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PPE Decision Matrix Introduction

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Definitions

Below is guidance on hazards as they relate to PPE selection.

TOXICITY:	This is the intrinsic toxicity (hazard) of the chemical without regard to the use of PPE.
Skin Absorption	The chemical can be absorbed through intact skin and impact other body organs/systems (Skin Notation). The following EU Risk Phrases (or combination of these phrases) can also be used to identify Skin Absorption Hazards: R21, R24, R27.
Skin Contact Hazard	Slight to moderate irritation, skin burns, and allergic skin reactions (dermal sensitizer). The following EU Risk Phrases (or combination of these phrases) can also be used to identify Skin Contact Hazards: R34, R35, R38, R43, R66.
Eye Hazard	Slight to moderate eye irritation, corneal injury, impairment of vision, and blindness. The following EU Risk Phrases (or combination of these phrases) can also be used to identify Eye Hazards: R21, R24, R27, R34, R35, R36, R41.
Respiratory Hazard	May cause irritation of the upper respiratory tract and lungs, simple asphyxia, lung injury, respiratory sensitizer, single or prolonged exposure may cause adverse health effects. The following EU Risk Phrases (or combination of these phrases) can also be used to identify Respiratory Hazards: R20, R23, R26, R29, R31, R32, R34, R35, R37, R40, R42, R45, R46, R48, R49, R60, R61, R62, R63, R65, R67, R68.
Carcinogen	<p>A chemical is considered to be a carcinogen if it meets one of the following criteria: IARC (International Agency for Research) 1 - Carcinogenic to humans, 2A - Probably carcinogenic to humans, 2B - Possibly carcinogenic to humans, or NTP (National Toxicology Program) K - Known carcinogens, R - Reasonably anticipated to be human carcinogens, or OSHA suspect carcinogens as defined by 29 CFR1910, or ACGIH (American Conference of Governmental Industrial Hygienists) Category A1 - Confirmed Human Carcinogen, Category A2 - Suspected Human Carcinogen, Category A3 - Confirmed Animal Carcinogen with Unknown Relevance to Humans.</p> <p>The following EU Risk Phrases can also be used to identify carcinogens: R45 - May cause cancer R49 - May cause cancer by inhalation</p>
Reproductive Hazard	<p>Reproductive hazards are chemicals which affect the reproductive capabilities including chromosomal damage (mutations) and effects on fetuses (teratogenesis).</p> <p>The following EU Risk Phrases can also be used to identify reproductive hazards: R46 - May cause heritable genetic damage R47 - May cause birth defects R60 - May impair fertility R61 - May cause harm to the unborn child R62 - Possible Risk of impaired fertility R63 - Possible risk of harm to the unborn child R64 - May cause harm to breast fed babies</p>

PHYSICAL HAZARDS:	These are physical hazards without regard to the use of PPE.
Thermal Hazard	Skin contact with hot surfaces can cause damage. Contact with surfaces above 140 F (60 C) typically result in burns and blistering
Laceration/Cut Hazard	Contact with sharp or pointed objects can cause damage.
Noise Hazard	Sound levels at or above 85 dBA are hazardous
Vibration Hazard	Contact with vibrating equipment can be hazardous.

EXPOSURE Routes:	
Eyes	Low: Low potential for exposure; Minimal splash, aerosol, or vapor contact possible; No flying particles or sprays. Medium: Limited potential for exposure; Moderate splash, aerosol, or vapor contact is anticipated; Potential for flying particles or sprays. High: High potential for exposure; High degree of splash, aerosol, or vapor contact is anticipated; Flying particles or sprays present.
Skin	Low: Low potential for exposure; Not anticipating chemical contact; Minimal splash, aerosol, or vapor contact possible; No flying particles or sprays. Medium: Limited potential for exposure; Anticipating possible chemical contact; Moderate splash, aerosol, or vapor contact is anticipated; Potential for flying particles or sprays. High: High potential for exposure; Expect chemical contact; High degree of splash, aerosol, or vapor contact is anticipated; Flying particles or sprays present.
Respiratory/Inhalation	Low: Low potential for chemical exposure; Not anticipating aerosols or vapors to be present; No flying particles/dust or sprays; chemical with low vapor pressure (<10 mm Hg); chemical is used in a fume hood or glove box. Medium: Under normal conditions some limited potential for chemical exposure; Anticipating aerosols or vapors; Potential for flying particles/dusts or sprays to be present; Inhalation exposures would be expected to be below the OEL; Chemical with moderate vapor pressure (10 - 100 mm Hg). High: Under normal conditions high potential for chemical exposure; Expect flying particles/dusts, aerosols or vapors to be present; Chemical with high vapor pressure (>100 mm Hg).

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Face & Head Protection						
PPE TYPE	Safety Glasses with Side Shields	Chemical Goggles	Face Shield	Welding or Cutting Goggles/ Helmet	Hearing Protection	Hardhat
When PPE Should Be Worn	Minimum eye protection required for anyone present in a laboratory	When there is the potential for spray/splash of liquid chemicals (especially acids and caustics) or the potential for flying particles, fragments, objects, large chips, sand, or dirt.	When there is high potential for eye/face exposure or for chemicals under pressure. A face shield shall be used in combination with safety glasses or goggles.	When welding, cutting, torch cutting, or soldering.	When working in areas or operating equipment that is at or above 85 dBA	When there is potential for impact from falling objects or striking stationary objects.
Examples	Walking through labs, when there is the potential for flying particles, fragments, objects, large chips, sand, or dirt.	Pouring/dispensing chemicals outside of a fume hood that may cause more than just eye irritation (e.g., R21, R34, R24, R27, R35, R41 for eye Contact)	Pouring/dispensing hot chemicals, corrosive chemicals, or skin absorption hazard chemicals outside of a fume hood.	Welding, cutting, torch cutting, or soldering (ensure the proper lens shade is selected for the application).	Operating a band saw or table saw that is above 85 dBA.	Working below others who are using equipment or tools that could fall.
	weighing samples, data entry, sanding, buffing, grinding, drilling, polishing, operating a saw.	Pouring/dispensing chemicals inside of a fume hood that may cause more than just eye irritation (e.g., R21, R34, R24, R27, R35, R41) when it is not possible to keep the sash in front of you.	Pouring/dispensing corrosive chemicals inside of a fume hood, when it is not possible to keep the sash in front of you.	Link to Lens/Shade Selection Guide:	Operating a grinder that is above 85 dBA.	Working around or under conveyors that are carrying materials.
	pouring/dispensing chemicals outside of a fume hood (R36 for eye contact).	Handling corrosive liquids inside or outside of a fume hood.	Pouring acid into a container outside of a fume hood.		Operating hand tools (saws, grinders, drills) that produce noise levels above 85 dBA.	Working below equipment or machinery which might cause materials or objects to fall.
		Pouring chemicals at or near eye level.	Pouring hot liquid into a container.		When using compressed air for cleaning (this can create noise levels above 85 dBA).	Working in an area with low or limited headspace.
		When using compressed air for cleaning (this can create flying particles).	Pouring chemicals that are skin contact or skin absorption hazards (e.g., R34, R35, R43 for skin contact or R21, R24, R27 for skin absorption) into equipment that has agitation or movement.		When using a portable shop vacuum that produces noise levels at or above 85 dBA.	
		Mixing liquids with a mixer outside of a hood.	Opening a line or vessel that might contain pressure.		Entering a mechanical room that is above 85 dBA.	
		Opening a line or vessel that might contain pressure.	Operating a pedestal grinder.			
		Pouring/dispensing liquid nitrogen.	Working with steam.			
		Connecting/disconnecting liquid nitrogen lines.				
		Working with steam.				
	Using a 2 part epoxy or glue under pressure to stick items together.					
Notes	If using Lasers or UV radiation sources alternative eye protection may be required.	If using Lasers or UV radiation sources alternative eye protection may be required.		Ensure the proper lens shade is selected for the application.		

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Respiratory Protection

PPE	Supplied Air Respirator (e.g., Full Face Scott SCBA)	Air Purifying Cartridge Respirator (e.g., 3M Series 6000 Half Face)	Powered Air Purifying Respirator (e.g., 3M Breath Easy Full Face)	Filtering Face-Piece/Dust Mask (e.g., 3M N95 8511, 3M P95 8577)
When PPE Should Be Worn	When in an Immediately Dangerous to Life and Health (IDLH) atmosphere or for chemicals that can not be trapped on a cartridge/filter.	When above an Occupational Exposure Limit (OEL) for a solid or liquid aerosol, gas, or vapor.	When above an Occupational Exposure Limit (OEL) for a solid or liquid aerosol, gas, or vapor.	When below an Occupational Exposure Limit (OEL) for a solid aerosol of low toxicity.
Examples	Spill clean-up where the concentration is unknown.	Working with a chemical above the OEL while waiting for ventilation to be installed.	Working with a chemical above the OEL while waiting for ventilation to be installed.	Manually handling solid additives when monitoring indicates exposures are below the OEL or with low risk.
	Work with methylene chloride when local ventilation is not used.	Used "voluntarily" for tasks where monitoring indicates exposures are below the OEL.	Used "voluntarily" for tasks where monitoring indicates exposures are below the OEL.	
	Work in an oxygen deficient atmosphere.			
Notes	Ensure proper fit and test before use.	Ensure the correct type of respirator is selected based on the Maximum Use Concentration. When using air purifying respirators, a cartridge change out schedule is recommended. This typically involves calculating a "service life".	Ensure the correct type of respirator is selected based on the Maximum Use Concentration. Ensure proper fit and test prior to use of a Powered Air Purifying Respirator (PAPR).	Dust mask type respirators should never be used as a "required use" respirator.

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Body Protection

PPE	Full Body Suit for Liquid Chemical Protection	Full Body Suit for Particle Protection	Lab Coat	Flame Resistant Clothing (FRC)	Cut Resistant Sleeves	Chemical Protective Sleeves	Chemical Protective Apron
When PPE Should Be Worn	When there is the potential for splash from large amounts of toxic, corrosive, or hot liquids.	When there is a dusty atmosphere.	When working in a lab where chemicals are used.	When a flash fire hazard is present.	When there is the potential for a cut to the forearms.	When there is the potential for splashes to the forearms.	When there is the potential for splashes of toxic, corrosive, or hot liquids.
Examples	Handling chemicals under pressure that are skin contact or skin absorption hazards (e.g., R34, R35, R43 for skin contact or R21, R24, R27 for skin absorption).			Handling flammable or pyrophoric materials.	Cutting sheets of plastic off a winder with a hand knife.	When the length of the chemical resistant glove is not long enough to provide protection to the wrist and forearm.	Pouring a corrosive chemical into a container.
	Working with steam.						Handling/pouring corrosive liquids or toxic liquids (e.g., R34, R35, R43 for skin contact or R21, R24, R27 for skin absorption).
							Carrying extremely toxic materials (e.g., R35 for skin contact or R24, R27 for skin absorption).
							Handling concentrated acid
Notes	Careful consideration of the amount of liquid that could potentially be spilled/released and the toxicity of the liquid shall be considered.						To make a good assessment, consider the volume carried/handled and how the material is carried/handled.

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Foot Protection

PPE	Chemical Resistant Boots	Steel Toe Shoes
When PPE Should Be Worn	When contact is anticipated with a chemical agent that can cause local skin effects and/or pass through the skin and cause systemic effects.	Potential for objects to be dropped, falling objects, rolling/moving objects, or puncture from sharp objects.
Examples		Handling materials such as packages, objects, parts or heavy tools which could be dropped; and for other activities where objects could fall onto the feet.
		Changing/moving compressed gas cylinders
		Working where sharp objects (such as nails, wire, tacks, screws, large staples, scrap metal, etc.), could be stepped on, causing a foot injury.
Notes		

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Hand Protection							
PPE	General Purpose Gloves	Cut Resistant Gloves	Chemical Resistant Gloves (Nitrile, Neoprene, Butyl, PVC)	Thin Chemical Lab Gloves (Nitrile, Neoprene)	Double Gloves	Heat Resistant Gloves	Cold Resistant Gloves
When PPE Should Be Worn	Handling objects where there is a potential for abrasions, scrapes, splinters, and scratches.	Handling objects where there is the potential for penetration and laceration exposures.	When contact with the chemical is anticipated.	When Not Anticipating Contact with the chemical.	When working with chemicals that pass through most common polymeric glove materials (e.g., nitrile, neoprene, butyl).	Handling materials that are hot (above 140 F or 60 C), or there is the potential for hot sparks.	Handling materials that are extremely cold.
Examples	Normal work activities, e.g., handling objects, working with tools, grasping rough-textured surfaces.	Cleaning up broken glassware	Pouring methanol (a skin absorption hazard) on a cloth to wipe down equipment	Pouring methanol into a beaker	Working with methylene chloride	Removing hot glassware from an autoclave (gloves which offer thermal protection and are impervious to water).	Pouring/dispensing liquid nitrogen
	Carrying boxes or equipment	Using a utility/retractable blade knife	Washing glassware with solvents	Using solvent wash/squirt bottles		Removing samples from inside a hot oven	Connecting/disconnecting liquid nitrogen lines
	Using hand tools (e.g., wrenches, files, hand saws)	Handling items that have sharp edges	Pouring acids and bases into a large container	Pipetting solvents		Using propane torches	Filling liquid nitrogen dewars
	Handling warm objects (<140 F or 60 C)	Cutting metal tubing		Opening solvent bottles		Using a heat gun	Handling dry ice
		Cutting glassware				Working with steam (gloves which offer thermal protection and are impervious to water).	
		Removing rubber hoses from glassware connections/nipples					
Notes	Not to be used around rotating equipment (e.g., drills, saws, lathes, pedestal grinders)		Consider the glove material (e.g., Nitrile, Neoprene, Butyl, PVC) based on the chemical being handled. Some glove materials are not compatible with some chemicals (e.g., acetone should not be used with nitrile gloves). Also, consider length of glove if wrist protection is needed (a chemical sleeve may also be needed).	Consider length of glove if wrist protection is needed. Consider potential Latex allergy issues if using disposable Latex gloves. May not want to use Thin gloves for corrosives.	Barrier should be worn under the polymeric glove. E.G. for thick chemical resistant gloves use a 4H Silvershield as the barrier glove. For thin disposable gloves use the disposable Ansell Lamine gloves as the barrier glove.		

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