COLGATE UNIVERSITY

Chemical Hygiene Plan

Colgate University
Environmental Health and Safety
13 Oak Drive, Hamilton, NY 13346

Last Updated: January 2023

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Emergency Contact Information

Emergency	911 (315) 228-7911
Environmental Health and Safety (EHS) Main Office	(315) 228-6331
Colgate University Campus Safety	(315) 228-7333
Hamilton Fire Department	(315) 824-2460
Hamilton Police Department	(315) 824-3311
Community Memorial Hospital	(315) 824-1100
Southern Madison County Ambulance Corps	(315) 824-6867
CHEMTREC	(800) 424-9300
Emergency Spill Response Contractor (Clean Harbors)	(800) 645-8265
National Response Center (NRC)	(800) 424-8802
New York State Hazmat Spill Notification	(800) 457-7362
US Environmental Protection Agency (EPA)	(212) 637-4040

Environmental Health and Safety Contact Information

Joe Hernon, Associate Vice President for Emergency Management, Campus Safety, and Environmental Health and Safety
121 McGregory Hall
Campus Phone: (315) 228-4087
Email: jhernon@colgate.edu

Mary Williams, Director of Environmental Health and Safety
133 Ho Science Center
Campus Phone: (315) 228-7994
Email: mwilliams@colgate.edu

Cindy Geertgens, EHS Manager
123 Ho Science Center
Campus Phone: (315) 228-6411
Email: cgeertgens@colgate.edu

Victoria Jones, EHS Specialist
B07 Ho Science Center
Campus Phone: (315) 228-6099
Email: vejones@colgate.edu

EHS Website: www.colgate.edu/EHS

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Introduction

The Occupational Safety and Health Administration (OSHA) regulation entitled "Occupational Exposure to Hazardous Chemicals in Laboratories" (29 CFR 1910.1450), commonly referred to as the Laboratory Standard, requires all employers engaged in the laboratory use of hazardous chemicals to develop and implement the provisions of a Chemical Hygiene Plan (CHP) that is capable of protecting workers from the health hazards associated with the hazardous chemicals used in that particular workplace.

This CHP applies to all laboratories and all laboratory workers at Colgate University. This includes, but is not limited to, teaching and research laboratories in the Departments of Art and Art History, Biology, Chemistry, Geology, Physics and Astronomy, and Psychology. OSHA defines a laboratory as "a workplace where relatively small quantities of hazardous chemicals are used on a non-production basis."

The effectiveness of Colgate University's CHP will be reviewed at least annually and updated as necessary.

Division of Responsibilities

Chemical Hygiene Officer (CHO) – Director of Environmental Health and Safety

- Establish, maintain, and update the Chemical Hygiene Plan (CHP)
- Create and revise safety policies and procedures
- Oversee procurement, use, storage, and disposal of chemicals
- Conduct regular inspections of the laboratories, prep rooms, and chemical storage rooms
- Maintain inspection, personnel training, and inventory records
- Provide technical assistance to faculty, staff, and students concerning appropriate storage, handling, and disposal of hazardous chemicals
- Seek ways to improve the chemical hygiene program

Department Chairpersons

- Support the CHO and assist in maintaining awareness and compliance with the CHP
- Prepare budget requests for health and safety improvements
- Oversee the purchase of necessary personal protective equipment for the laboratories
- Review changes to the CHP

Faculty and Staff

- Ensure that everyone working in the laboratory has received laboratory safety and hazardous waste management training and is following all policies and procedures outlined in the CHP
- Maintain awareness of the hazards and safe handling procedures of all chemicals being used
- Confirm that emergency equipment and necessary personal protective equipment is available
- Report all hazardous conditions to their supervisor or to EHS
- Report any job-related injury or illness to their supervisor and Human Resources
- Follow all lab-specific operating procedures, including use of personal protective equipment
- Notify the CHO of any experiment-specific deviations from the posted general laboratory hazard assessment's PPE requirements

Students

- All students participating in a laboratory course or research involving work with chemicals must attend a laboratory safety and hazardous waste management training session annually
- Maintain awareness of the hazards and safe handling procedures of all chemicals being used
- Report all hazardous conditions to their supervisor or to EHS
- Report any lab-related injury or illness to their supervisor and EHS

- Follow all lab-specific operating procedures, including use of personal protective equipment

Department of Environmental Health and Safety (EHS)

- Interact with local, state, and federal regulators and agencies
- Investigate and respond to all laboratory incidents and accidents
- Coordinate cleanup operations in the event of a hazardous spill
- Test safety equipment, including, but not limited to, eyewash stations and fume hoods
- Develop and conduct training programs in laboratory safety
- Receive, inspect, inventory, and deliver all chemical, biological, and radioactive materials
- Maintain a library of Safety Data Sheets (SDSs) and other laboratory health and safety literature (ChemWatch)
- Oversee and maintain the chemical inventory management system (Vertere)

General Procedures for Working in a Laboratory

Personal Hygiene

- Do not prepare, store, or consume food or beverages in the laboratory
- Do not apply cosmetics in the laboratory
- Do not smoke in any laboratory or have tobacco products in open packages
- Wash hands and lower arms before leaving the laboratory, even if gloves were worn
- Do not pipette or siphon by mouth
- Sandals, open toed shoes, shorts, and skirts must not be worn in laboratories
- Appropriate personal protective equipment (PPE) shall be worn
- Hair past shoulder length shall be tied back and loose jewelry should be removed
- Do not wear or take gloves, lab coats, or lab aprons outside of the laboratory without faculty or staff approval

Housekeeping

- Work areas shall be kept clean and aisles must be free from obstructions
- Access to emergency equipment, exits, and control panels shall be kept clear at all times
- Universal precautions require that gloves are disposed of in the provided step cans
- All chemical containers (including waste containers) shall be properly labeled
- Spilled chemicals shall be cleaned up and disposed of properly
- Hazardous waste containers are removed from the laboratory by EHS

Experiment in Progress

- Equipment such as hot plates, heating mantles, and water condensers shall not run unattended without fail-safe provisions
- Unattended operations and experiments shall be checked regularly
- Appropriate signage (available here) shall be posted

Working Alone

- Students shall not conduct hazardous laboratory operations alone
- Non-hazardous operations may be conducted alone with the supervisor approval
- If approved, frequent contact shall be maintained with someone in the immediate area

Security

- All laboratories shall be locked when not in use
- All suspicious persons or activities shall be immediately reported to Campus Safety

Glassware and Sharps

- Damaged or broken glassware shall be discarded, while wearing appropriate hand and eye protection, in designated, marked containers

- Adequate hand protection shall be worn when inserting glass tubing into rubber stoppers or corks, or when placing rubber tubing on glass connections
- Glass apparatuses under vacuum shall be handled with extreme care to prevent implosion
- Glassware or bottles used in laboratory operations shall not be used for food or beverages
- Collect all used needles and syringes in designated red sharps containers

Systems under Pressure

- Reactions under pressure shall be carried out in an apparatus that is designed to withstand the full pressure of the system
- All pressurized apparatuses shall have appropriate relief devices

Compressed Gases

- Gas cylinders shall be strapped or chained securely to a wall or bench top
- Gas cylinders shall be transported using cylinder carts designed specifically for this purpose
- An appropriate regulator shall be used and gas cylinders shall be capped when not in use
- Flammable compressed gases shall be stored away from heat, oxygen, and ignition sources
- Compressed gas cylinders shall be visually inspected daily for leaks, cracks, and defects
- Flame shall never be used to detect flammable gas leaks

Chemical Storage

- All chemical containers shall be properly labeled to show contents
- Chemical containers shall be stored in the appropriate location (e.g. flammable solvents in flammable safety cabinets) and must be returned to that location after each use
- Chemicals shall not be stored on desks, bench tops, or in fume hoods
- Wherever feasible, appropriate storage trays or secondary containment shall be used to minimize spills in the event of a break or leak
- Chemicals shall be stored by hazard class, not alphabetically, and separated by compatibility
- Chemicals shall only be stored in refrigerators designed and constructed for such a purpose
- Chemicals shall be periodically inspected and unwanted materials given to EHS

Peroxide Forming Chemicals

Complete Peroxide Forming Chemical Safety Program is available here.

- If safer alternatives are available, do not purchase or use high-risk peroxide forming chemicals without prior approval from EHS.
- Peroxides can build up over time as solvent evaporates and/or air seeps into the bottle. If possible, purchase peroxide forming chemicals that contain an appropriate peroxide inhibitor such as butylated hydroxytoluene (BHT). If

non-inhibited material must be stored, then material should be stored under an inert atmosphere.

- Do not store peroxide forming materials in clear glass bottles (light can accelerate peroxide formation). It is recommended that an amber transparent bottle be used. Do not store the material in a metal can or other container that must be opened to see inside.
- Do not store peroxide-forming chemicals near heat, sunlight, or ignition sources. Avoid places that undergo temperature variations that can cause the bottle to “breathe in” oxygen.
- Do not distill, evaporate or concentrate the material unless it has been tested for the presence of peroxides. Peroxides are usually less volatile than their parent material and tend to concentrate upon distillation.
- Never touch or attempt to open a container of a peroxide-forming liquid if there are crystals around the cap and/or in the bottle. Place the container in safe storage and contact EHS immediately.

Chemical Procurement and Inventory Management

In accordance with the OSHA Hazard Communication Standard (29 CFR 1910.1200), EHS maintains an inventory of hazardous chemicals on campus. The chemical inventory is updated as new chemicals are received and disposed, and the entire campus inventory is verified biennially.

All chemical, biological, and radioactive material purchases for the Natural Sciences Division are directed to the EHS chemical receiving room in Ho Science Center Room B07 by the Purchasing Department. Upon receipt of a shipment, EHS staff opens boxes and outer packaging in a fume hood, checking for completeness and integrity of all items in the shipment. Barcodes are added to chemical containers, and are then entered into the chemical inventory management system (Vertere). Chemicals and biologicals are then delivered to the laboratories by EHS. EHS must be notified if chemicals are transferred to a different location so that the inventory can be updated accordingly.

EHS assesses the need for prior approvals via review of all chemical orders and any associated hazards when the purchase order is generated.

EHS stocks commonly used and surplus chemicals for faculty and staff within the Natural Sciences. Lists of these chemicals are available upon request. A chemical requisition form must be submitted to request these items, and is available on the EHS website (www.colgate.edu/EHS/requisition-for-chemicals).

Safety Data Sheets

Upon completion of chemical inventory, Material Safety Data Sheets (MSDSs) or Safety Data Sheets (SDSs) are added to Colgate University's online SDS library (ChemWatch; jr.chemwatch.net/ chemwatch.web/account/autologinbyip). In addition, any SDSs received with chemical or biological orders will be kept on file in the SDS library in Ho Science Center B07.

MSDSs must be reviewed prior to working with unfamiliar or particularly hazardous chemicals. MSDSs identify the chemical's hazards, composition/ingredients, first-aid measures, fire-fighting measures, accidental release measures, handling and storage, exposure controls and personal protection, physical and chemical properties, stability and reactivity, toxicological and ecological information, and information on disposal, transport, and applicable regulations.

Classes of Hazardous Chemicals

The hazard class of a chemical provides information to help determine how it can be safely stored and handled. Each chemical container must have a label that clearly identifies the chemical constituents. More comprehensive hazard information can be found by referencing the chemical's MSDS. The OSHA Laboratory Standard defines a hazardous chemical as any element, chemical compound, or mixture of elements and/or compounds which is a physical or health hazard.

Physical Hazards

As defined in 29 CFR 1910.1200:

- An explosive is a solid or liquid chemical, such as a pyrotechnic chemical, "which is in itself capable by chemical reaction of producing gas at such a temperature and pressure and at such a speed as to cause damage to the surroundings."
- Flammables
  - Aerosols are non-refillable receptacles "containing a gas compressed, liquefied or dissolved under pressure, and fitted with a release device allowing the contents to be ejected as particles in suspension in a gas, or as a foam, paste, powder, liquid or gas. "Aerosols shall be considered flammable if they contain any component which is classified as flammable
  - Flammable gases have a flammable range with air at 20°C (68°F) and a standard pressure of 101.3 kPa (14.7 psi).
  - Flammable liquids have a flashpoint of less than 93°C (199.4°F).
  - Flammable solids are "readily combustible solids, or may cause or contribute to fire through friction. Readily combustible solids are powdered, granular, or pasty chemicals which are dangerous if they can be easily ignited by brief contact with an ignition source, such as a burning match, and if the flame spreads rapidly."
- Gases under pressure are gases which are contained in a receptacle at a pressure of 200 kPa (29 psi) (gauge) or more, or which are liquefied, or liquefied and refrigerated. They comprise compressed gases, liquefied gases, dissolved gases and refrigerated liquefied gases.
- Organic peroxides are chemicals "considered a derivative of hydrogen peroxide, where one or both of the hydrogen atoms have been replaced by organic radicals. Organic peroxides are thermally unstable chemicals, which may undergo exothermic self-accelerating decomposition. They may have one or more of the following properties:
  - Be liable to explosive decomposition;
  - Burn rapidly;
  - Be sensitive to impact or friction;
  - React dangerously with other substances."

- Oxidizers “may, generally by yielding oxygen, cause, or contribute to, the combustion of other materials.”
- Pyrophoric materials, “even in small quantities, are liable to ignite within five minutes after coming into contact with air.”
- Water-reactive materials are chemicals that “react with water to release a gas that is either flammable or presents a health hazard.”

Health Hazards

OSHA defines a health hazard as a chemical for which there is significant evidence that acute or chronic health effects may occur in an exposed employee. The following health hazards are defined in 29 CFR 1910.1200:

- Corrosives are chemicals that cause “visible destruction of, or irreversible alterations in, living tissue by chemical action at the site of contact.”
- Irritants are chemicals which cause a “reversible inflammatory effect on living tissue by chemical action at the site of contact.”
- Sensitizers are chemicals that cause “a substantial proportion of exposed people or animals to develop an allergic reaction in normal tissue after repeated exposure to the chemical.”
- Target organ toxins are chemicals that can cause adverse health effects in specific organs of the body. Examples include hepatotoxins, nephrotoxins, and neurotoxins.

Particularly Hazardous Substances

Particularly Hazardous Substances (PHSs) are defined in the Laboratory Standard as select carcinogens, reproductive toxins, and substances which have a high degree of acute toxicity. These chemicals may present additional risk to laboratory workers if not handled appropriately, and may require supplementary control measures when used. Laboratory supervisors, with EHS consultation, are responsible for assessing the hazards of these chemical materials that they may use or synthesize, and to take appropriate steps to implement safety controls, including creating a designated area or working exclusively in a fume hood.

A select carcinogen is a substance that meets one of the following criteria:

- It is regulated by OSHA as a carcinogen; or
- It is listed under the category, "known to be carcinogens," in the Annual Report on Carcinogens published by the National Toxicology Program (NTP) (latest edition); or
- It is listed under Group 1 ("carcinogenic to humans") by the International Agency for Research on Cancer Monographs (IARC) (latest editions); or
- It is listed in either Group 2A or 2B by IARC or under the category, "reasonably anticipated to be carcinogens" by NTP, and causes statistically significant tumor incidence in experimental animals in accordance with any of the following criteria:

- After inhalation exposure of 6–7 hours per day, 5 days per week, for a significant portion of a lifetime to dosages of less than 10 mg/m^3;
- After repeated skin application of less than 300 (mg/kg of body weight) per week; or
- After oral dosages of less than 50 mg/kg of body weight per day.

Reproductive toxins are substances, such as mutagens and teratogens, that have an adverse effect on various aspects of reproduction, including fertility, gestation, lactation, and general reproductive performance. Acute toxins are chemicals which may be fatal as a result of a single exposure or after an exposure of short duration. The OSHA Hazard Communication Standard, 29 CFR 1910.1200, states that highly toxic chemicals have the ability to cause harmful effects after a single exposure. Based on animal toxicity data, if available, a substance is highly toxic if it meets the following criteria:

- LD_{50} - ingestion: $\leq$ 50 mg/kg
- LD_{50} - contact (24hrs): $\leq$ 200 mg/kg
- LC_{50} - inhalation: $\leq$ 200ppm/1hr

Other Hazardous Materials

- Biological Hazards
  - Any laboratory where biological materials are used should include bench tops that are impervious to water and that can easily be decontaminated.
  - There are four biosafety levels for activities involving infectious microorganisms and laboratory animals. Work at Colgate University involves only Biosafety Level 1 (BSL1) and Biosafety Level 2 (BSL2).
    - BSL1 applies to work involving well-characterized agents not known to cause disease in healthy adult humans or animals, and of minimal potential hazard to laboratory personnel and the environment and is the minimum level for all laboratories using biological material.
    - BSL2 applies to work involving agents that can cause human disease, but whose potential for transmission is limited. BSL2 laboratories must have signs posted on their entrance doors identifying the Biosafety Level, the hazard, access restrictions, and emergency contact information.
  - After working with potentially biologically hazardous materials, laboratory users must wash their hands before leaving the laboratory.
  - Decontaminate work surfaces after completion of work and after any spill or splash of potentially infectious material with appropriate disinfectant.
  - Contact EHS for guidance on proper disposal of biological waste.
- Controlled Substances
  - The federal Drug Enforcement Agency (DEA) and New York State Department of Health (NYSDOH) strictly regulate the management and disposal of controlled substances. Contact EHS for a complete list of controlled substances, as well as licensing and ordering requirements.

    - Controlled substances must be locked in a secure location, based on drug schedule, and the Controlled Substance Use and Disposition Log must be completed for each container.
    - Unwanted controlled substances should be separated from those that are still in use by placing them in a bag or box, and writing “expired” or “for disposal” on each container.
- Laser Hazards
    - A laser (Light Amplification by Stimulated Emission of Radiation) produces an intense, highly directional beam of light. The human body is vulnerable to the output of certain types of lasers, and exposure can result in damage to the eyes and skin. Lasers are classified following the guidelines in the American National Standard for Safe Use of Lasers (ANSI Z136.1_2007).
    - In accordance with 12 NYCRR 50, appropriate controls must be followed, including signage, training, and PPE, such as protective eyewear designed specifically for laser use.
- Radioactive Material Hazards
    - The Radiation Safety Manual is an overview of radiation safety policies for all individuals who work with or in the vicinity of radioactive materials or radiation producing equipment. These policies and procedures have been developed to maintain individual and collective doses as low as reasonably achievable, and to ensure that all activities are being conducted safely, and in accordance with NRC and NYS Department of Health regulations and the conditions of the Colgate University Radioactive Materials License.

Hazard Assessments and Personal Protective Equipment

Personal protective equipment (PPE) is readily available in the laboratories and, based on laboratory hazard assessments, are to be used by all faculty, students, and staff. Colgate University conducts required laboratory hazard assessments in accordance with OSHA 29 CFR 1910 Subpart I *Personal Protective Equipment* using the suggested method in Appendix B to Subpart I (Compliance Guidelines for Hazard Assessment and Personal Protective Equipment Selection). Laboratories are also to provide appropriate PPE for all visitors. General laboratory hazard assessments are conducted annually by EHS, and include a survey of each individual laboratory. Laboratory surveys include consideration of the following basic hazard categories:

- Chemical
- Heat /Flammability
- Particulates
- Impact
- Penetration
- Compression (roll-over)
- Light (optical) radiation

Laboratory hazard assessments include a walk-through and evaluation of chemical, equipment, and process hazards present in each laboratory. Consideration of the chemical hazards present is performed through a biennial inventory of the chemicals in each laboratory and daily monitoring of all chemical orders and chemical stockroom deliveries to each laboratory. Hazard assessments are updated whenever there is a change in the hazards present. Material safety data sheet (MSDS) review of the chemicals present in each laboratory (conducted annually and at the time of chemical receipt) is carefully considered in the PPE analysis and selection process. Documentation and communication of the laboratory hazard assessments is achieved through hazard identification /emergency contact signage posted at the entrance to each laboratory (See Appendix A for example signage).

Experiment-specific laboratory hazard assessments for academic and/or research work are conducted as necessary by faculty and laboratory instructors or, by request, in collaboration with EHS. Experiment-specific laboratory hazard assessments provide a mechanism for faculty and laboratory instructors to increase or decrease the general laboratory hazard assessment PPE requirements based on experiment specific protocols and associated safety considerations. For instructional laboratories, experiment specific laboratory hazard assessments are to be documented, sent to EHS for recordkeeping, and clearly communicated to all experiment participants. For research laboratories, deviations from the general laboratory hazard assessment PPE requirements can be made at the discretion of the faculty supervisor based on the specific procedures being conducted. EHS can

provide guidance on appropriate levels of PPE across the range of experimental procedures encountered in the research setting.

Eye and Face Protection

Eye and face protection is to be worn by all persons whenever any one person in the laboratory is conducting an activity that involves potential eye and face hazards. Activities that present potential eye and face hazards include, but are not limited to, work involving the following:

- Hazardous chemicals
- Flying particles
- Hot solids, liquids, or molten metals
- Milling, sawing, turning, shaping, cutting, or stamping of any solid materials
- Heat treatment, tempering, or kiln firing of any metal or other materials
- Gas or electric welding
- Potentially injurious light radiation

All protective eyewear in the laboratory must meet the ANSI Z87.1-2003 standard. Work involving laser outputs must also meet the ANSI Z136.1-2007 standard. The below explanatory information and Appendix B (ANSI 287.1-2003 Occupational and Educational Personal Eye Protection Devices Selection Chart) are intended to aid in identifying and selecting eye and face protection to match the hazard source.

Safety Glasses

Safety glasses provide eye and face protection from moderate impact and particle hazards associated with grinding, sawing, scaling, broken glass, minor chemical splashes, etc. Side protectors are required when there is a hazard from flying objects. Although safety glasses meeting the ANSI 287.1-2003 standard provide adequate splash protection, splash goggles are an approved alternative for additional eye protection from chemical splash hazards.

Regular prescription eyeglasses (with or without side shields) and contact lenses are not a substitution for safety glasses or splash goggles. Contact lenses can be worn without increased risk in most laboratory environments. Use of contact lenses in the laboratory will be approved by the laboratory supervisor prior to commencing any activity involving a potential eye or face hazard. Faculty and staff who wear prescription eyeglasses or contact lenses should consider obtaining a pair of prescription safety glasses. Faculty and staff may obtain prescription safety glasses through the Colgate Prescription Safety Glasses Program by contacting EHS. Students, faculty, and staff who do not obtain prescription safety glasses are to wear safety glasses (for impact hazards) or safety goggles (for splash hazards) designed to go over their prescription glasses.

Splash Goggles
Splash goggles provide adequate eye protection from hazards including potential chemical splash, use of concentrated corrosive material, and bulk chemical transfer. Goggles are available with clear or tinted lenses, fog proofing, and vented or non-vented frames. If working with a chemical splash hazard, ensure the goggles are rated for use with chemicals. Be aware that goggles designed for woodworking are not appropriate for working with chemicals. These goggles can be identified by the numerous small holes throughout the face piece. In the event of a splash, the potential exists for chemicals to enter into the small holes resulting in a chemical exposure to the face.

Welder / Chipper Goggles
Welder goggles provide protection from flying sparks, metal spatter, slag chips, and harmful radiant energy. Lenses are impact resistant and are available in graduated lens shades depending on the nature of the work. Minimum protective shade numbers based on the type of welding operations can be found can be found in the OSHA 29 CFR 1910.133 Eye and Face Protection standard.

Face Shields
Face shields provide additional protection to the eyes and face when used in combination with safety glasses or splash goggles. Face shields consist of an adjustable headgear and a face shield with either tinted or clear lenses, or a mesh wire screen. Face shields should be used in operations when the entire face needs protection from flying particles, metal sparks, liquid cryogens, or chemical /biological splashes. Face shields are not a substitute for appropriate eyewear and should always be worn in conjunction with a primary form of eye protection such as safety glasses or goggles.

Welding Shields
Welding shields are similar in design to face shields but offer additional protection from radiant light burns, flying sparks, metal splatter, and slag chips encountered during welding, brazing, soldering, resistance welding, bare or shielded electric arc welding, and oxyacetylene welding and cutting operations. Equipment fitted with appropriate filter lenses are to be used to protect against light radiation. Tinted and shaded lenses are not filter lenses unless they are marked or clearly identified as such.

Laser Eye Protection
No single type of safety glasses is available for protection from all laser outputs. The type of eye protection required for laser operations is dependent on the spectral frequency and specific wavelength of the laser sources. Contact the Colgate University Laser Safety Officer or EHS for additional guidance on laser PPE selection.

Hand Protection

Gloves are to be used when handling hazardous chemicals in the laboratories. Typically, the requirements of the general laboratory hazard assessment should be followed. However, deviations may be made as outlined in the paragraph on experiment specific laboratory hazard assessments. EHS can provide guidance on appropriate hand protection in instructional and research settings. There is no single glove material that protects against all chemicals. It is important that the appropriate glove is used when handling chemicals. Gloves should be carefully selected for their degradation and permeation characteristics to provide proper protection. Consult chemical compatibility charts, MSDS, and protective equipment manufacturer resources to aid in the selection of the proper glove protection level based on the chemicals being handled (See Appendix C for a university approved manufacturer chemical compatibility chart).

In situations involving extremely hazardous chemicals, double gloves in combination with sleeve protectors and other chemically resistant PPE are recommended. The thin latex, vinyl, or nitrile gloves, popular for their dexterity, are not appropriate for highly toxic chemicals or solvents. Gloves should always be inspected before use and replaced immediately if they are contaminated or torn. Gloves are to be removed before handling telephones, doorknobs, computers, etc. Gloves shall also be removed before leaving the laboratory, with an exception being made for persons actively transporting chemical /biological material between labs. Persons transporting chemicals should either have a second person available to open /close doors for them, or they should employ the "one glove" rule, in which one hand is un-gloved and used to touch door handles, elevator buttons, etc., while the gloved hand handles the chemical /biological material. Glove protection is not required during the transport of chemicals in a cart, bottle carrier, or clean secondary container.

Colgate practices "Universal Precautions" for glove disposal. In practical terms, this means that all gloves will be treated as if they are contaminated (i.e. for disposal purposes, there will be no separation of contaminated and non-contaminated gloves). Every laboratory at Colgate is equipped with foot operated self-closing receptacles for glove waste disposal. The “Universal Precaution” glove disposal policy simplifies glove disposal, increases overall laboratory safety, and prevents inadvertent disposal of contaminated gloves in non-hazardous waste receptacles (and any related custodial chemical contact). It should be noted that classroom and research gloves contaminated with biologicals will be separated from gloves contaminated with chemical hazardous waste. Biological contaminated gloves will then be either autoclaved prior to disposal as a contaminated glove or sent out for disposal via the university's bio-waste service provider.

Protective Clothing

Lab coats and lab aprons prevent skin contact exposure to chemicals by providing a protective barrier between the hazard and the laboratory user's torso, waist, and extremities.

Lab Coats

Lab coats are to be used when handling hazardous chemicals in the laboratories. Typically, the requirements of the general laboratory hazard assessment should be followed. However, deviations may be made as outlined in the paragraph on experiment specific laboratory hazard assessments. EHS can provide guidance on appropriate protective clothing in instructional and research lab settings. Faculty, staff, and student lab coats are provided and maintained by EHS. Colgate University's lab coats have the following protective qualities:

- Flame-resistant fabric
- High tensile strength thread material
- NFPA 70E, HRC 2 compliant
- Arc Rated to 8 cal/cm^2
- Thermal and electrical arc hazard rated to ASTM 1506-02a standard
- Covered gripper snap front for quick and safe garment removal
- Covered gripper snap cuffs to prevent garment interference during chemical handling /experimentation work
- Lightweight (7 oz) Indura Ultra Soft fabric for unrestricted movement / user comfort
- 42 inches in length for maximum skin exposure protection

Lab coats are maintained, cleaned, and replaced, when necessary, by EHS. Lab coats will be cleaned by a qualified commercial laundry service provider at the end of each semester and at the end of the summer to ensure periodic removal of any potential chemical contaminants. Additional cleanings will be coordinated by EHS as necessary upon request. In the event a lab coat becomes contaminated, deteriorated, or damaged prior to the scheduled tri-annual cleaning, contact EHS for replacement and/or disposal of the garment.

Lab Apron

Plastic or rubber lab aprons provide additional protection from skin contact exposure to chemicals, especially when working with splash hazards and corrosive liquids. Lab aprons do not protect the user's extremities and should be used as an additional layer of protection, not as a substitute, for a lab coat.

Respiratory Protection Program

The OSHA regulations set forth in 29 CFR 1910.134 address respiratory protection in the workplace. The regulations in this section seek to "prevent atmospheric contamination ... [to control] those occupational diseases caused by breathing air

contaminated with harmful dusts, fogs, fumes, mists, gases, smokes, sprays, [and] vapors" (29 CFR 1910.134(a)(l)).

Colgate University shall first seek to prevent atmospheric contamination by implementing engineering controls whenever possible, prior to utilizing personal protective equipment (PPE).

Engineering controls can include enclosing the work area, introducing ventilation (mechanical /natural and local /general), and substitution of less toxic materials. After engineering controls are in place, respiratory PPE can be employed if deemed necessary. If respirators must be used to make the work environment safe, then their use shall be governed by the written, worksite specific Respiratory Protection Program (RPP). The RPP describes all aspects pertaining to the safe use and maintenance of university-issued respirators. Colgate University shall issue respirators for use at no cost to medically-cleared and properly trained employees enrolled in the RPP, and will develop, implement, and maintain the RPP to ensure the continued safe use of these respirators.

The RPP applies to all Colgate University employees working in conditions that require the use of a respirator while at any Colgate University location. In the event that an employee does not or cannot follow the guidelines established by this program, he or she will not be allowed to continue working on any task involving the use of a respirator. The RPP also applies to any Colgate University student that is required to wear a respirator while working as a university employee, whether during the course of a work study job, casual wage position, or any other instance in which he or she is employed by the university.

Engineering Controls and Safety Equipment

Fume Hoods and Ventilation

General ventilation provides only modest protection against inhalation hazards, and therefore will not be used for protection against toxins. Chemical fume hoods must be used to prevent harmful fumes, mists, dusts, gases, and vapors from entering the laboratory air. Fume hoods will be inspected and validated annually by trained Colgate representatives. Fume hoods are equipped with face velocity and sash height monitors that initiate an audible alarm when exhaust flow is at an unsafe condition. Fume hoods will maintain a face velocity between 80-120 linear feet per minute, with a calibrated performance bias, between 6" and 18" sash heights.

If a hood is found to be deficient, a warning sign indicating that the hood did not pass inspection and does not provide adequate protection will be attached in a conspicuous location. Under no circumstances should laboratory personnel continue to use a fume hood that has not passed the annual inspection/certification process, even if the fume hood appears to have airflow. Laboratory personnel must make arrangements with other laboratories that have functioning fume hoods if their work requires the use of a fume hood.

Work Practices for Chemical Fume Hoods:

- If you suspect that your fume hood is not functioning properly, alert EHS
- Set up work at least 6 inches from the face of the hood to avoid turbulence at the sash edge
- Separate and elevate each instrument by using blocks or racks so that air can flow easily around all apparatuses
- Do not clutter the hood with unnecessary bottles or equipment
- Do not use the hood for storage of chemicals or other materials - only materials in use should be in the hood
- Work with the sash in the lowest possible position
- Lower the sash completely when no one is working in the hood
- Do not obstruct the hood baffles or the slots at the back of the hood
- Do not dismantle or modify the physical structure of the hood or exhaust system in any way
- Do not place electrical receptacles or other spark producing equipment inside the hood
- Do not put your head inside an operating hood to check an experiment
- Clean up spills in the hood immediately, and contact EHS for assistance if needed
- Do not use a hood for evaporation of chemical wastes
- Heating of perchloric acid must only be performed in a perchloric acid fume hood. (These hoods are located in 319 Wynn Hall and 233 Ho Science Center.)

Laminar Flow Hoods and Biosafety Cabinets

The term laminar flow hood (LFH) refers to any device designed to maintain a clean environment inside the cabinet. LFHs offer no protection to the user from microorganisms or other pathogens, and are properly referred to as "clean benches." If an LFH is designed to contain pathogens within the unit, so as to minimize the chance of exposure from these agents to the user, then it is referred to as a biological safety cabinet (BSC). Because these devices may exhaust air directly into the room, they do not offer any protection from hazardous or toxic chemical vapors or gases. Working with acutely toxic substances (LD50 <50 mg/kg) may require more specialized local ventilation such as the use of a glove box or other closed system.

The IBC expects PIs to ensure appropriate training for all potential users of a BSC to alert users to, and prevent, potential exposure and other risks. All new BSCs at Colgate University must be purchased with consultation from the IBC, installed in accordance with NSF/ANSI 49 standards, and must be certified after installation (and annually thereafter).

- BSCs are not designed for use with volatile solvents or radioisotopes; for procedures involving these chemicals, use of a chemical fume hood is required.
- BSCs should always be used with appropriate personal protective equipment (PPE), to prevent contamination and potential exposure hazards. PPE includes gloves and lab coat; additional PPE should be used as recommended for the level of biohazard being handled.
- Vacuum flasks are recommended for disposal of liquid waste; all waste should be decontaminated appropriately prior to disposal.
- Open flames are not recommended for use in BSCs for the following reasons:
    - Open flames are not required for sterility, as the appropriate use of the BSC should guarantee a sterile work space. Surfaces may be decontaminated with appropriate solutions, generally 70% ethanol applied via wipes.
    - Open flames can compromise the sterility of the BSC; the heating of air from flames causes up-flow air that mixes with the down-flowing air in the cabinet to produce turbulence and recirculation of air within the BSC. This may lead to the generation of aerosols which can potentially contaminate cultures or create a risk of exposure to the BSC worker.
    - Excessive heat build-up may also damage the HEPA filter of the BSC, leading to decreased effectiveness and possible loss of containment.
    - The use of open flames in the BSC will inactivate any manufacturer's warranty, and automatically voids UL (Underwriter's Laboratories Inc.) approval.

    - Sources of open flames, particularly Bunsen burners, present a potential fire or explosion hazard; electrical components of the BSC, such as the fan motor, lights, and electrical outlets are not designed to operate in flammable atmosphere, where a spark could ignite a flash fire.
    - For inoculating bacterial cultures, sterile disposable loops or pipette tips are preferred; alternatively micro-burners or electric "furnaces" may be used.
    - If deemed absolutely necessary for the work to be performed, PIs may petition the IBC to use a pilotless burner or safety touch-plate microburner, as an alternative to a Bunsen burner.

In the end, for ensuring sterility, the BSC is only as effective as its user. Best practices include:

- Maintaining annual certification of the hood
- Operating cabinet blowers for at least 3-5 minutes prior to opening the sash to allow the BSC to purge particulates
- Using alcohol to clean the work surface of the BSC and to sterilize any glass being used; the amount of alcohol stored in the BSC should be for no more than one day's work.
- When working in the hood, moving arms in and out slowly, perpendicular to the face opening to reduce disruption of the air curtain.
- Do not cover the air intake vents (i.e. with paper, lab notebooks, etc.) during use.
- Perform all operations at least 4 inches from the front grille on the work surface.
- Do not bring potentially contaminated materials out of the cabinet until they have been surface decontaminated.
- UV light is not recommended as the sole means of decontaminating a BSC and should only be used in ways that minimize direct UV exposure to room occupants (i.e. by maintaining sash closure during UV use or by brief use while the room is not occupied).

Eyewash Stations and Safety Showers

The American National Standards Institute (ANSI) has developed voluntary standards concerning emergency equipment. Colgate University uses the standard ANSI Z358.1 as a guideline for establishing the design, installation, use, and performance of emergency safety equipment.

All hazardous material exposures resulting in eye, face, or body contamination are cause to use the emergency eyewash stations and safety showers located in the laboratories and hallways. Drench hoses are also installed in some laboratories as an extra precaution. There are several types of eyewashes and safety showers on campus, including combination units, and it is essential that all laboratory users

know the location and proper use of this equipment. In addition, the path to this equipment must not be obstructed. Laboratory users shall contact EHS or Facilities if they notice a nonfunctioning emergency eyewash or safety shower.

If the eyes and/or face are contaminated, immediately flush the eyes in the eyewash station for at least 15 minutes. The eyelids should be held open and eyeballs should be rolled around to fully irrigate the eye. If the body is contaminated, remove clothes at and below the affected area, and remain in the safety shower for at least 15 minutes. Contact Campus Safety and seek medical attention.

EHS posts appropriate signage indicating the presence of an eyewash and/or safety shower at each emergency station and performs periodic flushing of all eyewash stations. During a flush test, EHS visually inspects the unit and flushes for 3 minutes to remove any possible build-up. Facilities tests all eyewash and safety shower equipment biannually.

Fire Extinguishers

Fire extinguishers should only be used by trained personnel and should only be removed or discharged in an emergency situation. There are five classes of fire extinguishers. All fire extinguishers are labeled with standard symbols, letters, or both for the classes of fire they can put out:

- Class A extinguishers are designed for use on fires involving ordinary combustibles, such as wood and paper. The numerical rating for this class of fire extinguisher refers to the amount of water the fire extinguisher holds and the amount of fire it will extinguish.
- Class B extinguishers are designed to be used on fires involving flammable liquids, such as grease, gasoline, oil, etc. The numerical rating for this class of fire extinguisher states the approximate number of square feet of a flammable liquid fire that a non-expert person can expect to extinguish.
- Class C extinguishers are designed for use on electrically energized fires. This class of fire extinguishers does not have a numerical rating. The presence of the letter “C” indicates that the extinguishing agent is non-conductive.
- Class D extinguishers are designed for use on flammable metals and are often specific for the type of metal in question. There is no picture designator for Class D extinguishers. These extinguishers generally have no rating nor are they given a multi-purpose rating for use on other types of fires.
- Class K extinguishers are designed for use on kitchen fires caused by cooking media such as fats, greases, and oils.

Multi-purpose fire extinguishers labeled “ABC” may be used on all three classes of fire. Extinguishers labeled “For Class A Fires Only” contain water and are unsuitable for use on grease or electrical fires. A red slash through any symbols

indicates the extinguisher cannot be used on that class of fire. A missing symbol indicates the extinguisher has not been tested for that class of fire. Use of the wrong type of extinguisher can make the fire worse and endanger others.

Fire Extinguisher Operations:

- To operate a fire extinguisher, remember the word P.A.S.S.:
  - Pull the pin. Hold the extinguisher with the nozzle pointing away from you, and release the locking mechanism
  - Aim low. Point the extinguisher at the base of the fire
  - Squeeze the lever slowly and evenly
  - Sweep the nozzle from side-to-side
- Fire extinguishers are located in all university buildings. Fire extinguisher types in university buildings are based on a hazard evaluation specific to the space/area.
- Read the instructions that come with the fire extinguisher and become familiar with its parts and operation before use.
- Contact EHS to request fire extinguisher training.
- Fire extinguishers are installed close to exits. Keep your back to a clear exit when you use the device so you can make an easy escape if the fire cannot be controlled. If the room fills with smoke, leave immediately.
- Fire extinguishers are one element of a fire response plan, but the primary element is safe escape. Establish an emergency egress plan prior to use of any university building or residence. Employ the emergency egress plan if the fire cannot be readily extinguished with a fire extinguisher.

Training

Colgate University employees who work with hazardous chemicals, biologicals, and/or radiological materials require initial and periodic training appropriate to their level of responsibility. Faculty and staff must receive laboratory safety training prior to working with hazardous chemicals, biologicals, and/or radiological materials, and on an annual basis. In addition, general hazard communication information is presented to new employees who attend periodic new hire orientation sessions.

All students enrolled in a laboratory course or working in a laboratory setting are required to attend a Laboratory Safety and Hazardous Waste Management training session on an annual basis. These training sessions are conducted by EHS at the beginning of each semester, and before summer research. Training covers the contents of the CHP and is divided into four sections: General Laboratory Safety, Hazard Communication, Emergency Procedures, and Hazardous Waste Management. Students must sign a Laboratory Safety Agreement at the training session.

Special training is also provided by EHS upon request. Hazard-specific training is required if faculty, staff, or students will be working with bloodborne pathogens, controlled substances, biological materials, radioactive materials, and/or infectious substances. Reference materials pertaining to topics such as chemical hygiene, laboratory safety, occupational health and safety, and hazardous waste management are available on the EHS website.

Hazardous Waste Management

EHS coordinates all facets of laboratory waste management in accordance with state and federal regulations. Hazardous materials generated in laboratories, art studios, workshops, and other locations on campus are collected, labeled, and stored according to specific procedures detailed in this section and in the Waste Management and Disposal Guide. Hazardous materials are picked up by EHS and shipped off-campus by licensed disposal service providers. EHS is responsible for cradle-to-grave documentation of disposal activities.

Generators are required to coordinate management of all hazardous waste at Colgate University with EHS. Hazardous waste is defined as waste that has certain hazardous characteristics, or waste that appears as a listed waste in federal regulations. Some wastes that are not regulated could cause significant harm to people or the environment if disposed of improperly. Unless EHS has been consulted regarding disposal, all wastes will be collected and handled as if they are hazardous.

Satellite Accumulation Areas

Satellite Accumulation Areas (SAAs) are designated areas for hazardous waste storage within a laboratory or workspace and are labeled with yellow signage and demarcated by yellow/black striped tape. Each lab generating waste must have its own SAA. Hazardous waste must be stored within the SAA demarcation lines. All SAAs at Colgate University must be set up and approved by EHS. Contact EHS for SAA setup or relocation.

EHS supplies hazardous waste labels to each laboratory. Hazardous waste containers must be properly labeled with the words “Hazardous Waste” and a description of their contents. Labels must be written legibly, accurately listing all chemicals, using only complete chemical names, with no abbreviations or formulas (i.e. write the words “sulfuric acid” instead of “H_2SO_4”).

Hazardous waste containers must be compatible with the wastes that they are storing and their size should match the rate of waste accumulation. Containers must always be closed with a properly fitting lid when waste is not actively being added. Hazardous waste containers must be stored in the designated SAA, and must not be filled beyond 80% capacity.

Incompatible wastes must not be placed in the same waste container or secondary containment bin. For a list of general compatibility guidelines, see Appendix D: General Chemical Compatibility Guidelines. Consult the chemical’s MSDS for specific guidelines on compatibility. Questions regarding chemical compatibility should be directed to EHS before adding waste to a container.

Secondary containment trays are used to keep any spillage confined to a small area. All hazardous wastes must be stored in secondary containment. Incompatible wastes must not be stored in the same secondary containment tray.

Full hazardous waste containers will be picked up by EHS for disposal once per week, unless more frequent pick-ups have been arranged. If a waste bottle is not full but is ready for disposal, a note should be left for EHS to collect the waste container at the next weekly pick-up. Upon collection, EHS will replace hazardous waste containers with empty containers of similar size, quantity and material unless a different container type is requested.

Laboratory Glass and Plastics

All laboratory glass and plastic waste shall be placed in the appropriately marked waste containers for collection by EHS. Biologically contaminated glass and plastics must first be autoclaved. Glass waste containers are not to be used for needles and other sharps, or for radioactive materials. Any container placed in the glass waste containers should be empty, with no free liquids present. Chemically contaminated plastics will also be collected and disposed of through EHS.

Biological / Medical Waste

Biological / medical waste is defined as waste that is composed or contaminated with biological materials. Examples of biological wastes include cell cultures, animal tissues, any item containing infectious agents or recombinant DNA; or human tissues, bloods, or fluids.

Liquid biological waste is to be decontaminated (bacterial cultures, blood, animal fluids, etc.) by autoclaving, if appropriate. Decontaminated culture media, containing no chemicals or drugs, may be discarded into a sink drain. Contact EHS for a container to collect blood or other biological liquids. Biological waste that has been mixed with chemical waste must be managed as hazardous waste. The hazardous waste label must include a list of biological components in addition to the chemical components.

Solid biological waste (such as contaminated paper, plastic pipettes, and tips) should be placed in clear autoclave bags and promptly autoclaved. After autoclaving, the waste bags can be collected with non-hazardous solid wastes in the trash. Please contact EHS for assistance with any items that are too large to autoclave.

Animal carcasses (non-infectious tissues and associated non-sharps solid waste) are collected in red biohazard bags and sealed. Biohazard bags must be labeled with the words “For EHS Disposal” and placed in the Olin Hall room 226 freezer.

Needles, razors, and other sharps are collected in red puncture-proof sharps containers. Items must never be removed from these bins once they have been

placed inside. Full containers shall be dropped off in the biological waste room, which is located in the McGregory Hall loading dock Bunker #3. Upon drop off, the necessary information must be recorded on the Biological Waste Log. New sharps containers can also be picked up at that location.

Radioactive Wastes

Radioactive wastes have strict regulatory requirements that must be determined and met depending on the substance being used. EHS and the Radiation Safety Officer (RSO) must be notified prior to the production of any radioactive waste. Radioactive waste management at the laboratory level will be determined in a pre-waste generation meeting.

Used Laboratory Gloves

Colgate University collects all disposable gloves used within chemical and biological laboratories as a precaution, including gloves that may not have come into contact with chemical or biological materials. Place all gloves in the step can collection containers that EHS has provided in each laboratory. Gloves are picked up weekly during hazardous waste collection.

Empty Chemical Containers

Empty stock bottles and chemical containers must be collected for proper disposal and for inventory purposes. Collection bins for empty chemical containers have been placed in each laboratory that has chemicals within the inventory management system. Empty chemical containers are to be left in the blue bins marked “Empty Chemical Containers Only.” Do not throw empty chemical containers into the garbage or reuse them for waste collection.

Universal Waste Management

Universal waste can be defined as common items containing hazardous components that are subject to streamlined requirements for collection, storage, and processing.

Batteries

Batteries contain hazardous components that must not be disposed of in the regular trash. In non-residential areas on campus, EHS facilitates the battery collection program for the university. Battery collection stations have been set up around campus. A map of stations can be found on the EHS website. Any batteries put into the collection stations must have both terminals covered with non-conductive tape. Further instructions can be found on the label of each collection bin. Contact EHS for waste battery pickup when the containers are full.

The following battery types are accepted at battery collection stations:

- Alkaline and Non-alkaline household type batteries (AA, AAA, C, D, 9 volt)

- Rechargeable batteries such as nickel-cadmium type
- "Button" batteries found in watches, calculators, pagers, cameras

Do not place the following in battery collection stations:
- Batteries containing liquids, such as car batteries
- Large batteries such as power packs and computer batteries
- Other batteries not listed above

Fluorescent Lamps and Bulbs

Most used fluorescent lamps are classified as universal waste. The inside of a fluorescent tube is coated with chemicals and the tube contains a small amount of mercury vapor. Fluorescent lamps cannot be placed in the regular trash. Contact Facilities for lamp disposal and replacement.

Mercury Containing Equipment

To reduce the amount of mercury on campus, thermostats and other equipment containing mercury must be replaced with electronic devices or equipment that uses non-hazardous fluids. When applicable, mercury containing equipment waste can be placed in the SAA for collection. Contact EHS to schedule a pick-up if there is no SAA in the location where the mercury containing equipment is no longer needed. After collection, EHS will determine whether or not the equipment should be designated as universal or hazardous waste.

Pesticides

Contact EHS for disposal of waste pesticides, including unused materials or pesticides that have had their EPA registration cancelled.

Accidents, Chemical Spills, and Emergency Procedures

The HAZMAT Contingency Plan provides a written plan of action in the event of a fire, explosion, or unplanned release of hazardous materials or hazardous waste which could pose a threat to human health and/or the environment. Other documents, including Colgate University's Spill Prevention Control and Countermeasures (SPCC) Plan and Emergency Response Plan (ERP), may be used as additional resources during an incident involving hazardous materials or hazardous waste.

An incidental spill is defined by OSHA as a spill in which the substance can be absorbed, neutralized, or otherwise controlled at the time of release by employees in the immediate release area, or by maintenance personnel where there is no potential safety or health hazard (i.e. fire, explosion, or chemical exposure). It is a release of a hazardous substance which does not pose a significant safety or health hazard to employees in the immediate vicinity or to the worker cleaning it up, nor does it have the potential to become an emergency within a short time frame. An incidental spill may be safely cleaned up by employees who are familiar with the hazards of the chemicals with which they are working.

An incidental spill is able to be managed by laboratory personnel with limited experience and limited response equipment. Examples include small spills of salt and buffer solutions (potassium chloride, sodium acetate), latex paints, or culture media (agar). While these chemicals are relatively benign, it is imperative that they be cleaned up properly for both safety and compliance reasons.

For categorization as an incidental spill, all of the following criteria must be met:

- Less than or equal to one gallon of spilled material
- Not acutely toxic and not releasing toxic gas
- Did not cause a fire/explosion; not a fire/explosion hazard; not releasing flammable/ explosive vapors
- Inside a building, away from floor drains, doors, etc.

Incidental Spill Procedures

- Clear area of other personnel and students.
- Don appropriate PPE (eyewear and hand protection at a minimum).
- Use supplies from spill kits to contain and absorb spilled material.
- Visually inspect area to ensure that all spilled materials have been cleaned.
- Bag all debris, label with proper hazardous waste label, and place in SAA or contact EHS if there is no SAA.
- Notify EHS of the incidental spill and provide the following information: your name, the building and room number where the spill took place, the chemical name(s) and quantity of material spilled, which spill kits were utilized, where

the spill debris is located, and a phone number and email address where you can be reached.

Universal Emergency Response Procedures

In the event of an emergency, emergency contact numbers are located on each laboratory exit door (Appendix E).

- Evacuate: Pull fire alarm and verbally alert others. Without endangering yourself, help injured leave the area.
- Confine: Close doors and fume hood sashes as you leave.
- Report: From a safe place, call Campus Safety (911) or 315-228-7911 from a cellphone. Give your name, location, and the phone number you are calling from. Describe the incident, especially what chemicals were involved.
- Secure: Prevent student and personnel re-entry to affected area prior to Campus Safety taking over the scene

Assigned Evacuation Site/Meeting Areas

Evacuate the building if necessary and move to the assigned assembly point for accountability. The assembly points for the following buildings are:

Building	Primary Location	Secondary Location
Ho Science Center	Olin Hall Room 300	Student Union Second Floor
McGregory Hall	ALANA Cultural Center	Student Union
Olin Hall	ALANA Cultural Center	Student Union
Ryan Studio & Little Hall	Sanford Field House	Olin Hall Room 300
Wynn Hall	Olin Hall Room 300	Student Union Second Floor

Accident Reporting

Work-related accidents, injuries, and illnesses should be reported as soon as possible. Upon receipt, EHS will investigate the incident within 24 hours to ensure that no unsafe conditions exist and, when necessary, implement corrective actions. Employees are required to fill out an employee incident report and submit it to the Office of Human Resources. Similarly, students are required to fill out a student accident / injury report and submit it to EHS.

Medical Consultations

If an employee or other laboratory worker is exposed to an OSHA regulated substance, they shall obtain medical consultation and examination, under the following conditions:

- If the individual experiences signs or symptoms associated with a hazardous chemical to which he or she may have been exposed in the laboratory or workplace
- If exposure monitoring reveals an exposure level routinely above the OSHA Action Level (AL), Permissible Exposure Limit (PEL) or Short-term Exposure Limit (STEL).

- Whenever a spill, leak, or other incident results in the likelihood of a hazardous exposure to an employee or other laboratory worker.

All employees who work with hazardous chemicals must be given the opportunity to receive medical attention, including any follow-up examinations that the examining licensed physician decides are necessary. Employees will receive any medical examinations and consultations without cost or loss of pay and at a reasonable time and place. Certain information must be provided to the physician, including the identity of the hazardous chemicals, a description of the conditions under which the exposure occurred, and a description of the signs and symptoms of exposure that the employee is experiencing.

Definitions

Action level – a concentration designated in 29 CFR 1910 for a specific substance, calculated as an 8-hour time-weighted average (TWA) that initiates certain required activities, such as exposure monitoring and medical surveillance.

Carcinogen – a substance or agent capable of causing or producing cancer in humans.

CAS # – Chemical Abstracts Service's (a division of the American Chemical Society) unique registry number for a chemical.

Chemical Hygiene Officer (CHO) – is an employee who is designated by the employer, and who is qualified by training or experience, to provide technical guidance in the development and implementation of the provisions of the Chemical Hygiene Plan.

Chemical Hygiene Plan (CHP) – a written program developed and implemented by the employer which sets forth procedures, equipment, personal protective equipment, and work practices that are capable of protecting the health and safety of employees as required under 29 CFR 1910.1450.

Combustible liquid – a liquid having a flashpoint at or above 100°F but below 200°F.

Compressed gas – a gas or mixture of gasses having an absolute pressure above 40 psi at 70°F in a container.

Emergency – any occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment which results in an uncontrolled release of a hazardous chemical into the workplace.

Employee – an individual employed in a laboratory workplace who may be exposed to hazardous chemicals in the course of his or her assignments.

Flammable

Flashpoint – the minimum temperature at which a liquid gives off vapor in a container in sufficient concentration to form an ignitable mixture in air near the surface of the liquid.

Hazardous chemical – any chemical which is classified as health hazard or simple asphyxiant in accordance with the Hazard Communication Standard (29 CFR 1910.1200).

LC_{50} – The concentration of a chemical in a test atmosphere that kills half the population of test animals within one hour when inhaled.

LD_{50} – A standard measurement of acute toxicity that is stated in milligrams (mg) per kilogram (kg) of body weight. An LD_{50} represents the individual dose required to kill 50 percent of a population of test animals (e.g., rats, fish, mice, cockroaches).

Laboratory – a facility where the laboratory use of hazardous chemical occurs. It is a workplace where relatively small quantities of hazardous chemicals are used on a non-production basis.

Laboratory scale – work with substances in which the containers used for reactions, transfers, and other handling of substances are designed to be easily

and safety manipulated by one person. Laboratory scale excludes those workplaces whose function is to produce commercial quantities of materials.

Laboratory-type hood / fume hood – a device located in a laboratory, enclosure on five sides with a moveable sash or fixed partial enclosed on the remaining side; constructed and maintained to draw air from the laboratory and to prevent or minimize the escape of air contaminants into the laboratory; and allows chemical manipulations to be conducted in the enclosure without insertion of any portion of the employee's body other than hands and arms. Walk-in hoods with adjustable sashes meet the above definition provided that the sashes are adjusted during use so that the airflow and the exhaust of air contaminants are not compromised and employees do not work inside the enclosure during the release of airborne hazardous chemicals.

Laboratory use of hazardous chemicals – the handling or use of such chemicals in which chemical manipulations are carried out on a "laboratory scale," multiple chemical procedures or chemicals are used, procedures involved are not part of a production process, and "protective laboratory practices and equipment" are available and in common use.

Mutagen – a chemical that causes permanent changes in the amount or structure of the genetic material in a cell.

Permissible Exposure Limit (PEL) – a legally enforceable occupational exposure limit established by OSHA, usually measured as an eight-hour time-weighted average, but also may be expressed as a ceiling concentration exposure limit.

Protective laboratory practices and equipment – laboratory procedures, practices, and equipment accepted by laboratory health and safety experts as effective, or that the employer can show to be effected, in minimizing the potential for employee exposure to hazardous chemicals.

Short-Term Exposure Limit (STEL) – a maximum concentration for a continuous 15-minute exposure period published by the American Conference of Governmental Industrial Hygienists (ACGIH).

Teratogen – a substance that can cause malformations or alterations in the appearance or function of a developing embryo.

Appendix A: Example Laboratory Hazard Assessment

CAUTION

AUTHORIZED PERSONNEL ONLY

This room contains hazardous materials

In case of emergency
DIAL 911

From cell phones: **315-228-7911**

RESPONSIBLE PERSON:	Daniel Gough / Mary Williams
EMERGENCY CONTACT:	Daniel Gough / Mary Williams
TELEPHONE:	315-825-8550 / 315-525-6598
LOCATION:	Ho Science Center – B08

Annex I – Selection Chart

The Selection Chart is intended to aid in identifying and selecting the types of eye and face protectors that are available, their capabilities and limitation for the hazard "source" operations listed. This guide is not intended to be the sole reference in selecting the proper eye and face protector.

Selection Chart

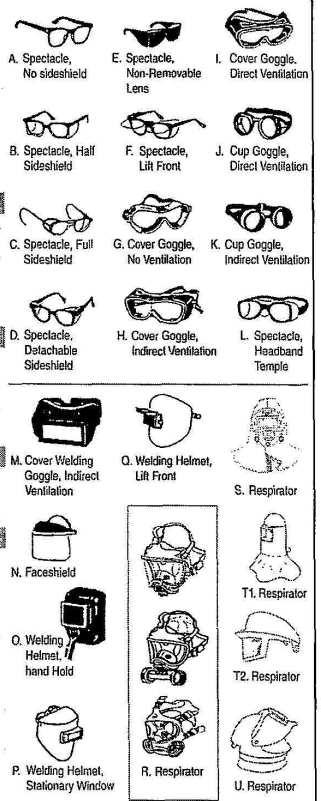
Care shall be taken to recognize the possibility of multiple and simultaneous exposure to a variety of hazards. Adequate protection against the highest level of the hazards must be provided.

The illustrations shown are only representative of protective devices commonly available at this time. Protective devices do not need to take the forms shown, but must meet the requirements of the standard.

Protective Devices

Activity and Assessment	Protector Category and Styles	Limitations	Not Recommended
IMPACT			
Chipping, grinding, machining, masonry work, riveting, and sanding. Flying fragments, objects. large chips. particles, sand, dirt, etc.	Spectacles. goggles: B, C, D, E, F, G, H, I, J, K, L. For severe exposure add N. Respirators, R,T. Faceshields shall only be worn over spectacles or goggles. Persons whose vision requires the use of prescription (Rx) lenses shall wear either protective devices fitted with prescription (Rx) lenses or protective devices designed to be worn over regular prescription (Rx) eyewear. Wearers of contact lenses shall also be required to wear appropriate spectacles or goggles depending on the specific hazard. Dusty and/or chemical environments may represent an additional hazard to contact lens wearers. Wearing of contact lenses under an R respirator is permitted. Goggles, helmets and faceshield windows that bear the marking "Z87+" comply with the High Impact Test Requirements. Those with "Z87" markings comply only with Basic Impact Testing Requirements. Spectacle lenses that are marked with the manufacturers logo and a "+" sign comply with the High Impact Test Requirements. Those spectacle lenses marked with the manufacturers logo and no "+" comply only with Basic Impact Testing Requirements. (It is important during the selection process to remember that different product categories are tested at different levels of impact resistance. Goggles are tested at a higher level of impact than spectacles and face shields are tested at a higher level than goggles.) The Z87-2 frame marking indicates the frame meets high impact requirements with a minimum lens thickness of 2mm.	Protective devices do not provide unlimited protection. **Note:** Caution should be exercised in the use of metal frame protective devices in electrical hazard areas. Metal frame protective devices could potentially cause electrical shock and electrical burns through contact with, or thermal burns from exposure to the hazards of electrical energy, which include radiation from accidental arcs. Atmospheric conditions and the restricted ventilation of the protector can cause lenses to fog. Frequent cleaning may be required.	Protectors that do not provide protection from side exposure. Filter or tinted lenses that restrict light transmittance, unless it is determined that a glare hazard exists. Refer to OPTICAL RADIATION. Use of faceshields alone, without spectacles or goggles.
HEAT			
Furnace operations, pouring, casting, hot dipping, gas cutting, and welding. Hot sparks Splash from molten metals High temperature exposure	**Note:** Operations involving heat may also involve optical radiation. (See electric arc, gas. and glare under Optical Radiation below.) Protection from both hazards shall be provided. Faceshields shall only be worn over spectacles or goggles. Goggles, spectacles: B, C, D, E, F, G, H, I, J, K, L. For severe exposure add N. Respirators R, T. Faceshields worn over goggles H,K. Respirators R, T or S, U if optical radiation hazard exists. Screen faceshields, Reflective faceshields over spectacles or goggles.	Spectacles, cup and cover type goggles do not provide unlimited facial protection. Operations involving heat may also involve optical radiation. Protection from both hazards shall be provided.	Protectors that do not provide protection from side exposure. Use of faceshields alone, without spectacles or goggles.
CHEMICAL			
Acid and chemicals handling, degreasing, plating. Splash and irritating mists.	Indirect vented: goggles, eyecup and cover types: G, H, K. For severe exposure, add N. Respirators R, T. Irritating Mist: Special purpose goggles: G. Cover goggle – No ventilation. Respirators R, T.	Provides protection from splash entry with adequate ventilation. Atmospheric conditions and the restricted ventilation of the protector can cause lenses to fog. Frequent cleaning may be required.	Spectacles, welding, helmets, or handshields
DUST			
Woodworking, buffing, general dusty conditions. Nuisance dust.	Goggles, eyecup and cover types: G, H, K, Respirators R, T.	Atmospheric conditions and the restricted ventilation of the protector can cause lenses to fog. Frequent cleaning may be required.	
OPTICAL RADIATION			
WELDING: Electric Arc Viewing electric arc furnaces and boilers	**Note:** Welding helmets or handshields shall be used only over spectacles or goggles. TYPICAL FILTER LENS SHADE: 10-14 PROTECTORS: Welding helmets or Welding Shields: O, P, Q. Respirators S, U	Protection from optical radiation is directly related to filter lens density. Select the darkest shade that allows adequate task performance. **Note:** Filter lenses shall meet the requirements for shade designations in Table 1.	Protectors that do not provide protection from optical radiation. **Note:** Filter lenses shall meet the requirements for shade designations in Table 1.
WELDING: Gas, and viewing gas-fired furnaces and boilers CUTTING TORCH BRAZING TORCH SOLDERING	TYPICAL FILTER LENS SHADE: 4-8. PROTECTORS: Welding goggles, Helmets. Welding Face sheilds over spectacles or goggles: J, K, L, M, N, P, P, Q or Respirators, S,U. TYPICAL FILTER LENS SHADE: 3-6. PROTECTORS: Welding goggles, Helmets. Welding face shields: J. K. L, M, N, O, P, Q, or Respirators S,U. TYPICAL FILTER LENS SHADE: 3-4. PROTECTORS: Welding goggles, Helmets. Welding face shields: J, K, L, M, N, O, P, Q, or Respirators, S,U. TYPICAL FILTER LENS SHADE: 1.5-3. PROTECTORS: Spectacles or Welding Faceshield over spectacles: B, C, D, E, F, N. or Respirators, S,U.	**Note:** Faceshields and welding helmets shall only be worn over spectacles or goggles.	Use of welding helmets or faceshields alone, without spectacles or goggles.
GLARE	Spectacle: A, B, Faceshields N over spectacles or goggles.	Shaded or Special Purpose lenses, as suitable. **Note:** Refer to Section 6.2.4.1 Special Purpose Lenses.	

Protective Devices



Appendix C: General Chemical Resistance Chart for Gloves

8th EDITION Permeation/Degradation Resistance Guide for Ansell Gloves

The first square in each column for each glove type is color coded to provide an overall rating for both Degradation and Permeation. The letter in each colored square is for Degradation alone.

- GREEN: The glove is very well suited for application with that chemical.
- YELLOW: The glove is suitable for that application under careful control of its use.
- RED: Avoid use of the glove with this chemical.

SPECIAL NOTE: The chemicals in this guide highlighted in BLUE ☐ are experimental carcinogens, according to the ninth edition of *Sax' Dangerous Properties of Industrial Materials*. Chemicals highlighted in GRAY ☐ are listed as suspected carcinogens, experimental carcinogens at extremely high dosages, and other materials which pose a lesser risk of cancer.

CHEMICAL	LAMINATE FILM BARRIER™ Degradation Rating	LAMINATE FILM BARRIER™ Permeation: Breakthrough	LAMINATE FILM BARRIER™ Permeation: Rate	NITRILE SOL-VEX® Degradation Rating	NITRILE SOL-VEX® Permeation: Breakthrough	NITRILE SOL-VEX® Permeation: Rate	UNSUPPORTED NEOPRENE 29-SERIES Degradation Rating	UNSUPPORTED NEOPRENE 29-SERIES Permeation: Breakthrough	UNSUPPORTED NEOPRENE 29-SERIES Permeation: Rate	SUPPORTED POLYVINYL ALCOHOL PVA™ Degradation Rating	SUPPORTED POLYVINYL ALCOHOL PVA™ Permeation: Breakthrough	SUPPORTED POLYVINYL ALCOHOL PVA™ Permeation: Rate	POLYVINYL CHLORIDE (Vinyl) SNORKEL® Degradation Rating	POLYVINYL CHLORIDE (Vinyl) SNORKEL® Permeation: Breakthrough	POLYVINYL CHLORIDE (Vinyl) SNORKEL® Permeation: Rate	NATURAL RUBBER *CANNERS AND HANDLERS™ Degradation Rating	NATURAL RUBBER *CANNERS AND HANDLERS™ Permeation: Breakthrough	NATURAL RUBBER *CANNERS AND HANDLERS™ Permeation: Rate	NEOPRENE/ NATURAL RUBBER BLEND *CHEMI-PRO® Degradation Rating	NEOPRENE/ NATURAL RUBBER BLEND *CHEMI-PRO® Permeation: Breakthrough	NEOPRENE/ NATURAL RUBBER BLEND *CHEMI-PRO® Permeation: Rate	BUTYL UNSUPPORTED CHEMTEK™ BUTYL Degradation Rating	BUTYL UNSUPPORTED CHEMTEK™ BUTYL Permeation: Breakthrough	BUTYL UNSUPPORTED CHEMTEK™ BUTYL Permeation: Rate	VITON/BUTYL UNSUPPORTED CHEMTEK™ VITON/BUTYL Degradation Rating	VITON/BUTYL UNSUPPORTED CHEMTEK™ VITON/BUTYL Permeation: Breakthrough	VITON/BUTYL UNSUPPORTED CHEMTEK™ VITON/BUTYL Permeation: Rate
1. Acetaldehyde	■	380	E	P	—	—	E	10	F	NR	—	—	NR	—	—	E	13	F	E	10	F	—	—	—	—	—	—
2. Acetic Acid, Glacial, 99.7%	■	150	—	G	158	—	E	390	—	NR	—	—	F	45	G	E	110	—	E	263	—	E	>480	—	DD	>480	—
3. Acetone	▲	>480	E	NR	—	—	G	10	F	P	143	G	NR	<5	—	E	10	F	G	12	G	E	>480	E	DD	93	VG
4. Acetonitrile	▲	>480	E	F	30	F	E	20	VG	■	150	G	NR	—	—	E	4	VG	E	13	VG	E	>480	E	DD	70	E
5. Acrylic Acid	—	—	—	G	120	—	E	395	—	NR	—	—	NR	—	—	E	80	—	E	67	—	—	—	—	—	—	—
6. Acrylonitrile	▲	>480	E	—	—	—	—	—	—	▲	>480	—	—	—	—	E	5	F	E	—	—	E	>480	—	E	>480	—
7. Allyl Alcohol	▲	>480	E	F	140	F	E	140	VG	P	—	—	P	60	G	E	10	VG	E	20	VG	E	>480	—	E	>180	—
8. Ammonia Gas	■	19	E	▲	>480	E	▲	>480	—	NR	—	—	—	—	—	■	27	E	—	—	—	—	—	—	—	—	—
9. Ammonium Fluoride, 40%	▲	>480	E	E	>360	—	E	>480	—	NR	—	—	E	>360	—	E	>360	—	—	—	—	—	—	—	—	—	—
10. Ammonium Hydroxide, Conc. (28-30% Ammonia)	E	30	—	E	>360	—	E	250	—	NR	—	—	E	240	—	E	90	—	E	247	—	E	>480	—	E	>480	—
11. n-Amyl Acetate	▲	470	E	E	198	G	NR	—	—	G	>360	E	P	—	—	NR	—	—	P	—	—	E	128	G	F	<10	F
12. Amyl Alcohol	▲	>480	E	E	>480	E	E	348	VG	G	180	G	G	12	E	E	25	VG	E	52	VG	E	>480	E	E	>480	E
13. Aniline	▲	>480	E	NR	—	—	E	145	F	F	>360	E	F	62	G	E	25	VG	NR	—	—	E	>480	G	E	>480	E
14. Aqua Regia	—	—	—	F	>360	—	G	>480	—	NR	—	—	G	120	—	NR	—	—	G	193	—	E	>480	—	E	>480	E
15. Benzaldehyde	▲	>480	E	NR	—	—	NR	—	—	G	>360	E	NR	—	—	G	10	VG	G	27	F	E	>480	E	E	>480	E
16. Benzene (Benzol)	▲	>480	E	P	—	—	NR	—	—	E	>360	E	NR	—	—	NR	—	—	NR	—	—	E	20	F	E	253	VG
17. Benzotrichloride	▲	>480	E	E	>480	E	NR	—	—	—	—	—	G	—	—	NR	—	—	NR	—	—	—	—	—	—	—	—
18. Benzotrifluoride	▲	>480	E	E	170	G	—	—	—	—	—	—	G	<10	F	P	50	G	P	—	—	—	—	—	—	—	—
19. Bromine Water	—	—	—	E	>480	E	E	>480	E	NR	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
20. 1-Bromopropane (Propyl Bromide)	▲	>480	E	▼	23	F	▼	<10	P	▲	>480	E	▼	<10	F	▼	<10	P	▼	<10	P	▼	10	P	■	182	VG
21. 2-Bromopropionic Acid	▲	>480	—	F	120	—	E	460	—	—	—	—	G	180	—	E	190	—	G	190	—	—	—	—	—	—	—
22. n-Butyl Acetate	▲	>480	E	F	75	F	NR	—	—	G	>360	E	NR	—	—	NR	—	—	P	—	—	E	80	G	DD	<10	F
23. n-Butyl Alcohol	▲	>480	E	E	>360	E	E	270	E	F	75	G	G	180	VG	E	35	VG	E	75	VG	E	>480	E	E	>480	E
24. Butyl Carbitol	—	—	—	E	>323	E	G	188	F	E	>480	E	E	397	VG	E	44	G	E	148	G	—	—	—	—	—	—
25. Butyl Cellosolve	▲	>480	E	E	470	VG	E	180	G	■	120	G	P	60	G	E	45	G	E	48	G	E	>480	—	E	>480	—
26. gamma-Butyrolactone	▲	>480	E	NR	—	—	E	245	G	E	120	VG	NR	—	—	E	60	G	E	104	F	E	>480	E	E	>480	E
27. Carbon Disulfide	▲	>480	E	G	30	F	NR	—	—	E	>360	E	NR	<5	—	NR	—	—	NR	—	—	▼	7	G	■	138	E
28. Carbon Tetrachloride	—	—	—	G	150	G	NR	—	—	E	>360	E	F	25	F	NR	—	—	NR	—	—	F	53	P	—	—	—
29. Cellosolve® (Ethyl Glycol Ether, 2-Ethoxyethanol)	E	>480	E	G	293	G	E	128	G	■	75	G	P	38	G	E	25	VG	E	25	VG	E	>480	E	E	465	E
30. Cellosolve Acetate® (2-Ethoxyethyl Acetate, EGEAA)	▲	>480	E	F	90	G	G	40	F	■	>360	E	NR	—	—	E	10	G	E	23	G	E	>480	E	DD	105	VG

CHEMICAL	BARRIER			SOL-VEX			29-SERIES			PVA			SNORKEL			CANNERS AND HANDLERS*			CHEMI-PRO®			CHEMTEK BUTYL			CHEMTEK VITON/BUTYL		
31. Chlorine Gas	▲	>480	E	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
32. Chlorobenzene	▲	>480	E	NR	—	—	NR	—	—	E	>360	E	NR	—	—	NR	—	—	NR	—	—	P	9	P	F	>480	E
33. 4-Chlorobenzotrifluoride	—	—	—	E	320	VG	F	50	F	F	—	—	F	—	—	P	—	—	P	—	—	■	75	F	■	48	F
34. 2-Chlorobenzyl Chloride	E	120	E	—	—	—	F	200	E	E	>480	E	F	65	E	F	20	F	—	—	—	E	>480	E	E	>480	E
35. Chloroform	E	20	G	NR	—	—	NR	—	—	E	>360	E	NR	—	—	NR	—	—	NR	—	—	P	5	P	■	212	VG
36. 1-Chloronaphthalene	▲	>480	E	P	—	—	NR	—	—	G	>360	E	NR	—	—	NR	—	—	P	—	—	E	>480	E	E	>480	E
37. 2-Chlorotoluene	▲	>480	E	G	120	G	NR	—	—	—	—	—	—	—	—	NR	—	—	NR	—	—	NR	—	—	—	—	—
38. 4-Chlorotoluene	▲	>480	E	P	—	—	NR	—	—	—	—	—	P	—	—	NR	—	—	NR	—	—	▼	30	F	▲	>480	E
39. "Chromic Acid" Cleaning Solution	—	—	—	F	240	—	NR	—	—	NR	—	—	G	>360	—	NR	—	—	NR	—	—	E	>480	—	E	>480	—
40. Citric Acid, 10%	—	—	—	E	>360	—	E	>480	—	F	50	—	E	>360	E	E	>360	—	E	>480	—	—	—	—	—	—	—
41. Cyclohexane	—	—	—	▲	>360	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	G	30	F	▲	>480	—
42. Cyclohexanol	▲	>480	E	E	>360	E	E	390	VG	G	>360	E	E	360	E	E	103	VG	E	47	G	E	>480	E	▲	>480	E
43. Cyclohexanone	▲	>480	E	F	103	G	P	23	F	E	>480	E	NR	—	—	P	—	—	P	—	—	E	>480	—	▼	150	—
44. 1,5-Cyclooctadiene	▲	>480	E	E	>480	E	NR	—	—	—	—	—	NR	—	—	NR	—	—	NR	—	—	P	—	—	—	—	—
45. Diacetone Alcohol	▲	>480	E	G	240	E	E	208	VG	■	150	G	NR	—	—	E	43	VG	E	60	VG	E	>480	—	DD	—	—
46. Dibutyl Phthalate	—	—	—	G	>360	E	F	132	G	E	>360	E	NR	—	—	E	20	—	G	>480	E	—	—	—	—	—	—
47. 1,2-Dichloroethane (Ethylene Dichloride, EDC)	▲	>480	E	NR	—	—	NR	—	—	E	>360	E	NR	—	—	P	—	—	P	—	—	—	—	—	—	—	—
48. Diethylamine	▲	>480	E	F	51	F	P	—	—	NR	—	—	NR	—	—	NR	—	—	NR	—	—	F	18	—	▼	19	—
49. Diisobutyl Ketone (DIBK)	▲	>480	E	E	263	G	P	—	—	G	>360	E	P	—	—	P	—	—	P	—	—	E	231	G	DD	15	G
50. Dimethyl Sulfoxide (DMSO)	▲	>480	E	E	240	VG	E	398	G	NR	—	—	NR	—	—	E	180	E	E	150	E	E	>480	—	DD	>480	—
51. Dimethylacetamide (DMAC)	▲	>480	E	NR	—	—	NR	—	—	NR	—	—	NR	—	—	E	15	G	E	30	G	E	>480	—	DD	>480	—
52. Dimethylformamide (DMF)	▲	>480	E	NR	—	—	E	45	F	NR	—	—	NR	19	—	E	25	VG	E	40	G	E	>480	E	DD	>480	E
53. Dioctyl Phthalate (DOP, DEHP)	▲	>480	E	G	>360	E	G	>480	E	E	30	F	NR	—	—	P	—	—	E	>360	E	—	—	—	—	—	—
54. Di-n-Octyl Phthalate (DNOP)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	E	>480	—	—	—	—
55. 1,4-Dioxane	▲	>480	E	NR	—	—	NR	—	—	P	—	—	NR	—	—	F	5	F	F	18	F	E	>480	—	—	—	—
56. Electroless Copper Plating Solution	—	—	—	E	>360	—	E	>360	—	NR	—	—	E	>360	—	E	>360	—	—	—	—	—	—	—	—	—	—
57. Electroless Nickel Plating Solution	—	—	—	E	>360	—	E	>360	—	NR	—	—	E	>360	—	E	>360	—	—	—	—	—	—	—	—	—	—
58. Epichlorohydrin	▲	>480	E	NR	—	—	P	—	—	E	300	E	NR	—	—	E	5	F	E	17	VG	E	>480	—	—	—	—
59. Ethidium Bromide, 10%	▲	>480	E	▲	>480	E	—	—	—	NR	—	—	—	—	—	—	—	—	—	—	—	E	>480	—	E	>480	—
60. Ethyl Acetate	▲	>480	E	NR	—	—	F	10	P	F	>360	E	NR	—	—	G	5	F	F	10	F	E	196	G	DD	10	G
61. Ethyl Alcohol, Denatured, 92% Ethanol	▲	>480	E	E	240	VG	E	113	VG	NR	—	—	G	60	VG	E	15	VG	E	37	VG	E	>480	E	E	>480	E
62. Ethylene Glycol	▲	>480	E	E	>360	E	E	>480	E	F	120	VG	E	>360	E	E	>360	E	E	>480	E	—	—	—	—	—	—
63. Ethylene Oxide Gas	■	234	E	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
64. Ethyl Ether	▲	>480	E	E	95	G	F	<10	F	G	>360	E	NR	—	—	NR	—	—	NR	—	—	—	—	—	—	—	—
65. Ethyl L-Lactate	E	>480	E	E	273	G	E	125	VG	E	125	G	E	15	G	E	15	VG	E	28	VG	E	>480	E	E	>480	E
66. Formaldehyde, 37% in 1/3 Methanol/Water	▲	>480	E	E	>360	E	E	39	VG	P	—	—	E	100	E	E	10	G	E	32	E	E	>480	—	E	>480	—
67. Formic acid, 90%	▲	>480	—	F	240	—	E	>480	—	NR	—	—	E	>360	—	E	150	—	E	>360	—	E	>480	—	—	—	—
68. Furfural	▲	>480	E	NR	—	—	E	40	P	F	>360	E	NR	—	—	E	15	VG	E	43	VG	E	>480	—	G	>480	—
69. Freon TF	—	—	—	E	>360	E	E	240	E	G	>360	E	NR	—	—	NR	—	—	NR	—	—	—	—	—	—	—	—
70. Gasoline, Unleaded (Shell Premium winter blend)	▲	170	E	E	>480	E	NR	—	—	G	>360	E	P	—	—	NR	—	—	NR	—	—	F	20	F	E	>480	E
71. Glutaraldehyde, 25%	—	—	—	E	>360	E	E	>480	E	P	<10	F	E	>360	E	E	210	VG	—	—	—	—	—	—	—	—	—
72. HCFC-141B	▲	>480	E	E	92	F	F	33	F	P	—	—	NR	—	—	NR	—	—	NR	—	—	F	40	F	F	<10	F
73. n-Heptane	▲	>480	E	—	—	—	—	—	—	▲	>480	—	NR	—	—	—	—	—	—	—	—	P	10	F	E	>480	E
74. Hexamethyldisilazine	▲	>480	E	E	>360	—	E	42	—	G	>360	—	P	—	—	F	15	F	F	43	G	■	305	G	■	>480	G
75. n-Hexane	▲	>480	E	E	>480	E	E	48	G	G	>360	E	NR	—	—	NR	—	—	P	—	—	P	5	F	E	>480	E
76. HFE 7100	▲	>480	E	E	>480	E	E	>480	E	P	—	—	E	>480	E	E	120	E	—	—	—	—	—	—	—	—	—
77. HFE 71DE	■	164	E	F	10	F	F	<10	F	F	>480	E	NR	—	—	NR	—	—	—	—	—	—	—	—	—	—	—
78. Hydrazine, 65%	—	—	—	E	>480	—	E	386	—	NR	—	—	E	>360	—	E	150	VG	E	>360	—	E	>480	—	—	—	—
79. Hydrobromic Acid, 48%	▲	>480	—	E	>360	—	E	>480	—	NR	—	—	E	>360	—	E	>360	—	E	>360	—	—	—	—	—	—	—

80. Hydrochloric Acid, 10%	—	—	—	E	>360	—	E	>480	—	NR	—	—	E	>360	—	E	>360	—	E	>360	—	—	—	—	—	—	—	—
81. Hydrochloric Acid, 37% (Concentrated)	▲	>480	—	E	>480	—	E	>480	—	NR	—	—	E	300	—	E	290	—	E	>360	—	—	—	—	—	—	—	—
82. Hydrofluoric Acid, 48%	▲	>480	—	E	334	—	■	>480	—	NR	—	—	■	155	—	▲	>480	—	—	—	—	E	>480	—	▲	>480	—
83. Hydrofluoric Acid, 95%	▲	>480	E	—	—	—	■	342	VG	—	—	—	—	—	—	—	—	—	—	—	—	▲	>480	E	—	—	—
84. Hydrogen Fluoride Gas	▲	>480	E	■	<15	P	—	—	—	—	—	—	■	2	—	■	15	F	■	<15	F	—	—	—	—	—	—
85. Hydrogen Peroxide, 30%	—	—	—	E	>360	—	E	>480	—	NR	—	—	E	>360	—	E	>360	—	G	>360	—	—	—	—	▲	>480	—
86. Hydroquinone, saturated solution	—	—	—	E	>360	E	E	108	E	NR	—	—	E	>360	E	G	>360	E	E	>360	E	—	—	—	—	—	—
87. Hypophosphorus Acid, 50%	—	—	—	E	>480	—	E	>240	—	NR	—	—	E	—	—	E	>480	—	—	—	—	—	—	—	—	—	—
88. Isobutyl Alcohol	▲	>480	E	E	>360	E	E	478	E	P	—	—	F	10	VG	E	15	VG	E	52	E	E	>480	E	E	>480	E
89. Isooctane	▲	>480	E	E	>360	E	E	268	VG	E	>360	E	P	—	—	NR	—	—	P	—	—	■	58	F	▲	>480	E
90. Isopropyl Alcohol	▲	>480	E	E	>360	E	E	110	E	NR	—	—	G	150	E	E	35	VG	E	57	E	—	—	—	—	—	—
91. Kerosene	▲	>480	E	E	>360	E	E	185	G	G	>360	E	F	>360	E	NR	—	—	P	—	—	G	82	—	E	>480	—
92. Lactic Acid, 85%	▲	>480	—	E	>360	—	E	>480	—	F	>360	—	E	>360	—	E	>360	—	E	>360	—	—	—	—	—	—	—
93. Lauric Acid, 36% in Ethanol	—	—	—	E	>360	—	E	>480	—	NR	—	—	F	15	—	E	>360	—	E	>360	—	—	—	—	—	—	—
94. d-Limonene	▲	>480	E	E	>480	E	NR	—	—	G	>480	E	G	125	G	NR	—	—	NR	—	—	F	57	F	F	>480	E
95. Maleic Acid, saturated solution	—	—	—	E	>360	—	E	>480	—	NR	—	—	G	>360	—	E	>360	—	E	>360	—	—	—	—	—	—	—
96. Mercury	—	—	—	▲	>480	E	—	—	—	—	—	—	▲	>480	E	▲	>480	E	—	—	—	—	—	—	—	—	—
97. Methyl Alcohol (Methanol)	▲	>480	E	E	103	VG	E	73	VG	NR	—	—	G	45	G	E	12	VG	E	22	E	E	>480	—	DD	363	—
98. Methylamine, 40%	▲	>480	E	E	>360	E	E	153	G	NR	—	—	E	135	VG	E	55	VG	E	100	E	E	>480	—	E	>480	—
99. Methyl Amyl Ketone (MAK)	▲	>480	E	F	53	F	F	10	F	E	>360	E	NR	—	—	F	<10	F	F	<10	F	E	155	G	DD	17	F
100. Methyl-t-Butyl Ether (MTBE)	E	>480	E	E	>360	E	P	—	—	G	>360	E	NR	—	—	NR	—	—	NR	—	—	G	38	F	—	—	—
101. Methyl Cellosolve®	■	470	F	F	208	G	E	10	F	E	30	G	P	55	G	E	20	VG	—	—	—	▲	>480	E	▲	>480	E
102. Methylene Bromide (DBM)	▲	>480	E	NR	—	—	NR	—	—	G	>360	E	NR	—	—	NR	—	—	NR	—	—	E	70	F	E	>480	E
103. Methylene Chloride (DCM)	E	20	VG	NR	—	—	NR	—	—	G	>360	E	NR	—	—	NR	—	—	NR	—	—	G	13	P	E	29	G
104. Methylene bis(4-Phenylisocyanate) (MDI)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	▲	>480	E	▲	>480	E	—	—	—	—	—	—
105. Methyl Ethyl Ketone (MEK)	▲	>480	E	NR	—	—	P	—	—	F	90	VG	NR	—	—	F	5	F	P	<10	F	E	183	G	DD	20	G
106. Methyl Ethyl Ketone (MEK)/Toluene, 1/1	▲	>480	E	—	—	—	—	—	—	—	—	—	—	—	—	F	5	F	—	—	—	F	60	—	—	—	—
107. Methyl Iodide (Iodomethane)	▲	>480	E	NR	—	—	NR	—	—	F	>360	E	NR	—	—	NR	—	—	NR	—	—	F	15	P	G	215	VG
108. Methyl Isobutyl Ketone (MIBK)	▲	>480	E	P	45	F	NR	—	—	F	>360	E	NR	—	—	P	—	—	P	—	—	E	245	G	DD	30	G
109. Methyl Methacrylate (MMA)	▲	>480	E	P	35	P	NR	—	—	G	>360	E	NR	—	—	P	—	—	NR	—	—	E	85	G	DD	10	F
110. N-Methyl-2-Pyrrolidone (NMP)	▲	>480	E	NR	—	—	NR	—	—	NR	—	—	NR	—	—	E	75	VG	F	47	VG	E	>480	—	DD	—	—
111. Mineral Spirits, Rule 66	▲	>480	E	E	>480	E	E	125	G	E	>360	E	F	150	VG	NR	—	—	G	23	G	—	—	—	—	—	—
112. Monoethanolamine	—	—	—	E	>360	E	E	400	E	E	>360	E	E	>480	E	E	50	E	E	57	E	—	—	—	■	>120	—
113. Morpholine	▲	>480	E	NR	—	—	P	—	—	G	90	G	NR	—	—	G	20	G	E	43	G	E	>480	E	DD	235	VG
114. Naphtha, VM&P	▲	>480	E	E	>360	E	G	103	G	E	420	E	F	120	VG	NR	—	—	NR	—	—	—	—	—	—	—	—
115. Nitric Acid, 10%	▲	>480	—	E	>360	—	E	>480	—	NR	—	—	G	>360	—	G	>360	—	E	>360	—	—	—	—	—	—	—
116. Nitric Acid, 70% (Concentrated)	E	>480	—	NR	—	—	▲	>480	—	NR	—	—	F	109	—	NR	—	—	NR	—	—	—	—	—	—	—	—
117. Nitric Acid, Red Fuming	▲	>480	E	NR	—	—	NR	—	—	NR	—	—	P	—	—	P	—	—	NR	—	—	—	—	—	—	—	—
118. Nitrobenzene	▲	>480	E	NR	—	—	NR	—	—	G	>360	E	NR	—	—	F	15	G	F	42	G	E	>480	—	E	>480	—
119. Nitromethane	▲	>480	E	F	30	F	E	60	G	G	>360	E	P	—	—	E	10	G	E	30	E	E	>480	E	E	249	E
120. 1-Nitropropane	■	368	E	NR	—	—	F	30	G	E	>480	G	NR	—	—	E	15	G	E	25	G	E	>480	E	DD	255	E
121. 2-Nitropropane	▲	>480	E	NR	—	—	F	25	F	E	>360	E	NR	—	—	E	5	G	E	30	VG	—	—	—	—	—	—
122. n-Octyl Alcohol	—	—	—	E	>360	E	E	218	E	G	>360	E	F	>360	E	E	30	VG	E	53	G	—	—	—	—	—	—
123. Oleic Acid	—	—	—	E	>360	E	F	13	VG	G	60	E	F	90	VG	F	>360	E	G	120	—	—	—	—	—	—	—
124. Oxalic Acid, saturated solution	—	—	—	E	>360	—	E	>480	—	P	—	—	E	>360	—	E	>360	—	E	>360	—	—	—	—	—	—	—
125. Pad Etch® 1 (Ashland Chemical)	—	—	—	E	>360	—	E	>360	—	F	34	—	E	>360	—	E	>360	—	E	>360	—	—	—	—	—	—	—
126. Palmitic Acid, saturated solution	—	—	—	G	30	—	E	>480	—	P	—	—	G	75	—	G	5	—	E	193	—	—	—	—	—	—	—
127. Pentachlorophenol, 5% in Mineral Spirits	—	—	—	E	>360	E	E	151	F	E	5	F	F	180	E	NR	—	—	—	—	—	—	—	—	—	—	—
128. n-Pentane	E	>480	E	E	>360	E	G	30	G	G	>360	E	NR	—	—	P	—	—	E	13	G	—	—	—	—	—	—

129. Perchloric Acid, 60%	—	—	—	E	>360	—	E	>480	—	NR	—	—	E	>360	—	F	>360	—	E	>360	—	—	—	—	—	—	—	—
130. Perchloroethylene (PERC)	▲	>480	E	G	361	VG	NR	—	—	E	>360	E	NR	—	—	NR	—	—	NR	—	—	P	<10	F	E	>480	E
131. Phenol, 90%	▲	>480	E	NR	—	—	E	353	G	F	>360	E	G	75	VG	E	90	—	E	180	E	E	>480	—	E	>480	—
132. Phosphoric Acid, 85% (Concentrated)	▲	>480	—	E	>360	—	G	>360	—	NR	—	—	G	>360	—	F	>360	—	G	>360	—	—	—	—	—	—	—
133. Potassium Hydroxide, 50%	—	—	—	E	>360	—	E	>480	—	NR	—	—	E	>360	—	E	>360	—	E	>360	—	—	—	—	—	—	—
134. Propane Gas	—	—	—	▲	>480	E	▲	>480	E	—	—	—	■	7	VG	—	—	—	—	—	—	—	—	—	—	—	—
135. n-Propyl Acetate	—	—	—	F	20	G	P	—	—	G	120	VG	NR	—	—	P	—	—	P	—	—	E	135	G	DD	<10	F
136. n-Propyl Alcohol	E	>480	E	E	>360	E	E	323	E	P	—	—	F	90	VG	E	23	VG	E	30	E	E	>480	—	E	>480	—
137. Propylene Glycol Methyl Ether Acetate (PGMEA)	▲	>480	E	E	200	F	G	37	F	E	>360	E	P	—	—	G	13	F	G	18	F	▲	>480	E	■	334	E
138. Propylene Glycol Monomethyl Ether (PGME)	—	—	—	—	—	—	P	—	—	—	—	—	P	—	—	—	—	—	—	—	—	▲	>480	E	▲	>480	E
139. Propylene Oxide	▲	>480	E	NR	—	—	NR	—	—	G	35	G	NR	—	—	P	—	—	P	—	—	■	43	F	DD	<10	F
140. Pyridine	▲	>480	E	NR	—	—	NR	—	—	G	10	F	NR	—	—	F	10	F	P	10	F	▲	465	E	DD	40	—
141. Rubber Solvent	—	—	—	E	>360	E	E	43	G	E	>360	E	NR	—	—	NR	—	—	NR	—	—	—	—	—	—	—	—
142. Silicon Etch	▲	>480	E	NR	—	—	E	>480	—	NR	—	—	F	150	—	NR	—	—	P	—	—	—	—	—	—	—	—
143. Skydrol® 500B-4	▲	>480	E	NR	—	—	NR	—	—	—	—	—	NR	—	—	NR	—	—	NR	—	—	E	>480	E	DD	>480	E
144. Sodium Hydroxide, 50%	E	>480	—	E	>360	—	E	>480	—	NR	—	—	G	>480	—	E	>360	—	E	>360	—	E	>480	—	E	>480	—
145. Stoddard Solvent	▲	>480	E	E	>360	E	E	139	G	E	>360	E	F	57	G	NR	—	—	G	10	G	—	—	—	—	—	—
146. Styrene	▲	>480	E	NR	—	—	NR	—	—	G	>360	E	NR	—	—	NR	—	—	NR	—	—	G	26	—	E	>480	—
147. Sulfur Dichloride	—	—	—	P	>480	E	NR	—	—	—	—	—	—	—	—	NR	—	—	NR	—	—	—	—	—	—	—	—
148. Sulfuric Acid, 47% (Battery Acid)	—	—	—	E	>360	—	E	>360	—	NR	—	—	G	>360	—	E	>360	—	E	>360	—	—	—	—	—	—	—
149. Sulfuric Acid, 95-98% (Concentrated)	E	>480	E	NR	—	—	F	24	—	NR	—	—	G	26	—	NR	—	—	NR	—	—	E	>480	—	E	>480	—
150. Sulfuric Acid, 120% (Oleum)	▲	>480	E	—	—	—	F	53	G	NR	—	—	▼	25	G	—	—	—	—	—	—	—	—	—	—	—	—
151. Tannic Acid, 65%	—	—	—	E	>360	—	E	>480	E	P	—	—	E	>360	—	E	>360	—	E	>360	—	—	—	—	—	—	—
152. Tetrahydrofuran (THF)	▲	>480	E	NR	—	—	NR	—	—	P	115	F	NR	—	—	NR	—	—	NR	—	—	F	13	F	DD	10	F
153. Toluene (Toluol)	▲	>480	E	F	34	F	NR	—	—	G	>1440	E	NR	—	—	NR	—	—	NR	—	—	P	20	F	E	313	—
154. Toluene Diisocyanate (TDI)	▲	>480	E	NR	—	—	NR	—	—	G	>360	E	P	—	—	G	7	G	G	65	VG	E	>480	—	E	>480	—
155. Triallylamine	▲	>480	E	▲	>480	E	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
156. Trichloroethylene (TCE)	▲	>480	E	NR	—	—	NR	—	—	E	>360	E	NR	—	—	NR	—	—	NR	—	—	NR	—	—	DD	204	VG
157. Tricresyl Phosphate (TCP)	—	—	—	E	>360	E	F	253	F	G	>360	E	F	>360	E	E	45	E	E	>360	E	E	>480	—	E	>480	—
158. Triethanolamine (TEA)	—	—	—	E	>360	E	E	170	VG	G	>360	E	E	>360	E	G	>360	E	—	—	—	—	—	—	—	—	—
159. Turpentine	▲	>480	E	E	>480	E	NR	—	—	G	>360	E	P	—	—	NR	—	—	NR	—	—	■	58	—	■	>480	E
160. Vertrel® MCA	▲	>480	E	E	110	G	E	23	G	F	>360	E	G	13	F	G	<10	F	G	<10	F	■	173	VG	DD	20	G
161. Vertrel® SMT	E	10	G	P	—	—	F	<10	F	G	17	G	G	<10	F	F	<10	F	P	<10	P	▼	18	F	DD	<10	F
162. Vertrel® XE	E	105	E	E	>480	E	E	47	G	F	40	VG	G	303	E	E	17	VG	E	43	VG	E	>480	E	DD	398	E
163. Vertrel® XF	E	>480	E	E	>480	E	E	>480	E	F	387	VG	E	>480	E	E	337	VG	E	204	G	E	>480	E	DD	>480	E
164. Vertrel® XM	E	>480	E	E	>480	E	E	105	E	F	10	G	P	55	G	E	23	VG	E	30	VG	—	—	—	—	—	—
165. Vinyl Acetate	▲	>480	E	F	18	F	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	NR	—	—
166. Vinyl Chloride Gas	▲	>480	E	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
167. Xylenes, Mixed (Xylol)	▲	>480	E	G	96	F	NR	—	—	E	>360	E	NR	—	—	NR	—	—	NR	—	—	P	27	F	E	>480	E

▲ A degradation test against this chemical was not run. However, since its breakthrough time is greater than 480 minutes, the Degradation Rating is expected to be **Good** to **Excellent**. ■ A degradation test against this chemical was not run. However, in view of degradation tests performed with similar compounds, the Degradation Rating is expected to be **Good** to **Excellent**. ▼ A degradation test against this chemical was not run. However, in view of data obtained with similar compounds, the Degradation Rating is expected to be **Fair** to **Poor**. ***CAUTION:** This product contains natural rubber latex which may cause allergic reactions in some individuals.

NOTE:

These recommendations are based on laboratory tests, and reflect the best judgement of Ansell in the light of data available at the time of preparation and in accordance with the current revision of ASTM F 739. They are intended to guide and inform qualified professionals engaged in assuring safety in the workplace. Because the conditions of ultimate use are beyond our control, and because we cannot run permeation tests in all possible work environments and across all combinations of chemicals and solutions, these recommendations are advisory only. The suitability of a product for a specific application must be determined by testing by the purchaser.

The data in this guide are subject to revision as additional knowledge and experience are gained. Test data herein reflect laboratory performance of partial gloves and not necessarily the complete unit. Anyone intending to use these recommendations should first verify that the glove selected is suitable for the intended use and meets all appropriate health standards. Upon written request, Ansell will provide a sample of material to aid you in making your own selection under your own individual safety requirements.

NEITHER THIS GUIDE NOR ANY OTHER STATEMENT MADE HEREIN BY OR ON BEHALF OF ANSELL SHOULD BE CONSTRUED AS A WARRANTY OF MERCHANTABILITY OR THAT ANY ANSELL GLOVE IS FIT FOR A PARTICULAR PURPOSE. ANSELL ASSUMES NO RESPONSIBILITY FOR THE SUITABILITY OR ADEQUACY OF AN END-USER'S SELECTION OF A PRODUCT FOR A SPECIFIC APPLICATION.

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Appendix D: General Chemical Compatibility Guidelines

The following information is to be used only as a guide. Specific incompatibilities will be listed on the Material Safety Data Sheets.

Separate acids from

- Bases (possible violent exothermic reaction)
- Most metals (production of flammable hydrogen gas)
- Cyanides (forms toxic and flammable hydrogen cyanide gas)
- Sulfides (forms toxic and flammable hydrogen sulfide gas)
- Azides (may form explosive hydrazoic acid)
- Phosphides (may form toxic and flammable phosphene gas)
- Oxidizers (may form toxic and/or explosive compounds)

Separate oxidizers from

- Acids (may form toxic and/or explosive compounds) (For example: concentrated sulfuric acid mixed with chlorates or perchlorates forms explosive compounds)
- Organic materials (especially when mixed with flammables, may ignite)
- Metals (may form explosive compounds)
- Reducing agents (for example: boranes, hydrides, sodium hydrosulfite, etc.)
- Ammonia (anhydrous or aqueous)

Separate water-reactive chemicals from

- Aqueous solutions and in many cases just the moisture in the air (for example: metal hydrides, alkali metals and certain metal dusts in moist air will form hydrogen gas and ignite; halosilanes and acid halides will react with water to form toxic acid gases)

Separate Sodium Hypochlorite (bleach) from

- Acids (release of chlorine gas may occur)
- Solution containing ammonia (release of chlorine gas may occur, risk of explosive compounds)
- Organics (release of chlorine gas may occur, risk of explosive compounds)
- Metals (Pressurization may occur)
- Hydrogen Peroxide (violent release of oxygen gas may occur)
- Reducing Agents (heat reaction may occur)

Appendix E: CHP Annual Review and Amendments

Name: _____

Signature:_____

Title: _____

Review Date: _____

Updated? ☐ Yes ☐ No

If yes, provide a brief description of amendments and/or changes:_____

_____

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_____

Name: _____

Signature:_____

Title: _____

Review Date: _____

Updated? ☐ Yes ☐ No

If yes, provide a brief description of amendments and/or changes:_____

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