators, potent irritants, or stenches	acetic anhydride, capsaicin, ethanethiol (GHS: H290; H314; H318; H302; H312; H315; H317; H319; H332; H335)
Highly toxic compounds	acrolein, abrin, bromine, diacetoxyscirpenol,, diazomethane, dimethylmercury, shigatoxin, sodium azide, sodium cyanide, toluene diisocyanate, ethidium bromide, hydrofluoric acid (GHS:H300; H301; H310; H311; H330; H331)
Cryogenic materials	Argon, Helium, Hydrogen, Nitrogen, Oxygen, Methane
Environmental Hazard	Iodine, Zinc sulfate, Copper sulfate (GHS: H400-H420)
Corrosivity Highly corrosive chemicals	Hydrogen fluoride, hydrofluoric acid, sodium hydroxide
Reactivity	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 3 (Moderate Risk)	
Hazard Description	Examples
Health Unknown toxicities or OEL < 10ppm Specific target organs or irreversible effects probable Possible human carcinogens, mutagens, or teratogens Irritants	t-butanol, butyl acetate, sodium sulfide, isopropanol, amyl acetate, cyclohexanone, sodium hydroxide, formamide
Corrosivity	See CSL 4 above, in small quantities or low concentrations.
Reactivity Can detonate or explode but requires a strong initiating force or confined heating before initiation. Readily promotes oxidation with combustible materials and may cause fires. Is sensitive to thermal or mechanical shock at elevated temperatures. May react explosively with water without requiring heat or confinement. Chemicals being used have known reactions or contamination hazards	See CSL 4 above, in small quantities or low concentrations.
Flammability Flammables solvents and gases. Vaporizes readily and can be ignited under almost all ambient conditions. May form explosive mixtures with or burn rapidly in air. May burn rapidly due to self-contained oxygen.	acetone, ethanol, hexane, methanol, xylene, 1,2 butanol

Chemical Safety Level 2 (Low Risk)	Chemical Safety Level 1 (Minimal Risk)
Health Toxicity is known and10ppm < OELs <500ppmSpecific targe organs or irreversible effects suspected Water soluble alcohols (Lower alcohols) Solid salts Compressed gases are simple asphyxiants	*Health* No suspected human carcinogens All chemicals have known toxicities and OELs > 500ppm Consumer products in consumer packaging, unopened Instrumental labs
Corrosivity Low concentration acids or bases pH less than 2 or greater than 10.5	*Corrosivity* Chemicals with hazardous characteristics are not present or are in small capped vials, sampled with a pipette or syringe 2<pH<10.5
Reactivity All chemicals being used are compatible. Limited quantities (<1L, or 0.5kg) of CSL 3 chemicals. No CSL 4 chemicals.	*Reactivity* No chemical changes expected in the process Normally stable, does not react with water, can become unstable at high temperature and pressure
Flammability Flashpoint near ambient **Expected concentration <10% LEL** Examples: gasoline, antifreeze	*Flammability* Slightly combustible, will burn in air when exposed at 150°F (315.5°C) for 5 minutes Noncombustible, will not burn in air when exposed at 150°F (315.5°C) for 5 minutes Flashpoint above ambient temperature (140°F) Examples: Lysol, 6% Hydrogen peroxide (hair bleaching)

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. (BSL-1)	Exposure to infectious material or preservatives. Eye or skin irritation.	Lab bench, sink	• Peer-reviewed 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

				Medicalsurveillance policies Autoclave must be available	
	Indigenous or exotic agents (BSŁ3)	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.	• Peer-reviewed written procedure (SOP) • Safety Data Sheets (SDS) • Job-specific training • EH&S Lab Safety training • Oxygen monitor if greater than 60 gallons of liquid nitrogen	• Safety glasses or goggles for large volumes • Heavy, impermeable insulated gloves; lab coat • Consider a face shield
	Working with very cold equipment or dry ice	Frostbite, Hypothermia	• 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 glove box	• Peer-reviewed written procedure (SOP) • Safety Data Sheets (SDS) • Job-specific training • EH&S Lab Safety training • Do not store dry ice in cold rooms	• 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	• Peer-reviewed written procedure (SOP) • Job-specific training • Use plastic disposables	• 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		• Develop & follow task specific SOPs • Signs and postings notifying others of the hazard present • Inspect power cords prior to use	• Safety glasses • Protective gloves
	Harmful dusts, fumes, mists or vapors	Inhalation, lung damage, eye irritation	• Work with material or equipment in a laboratory or laboratory support areas with adequate air exchanges • Local exhaust ventilation	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	• Safety goggles • Respirator after consultation with EH&S Industrial Hygiene
	Manipulation of large objects (lifting)	Back injury Crush injury	Use carts and mechanical hoists Install conveyor belts and m(a)-2.9		

Check if applicable	Activity	Potential Hazard	Engineering Controls	Administrative Controls	Recommended PPE
	Performing alignment, trouble-shooting or maintenance that requires working with an open beam and/or defeating the interlock(s) on any Class 3 of Class 4 laser system All class 3b and 4 lasers must be registered with USF's laser safety officer 813-974-1194	Eye and/or skin damage	Enclosures to limit access to laser beam	Follow requirements in the USF Laser Safety Program – available on-line. Warning Signs, limited access and exposure time.	•Proper Laser Safety glasses •impermeable gloves •Lab coat
	Viewing a Class 3R laser beam with magnifying optics (including eyeglasses)	Eye damage	Enclosures to limit access to laser beam	Follow requirements in the USF Laser Safety Program – available on-line. Warning Signs, limited access and exposure time.	Proper Laser Safety glasses
	Handling dye and other laser-related materials such as chemicals and solvents.	Adverse health			

				for use	
	Laser high voltage supplies	Electrocution	Use properly grounded equipment and tools	• Peer-reviewed 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. Generation or manipulation r7 (t)1.5eu2 qh			exposures by using jɵb rotation schedules	

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	• Peeгre [(R)2 (t1dE.4 (ϵ	

Clay modeling, sculpting	• Laceration hazard • Metal poisoning • Respiratory system damage • Skin irritation • Potential eye damage due to flying debris	Vent kilns to the outside	• Peer-reviewed written procedure (SOP) • Job-specific training • EH&S training	• Eye protection (for flying debris o 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 Driving Consideration				
	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

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Driving Consideration				

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