

Cal Poly - San Luis Obispo

Hazard Communication Program

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I. Scope and Application

- A. This Hazard Communication program applies to all Cal Poly faculty, staff, and student employees who, under normal work conditions or foreseeable emergency, may be exposed to hazardous materials.
- B. This program does not apply to a laboratory setting whose workers (Principal Investigator, Faculty, graduate student, lab supervisor, teaching assistants, etc, or students working in research laboratories or enrolled in academic laboratory courses) under the direct supervision and regular observation of an individual (eg. Principal Investigator) who has knowledge of the physical hazards, health hazards, and emergency procedures associated with the use of the particular hazardous substances involved, and who conveys this knowledge to workers. Such excepted laboratories are governed by Cal Poly's Chemical Hygiene Plan.
- C. This program does not apply to wastes and programs having their own federal and/or state regulations (ie: hazardous waste; medical/biohazardous waste; pesticides; ionizing and non-ionizing radiations, etc)
- D. This program does not apply to tobacco or tobacco products; liquor; wood or wood products; food, drugs, or cosmetics intended for personal consumption by employees while in the workplace; retail food sale establishments; and consumer products packaged for distribution.
- E. This program does not apply to consumer products or hazardous substances that it are used in the workplace for the purpose intended by the chemical manufacturer and the use results in a duration and frequency of exposure which is not greater than the range of exposures that could reasonably be experienced by consumers when used for the purpose intended (eg, Windex, Simple Green, dish soap, etc)
- F. As a state agency, Cal Poly is not subject to Proposition 65 warning and notification requirements (CCR b (6) (A) 2).

II. RESPONSIBILITIES

- A. University President
The University President designates the director of Environmental, Health and Safety as the responsible manager to develop, implement and maintain the Hazard Communication Program.

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- B. Environmental Health and Safety Department (EH&S)
EH&S is responsible to:
1. Develop, implement and maintain the Hazard Communication Program.
 2. Provide subject matter expertise to faculty, staff, and student employees related to the Hazard Communication program
 3. Maintain a master inventory of hazardous materials on campus.
 4. Audit departments for compliance with respect to Hazard Communication program and provide summary of audit results to appropriate department administrators and senior management.
- C. Deans, Directors, Department Chairs, Department Heads
1. As they relate to operations under their control, it is the responsibility of Deans, Directors, Department Chairs and Department Heads to work with the EH&S department to ensure compliance with the Hazard Communication Program. Specifically, the program will include employees, i.e., faculty, staff, student assistants and identified volunteers who handle or are exposed to hazardous materials at work.
 2. In collaboration with EH&S, develop and maintain written departmental procedures as necessary and ensure that each supervisor adheres to Hazard Communication Program. Examples of procedures includes:
 - a. How those needing Hazard Communication training are identified and communicated to EH&S.
 - b. Who maintains and communicates the department Hazardous Materials Inventory and corresponding SDSs.
 3. In collaboration with EH&S, develop and maintain a system of education and training designed to instruct employees in the Hazard Communication Program. Such education and training shall take place prior to the employee being assigned to potentially hazardous operations.
 4. Permit only those persons qualified by training to handle hazardous materials. Ensure that newly hired, newly assigned or reassigned employees, are properly trained in all safety procedures associated with new duties.
 5. Develop and maintain an inventory of hazardous materials present in all work areas. A copy of this inventory must be forwarded to the Office of Environmental Health and Safety on an annual basis.

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6. When ordering hazardous materials, request a Safety Data Sheet (SDS) on the Requisition Form (unless an SDS for the material is already available in the work area).
7. Post appropriate safety notices or procedures in a conspicuous location.
8. Develop methods, as appropriate, to inform Cal Poly project managers of hazards, etc. within their respective departments to provide outside contractors and their employees with pertinent hazard information in areas under department jurisdiction

D. Employees (faculty, staff, student assistants and identified volunteers)
It is the responsibility of all Cal Poly employees subject to the Hazard Communication Program to:

1. Read and comply with the Hazard Communication Program.
2. Inform their supervisors of workplace hazards without fear of reprisal.
3. Attend established education and training sessions. They are expected to understand and comply with all applicable safety requirements. Failure to comply with established safety rules may be reflected in performance evaluations and may lead to disciplinary action consistent with procedures described in respective collective bargaining contracts, where applicable.
4. Ask questions of their supervisors when there is concern about an unknown or hazardous situation.

III. REQUIREMENTS

Cal Poly will to have a written Hazard Communication program that shall be available to all faculty, staff, and student employees.

- A. Cal Poly is required to:
1. Develop implement, and maintain a written Hazard Communication program
 2. Maintain an inventory of hazardous chemical
 3. Have a physical (paper) or available electronic copy (online access) SDSs for each hazardous chemical present at Cal Poly.
 4. Significant revisions in the SDS shall be provided to employees in writing by the department within thirty (30) days after receipt by Facilities Services/EH&S
 5. All departments must ensure that labels of incoming containers of hazardous substances are not removed or defaced pursuant to section Title 8, 5194(f)(6), and must maintain any material safety data sheets that are received with incoming

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shipments of hazardous substances and ensure that they are readily available to laboratory employees pursuant to Title 8, section 5194(g).

- B. It is an employee's right:
1. To know of any operations in their work area where hazardous substances are present.
 2. To be made aware of hazard and safe handling information regarding hazardous substances they may be exposed to.
 3. To be made aware of methods and observations that may be used to detect the presence or release of hazardous substances in the work area.
 4. To protection from dismissal or other discrimination due to the employee's exercise of their rights afforded by State law.
 5. The location and availability of the written Hazard Communication Program.
 6. The requirements and details of the Hazard Communication Program including an explanation of the labeling system, the SDS, and how employees can obtain and use the appropriate hazard information.
 7. The physical and health hazards of the substances in the work area, and the measures they can take to protect themselves from these hazards. These measures shall include specific procedures the department has implemented to protect employees from exposure to hazardous substances, such as appropriate work practices, emergency procedures, and personal protective equipment to be used.
 8. That their physician or collective bargaining agent receive such information.
- C. Employee Training
- All Cal Poly faculty, staff, and paid student employees who come in contact with hazardous materials shall be
1. Trained in Hazard Communication at the time of their initial assignment and whenever a new chemical hazard is introduced into their work area.
 2. Such training will be renewed every 3 years.
 3. Managers of faculty, staff, and paid student employees will identify such individuals subject to this program to their respective training officer in order to be signed up for online (SkillSoft) Hazard Communication training or attend a live Hazard Communication training session.

Hazard communication training shall consist of the following:

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4. Faculty, staff, and paid student employees shall be trained in the methods and observations that may be used to detect the presence or release of a hazardous substance in the work area (such as monitoring conducted by the University, visual appearance, symptoms of exposure or odor of hazardous substances when being released, etc.);
 5. Faculty, staff, and paid student employees shall be trained in the physical and health hazards of substances in the work area, and the measures they can take to protect themselves from these hazards, including specific procedures and equipment the University uses to protect employees from exposure to hazardous substances. Examples are appropriate work practices, emergency procedures, and personal protective equipment.
 6. Faculty, staff, and paid student employees shall be trained in the details of the hazard communication program, including an explanation of the labeling system and material safety data sheets (SDSs), and how employees can obtain and use the appropriate hazard information.
- D. Labeling
1. All hazardous substances shipped to Cal Poly are to be labeled with a factory label that includes:
 - a. Product Identifier (name of hazardous substance)
 - b. Signal word
 - c. Hazard statement
 - d. Pictograms
 - e. Precautionary statements
 - f. Name, address and phone number of the manufacturer
- or-
2. if the hazardous material is transferred to a “secondary container,” the container shall be labeled with a product identifier and words or symbols, or combination thereof to convey the hazards of the material
 3. Employees shall not remove or deface existing labels on incoming containers of hazardous substances.
 4. Materials that are not adequately labeled within ten (10) days after the material is discovered are considered waste and labeled appropriately by the lab supervisor or their designee. Contact EH&S (756-6661) for removal.

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E. Safety Data Sheets (SDS)

1. Departments shall request an SDS on the purchase requisition form for all suspected hazardous substances which they use where one is not currently present in the department or available from the EH&S Office. Each SDS shall be in English and shall contain specific information regarding hazards, physical properties, personal protective equipment, exposure limits, etc.
2. Principal Investigators and site supervisors are to provide Safety Data Sheet access for each hazardous chemical that are present in their area of operational authority. This may be in the form of
 - a. Hard copy (paper) SDS
 - b. Online access
3. Departments shall ensure that this information is readily accessible during each work shift to employees when they are in their work area(s). This shall take the form of an SDS binder covering all hazardous materials within the lab or an immediately accessible computer connected to the online database of SDSs. To retrieve an SDS from the Internet, visit MSDSONline (from on-campus computers only) by following the below link.

<http://hq.msdsonline.com/csuedusl/Search/Default.aspx>

4. EH&S shall maintain an inventory of hazardous substances on campus and also maintain the contract for the online SDS database, currently “msdsonline”
5. If an SDS is not provided by the manufacturer, and after an unsuccessful attempt to obtain the SDS by the purchasing department via the internet, phone, or written request, contact the Environmental Health and Safety office. EH&S will obtain the SDS or, as necessary, notify the proper authorities.

F. Non-routine tasks involving Hazardous Materials

The department head or designee shall provide appropriate controls, including personal protective equipment and additional training as required. EH&S shall be consulted as needed.

G. Trade Secrets

Under certain circumstances, the manufacturer may withhold the specific chemical identity, including the chemical name and other specific identification of a hazardous substance, from the SDS. However, when a treating physician determines that a medical emergency exists and the chemical identity is required for first-aid treatment, the manufacturer must disclose the trade secret information to the physician.

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H. Informing Contractors

The appropriate project manager is responsible for informing any contractors and subcontractors with employees working on campus of the hazardous substances to which their employees may be exposed.

This information shall be provided to the contractor prior to commencing work. The SDSs for any hazardous materials that may be encountered will be provided to the contractor at that time.

The project manager is also responsible for obtaining copies of SDSs for any hazardous substance that the contractor is bringing into the workplace. This information shall be provided to EH&S upon request.

Contact Tom Featherstone tfeather@calpoly.edu or 805-756-6661 for assistance.

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Appendix A: References

[California Code of Regulations, Title 8, sections 337-340.2 and 5194](#)

[Code of Federal Regulations, 1910.1200 – Hazard Communication](#)

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Appendix B: Definitions

Article: A manufactured item: (1) Which is formed to a specific shape or design during manufacture; (2) which has end use function(s) dependent in whole or in part upon its shape or design during end use; and (3) which does not release, or otherwise result in exposure to, a hazardous chemical under normal conditions of use or in a reasonably foreseeable emergency resulting from workplace operations.

CAS number: The unique identification number assigned by the Chemical Abstracts Service to specific chemical substances.

Chemical: any element, chemical compound or mixture of elements and/or compounds.

Chemical name: The scientific designation of a chemical in accordance with the nomenclature system developed by the International Union of Pure and Applied Chemistry (IUPAC) or the Chemical Abstracts Service (CAS) rules of nomenclature, or a name which will clearly identify the chemical for the purpose of conducting a hazard classification.

Chief: The Chief of the Division of Occupational Safety and Health, P.O. Box 420603, San Francisco, CA 94142, or designee.

Classification: Identification of relevant data regarding the hazards of a chemical; review of that data to ascertain the hazards associated with the chemical; and decision regarding whether the chemical will be classified as hazardous according to the definition of hazardous chemical. In addition, classification for health and physical hazards includes the determination of the degree of hazard, where appropriate, by comparing the data with the criteria for health and physical hazards.

Combustible liquid: means any liquid having a flash point at or above 100 deg. F (37.8 deg. C), but below 200 deg. F (93.3 deg. C), except any mixture having components with flash points of 200 deg. F (93.3 deg. C) or higher, the total volume of which make up 99 percent or more of the total volume of mixture.

Common name: Any designation or identification such as code name, code number, trade name, brand name or generic name used to identify a chemical other than by its chemical name.

Compressed gas: any compound that exhibits one of the following characteristics.

- A gas or mixture of gases having, in a container, an absolute pressure exceeding 40 psi at 70 deg. F.

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- A gas or mixture of gases having, in a container, an absolute pressure exceeding 104 psi at 130 deg. F. regardless of the pressure at 70 deg. F.
- A liquid having a vapor pressure exceeding 40 psi at 100 deg. F.

Container: any bag, barrel, box, can, cylinder, drum, reaction vessel, storage tank, or the like that contains a hazardous chemical. For purposes of this section, pipes or piping systems, and engines, fuel tanks, or other operating systems in a vehicle, are not considered to be containers.

Department: The Department of Industrial Relations, P.O. Box 420603, San Francisco, CA 94142, or designee.

Designated representative: Any individual or organization to whom an employee gives written authorization to exercise such employee's rights under this section. A recognized or certified collective bargaining agent shall be treated automatically as a designated representative without regard to written employee authorization.

Director: The Director of Industrial Relations, P.O. Box 420603, San Francisco, CA 94142, or designee.

Distributor: A business, other than a manufacturer or importer, which supplies hazardous chemicals to other distributors or to employers.

Division: The Division of Occupational Safety and Health (Cal/OSHA), California Department of Industrial Relations, or designee.

Emergency: Any potential occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment, which may or does result in a release of a hazardous chemical into the workplace.

Explosive: a chemical that causes a sudden, almost instantaneous release of pressure, gas, and heat when subjected to sudden shock, pressure, or high temperature.

Employee: a person who is employed by Cal Poly, including faculty, staff, student assistants and identified volunteers.

Employer means:

(A) The State and every State agency.

(B) Each county, city, district, and all public and quasi-public corporations and public agencies therein.

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(C) Every person including any public service corporation, which has any natural person in service.

(D) The legal representative of any deceased employer.

Exposure or exposed: an employee is subjected in the course of employment to a chemical that is a physical or health hazard, and includes potential (e.g. accidental or possible) exposure. Subjected in terms of health hazards includes any route of entry (e.g., inhalation, ingestion, skin contact or absorption.)

Flammable: a chemical that falls into one of the following categories.

- “Aerosol, flammable” means an aerosol that yields a flame projection exceeding 18 inches at full valve opening, or a flashback (a flame extending back to the valve) at any degree of valve opening.
- “Gas, flammable” means:
 - A gas that, at ambient temperature and pressure, forms a flammable mixture with air at a concentration of thirteen (13) percent by volume or less.
 - A gas that, at ambient temperature and pressure, forms a range of flammable mixtures with air wider than twelve (12) percent by volume, regardless of the lower limit.
- “Liquid, flammable” means any liquid having a flash point below 100 deg. F., except any mixture having components with flash points of 100deg. F. or higher, the total of which make up 99 percent or more of the total.
- “Solid, flammable” any solid, other than a blasting agent or explosive, as defined in section 5237 (a) or that is liable to cause a fire through friction, absorption of moisture spontaneous chemical change, or will retain heat from manufacturing, or processing, or which can be ignited readily and when ignited burns so vigorously and persistently as to create a serious hazard. A chemical shall be considered to be flammable solid if, when tested by the method described in 16 CFR 1500.44, it ignites and burns with a self-sustained flame at a greater than one-tenth of an inch per second along its major axis.

Flash point: the minimum temperature at which a liquid gives off a vapor in sufficient concentration to ignite.

Hazard category: The division of criteria within each hazard class, e.g., oral acute toxicity and flammable liquids include four hazard categories. These categories compare hazard severity within a hazard class and should not be taken as a comparison of hazard categories more generally.

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Hazard class: The nature of the physical or health hazards, e.g., flammable solid, carcinogen, oral acute toxicity.

Hazard statement: A statement assigned to a hazard class and category that describes the nature of the hazard(s) of a chemical, including, where appropriate, the degree of hazard.

Hazard warning: any words, pictures, symbols, or combination appearing on a label or other appropriate form of warning which convey the specific physical and health hazard(s), including target organ effects, of the chemical(s) in the container(s). See the definitions for “physical hazard” and “health hazard” to determine the hazards which must be covered.

Hazard not otherwise classified (HNOC): An adverse physical or health effect identified through evaluation of scientific evidence during the classification process that does not meet the specified criteria for the physical and health hazard classes addressed in this section. This does not extend coverage to adverse physical and health effects for which there is a hazard class addressed in this section, but the effect either falls below the cut-off value/concentration limit of the hazard class or is under a GHS hazard category that has not been adopted by OSHA (e.g., acute toxicity Category 5).

Hazardous chemical: Any chemical which is classified as a physical hazard or a health hazard, a simple asphyxiant, combustible dust, pyrophoric gas, a hazard not otherwise classified, or is included in the List of Hazardous Substances prepared by the Director pursuant to Labor Code section 6382.

Hazardous Material: any material that is a physical hazard or health hazard.

Hazardous Substance Exemptions: this program does not apply to the following hazardous substances.

- Hazardous waste
- Tobacco products
- Wood products
- Manufactured items that do not release or have any hazardous exposure
- Food, drugs, or cosmetics
- Products purchased by the University in the same form, approximate amount, concentration, and manner as sold to retail consumers

Health hazard: a chemical for which there is evidence that acute or chronic health effect may occur to exposed employees. The term “health hazard” includes chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers,

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hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic system and agents which damage the lungs, skin, eyes, or mucous membranes. As specified in 29 CFR part 10, subpart Z.

Identity: any chemical or common name, which is indicated on the material safety data sheet (SDS) for the chemical. The identity used shall permit cross-references to be made among the required list of hazardous chemicals, using the label and the SDS.

Immediate use: the hazardous chemical will be under the control of and used only by the person who transfers it from a labeled container and only within the work shift in which it is transferred.

Importer: The first business with employees within the Customs Territory of the United States which receives hazardous chemicals produced in other countries for the purpose of supplying them to distributors or purchasers within the United States.

Label: any written, printed, or graphic material displayed on or affixed to containers of hazardous substances.

Label elements: The specified pictogram, hazard statement, signal word and precautionary statement for each hazard class and category.

Manufacturer: A person who produces, synthesizes, extracts, or otherwise makes a hazardous chemical.

Material Safety Data Sheet (SDS): written or printed material concerning a hazardous chemical that is prepared in accordance with CCR, section 5194 (g) requirements.

Mixture: any combination of two or more chemicals if the combination is not, in whole or in part, the result of a chemical reaction.

NIOSH. The National Institute for Occupational Safety and Health, U.S. Department of Health and Human Services.

Oxidizer: means a chemical other than a blasting agent or explosive as defined in, CCR, section 5237 (a) that initiates or promotes combustion in other materials, thereby causing fire either of itself or through the release of oxygen or other gases.

Physical hazard: a substance for which there is scientifically valid evidence that it is a combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer, pyrophoric, unstable (reactive) or other gases.

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Pictogram: A composition that may include a symbol plus other graphic elements, such as a border, background pattern, or color, that is intended to convey specific information about the hazards of a chemical. Eight pictograms are designated under this standard for application to a hazard category.

Precautionary statement: A phrase that describes recommended measures that should be taken to minimize or prevent adverse effects resulting from exposure to a hazardous chemical, or improper storage or handling.

Produce: To manufacture, process, formulate, repackage, or relabel.

Product identifier: The name or number used for a hazardous chemical on a label or in the SDS. It provides a unique means by which the user can identify the chemical. The product identifier used shall permit cross-references to be made among the list of hazardous chemicals required in the written hazard communication program, the label and the SDS.

Pyrophoric gas: A chemical in a gaseous state that will ignite spontaneously in air at a temperature of 130 degrees F (54.4 degrees C) or below.

Responsible party: Someone who can provide additional information on the hazardous chemical and appropriate emergency procedures, if necessary.

Safety Data Sheet (SDS): Modern version of the SDS, associated with the Globally Harmonized System. Like the SDS, it is a written, printed, or electronic bulletin concerning a hazardous chemical or material. Prepared in accordance with CCR, section 5194 (g) requirements.

Signal word: A word used to indicate the relative level of severity of hazard and alert the reader to a potential hazard on the label. The signal words used in this section are “danger” and “warning.” “Danger” is used for the more severe hazards, while “warning” is used for the less severe.

Simple asphyxiant: A substance or mixture that displaces oxygen in the ambient atmosphere, and can thus cause oxygen deprivation in those who are exposed, leading to unconsciousness and death.

Specific chemical identity: The chemical name, Chemical Abstracts Service (CAS) Registry Number, or any other information that reveals the precise chemical designation of the substance.

Substance: Chemical elements and their compounds in the natural state or obtained by any production process, including any additive necessary to preserve the stability of the product and

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any impurities deriving from the process used, but excluding any solvent which may be separated without affecting the stability of the substance or changing its composition.

Trade secret: Any confidential formula, pattern, process, device, information, or compilation of information which gives its user an opportunity to obtain a business advantage over competitors who do not know or use it. A trade secret shall not include chemical identity information which is readily discoverable through qualitative analysis. Appendix E to section 5194-Definition of Trade Secret sets out the criteria to be used in evaluating trade secrets.

Unstable (reactive): a substance which in the pure state, or as produced or transported, will vigorously polymerize, decompose, condense, or will become self-reactive under conditions of shocks, pressure, addition of water, or temperature.

Use: To package, handle, react, or transfer.

Work area: A room or defined space in a workplace where hazardous chemicals are produced or used, and where employees are present.

Workplace: Any place, and the premises appurtenant thereto, where employment is carried on, except a place the health and safety jurisdiction over which is vested by law in, and actively exercised by, any state or federal agency other than the Division.

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Appendix C: Cal Poly Standard Operating Procedures for Use of Chemicals/Hazardous Materials

Note: Use of these guidelines will minimize exposure of laboratory workers to chemicals they work with. Numbers in parentheses [e.g. **(82)**] are page references in Prudent Practices for Handling Hazardous Chemicals in Laboratories, National Research Council - Committee on Hazardous Substances in the Laboratory, 2011. This reference is available in hardback from many vendors. It can also be accessed online page-by-page at <http://books.nap.edu/openbook.php?isbn=0309052297&page=R1#pagetop>

The following guidelines are provided for the benefit of laboratory Faculty, Staff, and Student Employees and are therefore written as information/instructions to those individuals.

General Safety Guidelines: You should follow these guidelines and instructions for all laboratory use of chemicals, whether or not you consider your materials to be hazardous. The concept of “dangerous chemicals” varies with individual attitudes and experience.

There are three important attitudes to assume while working with chemicals in the laboratory

BE AWARE - Know the hazards before you begin your experiment.

At minimum, read the label and become familiar with information on Safety Data Sheets (SDSs).

Evaluate your lab facility and its equipment. Is it sufficient for the procedure you wish to perform? Should you move to a more adequate space or consider postponing or modifying your procedure?

BE PREPARED - Answer the following questions:

What is the worst thing that can go wrong?

What must I do to prepare for it?

What must I do when it happens?

BE PROTECTED -

What practices and equipment can minimize my exposure to the hazards of my work when things are happening **normally** – when work proceeds as “expected”?

What practices and equipment can minimize my exposure to the hazards of my work when **unexpected** things happen? What should I be doing (or not doing) and what protections shall I use (plan to use) when things go terribly wrong?

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1. General Safety Guidelines

- A. **Working alone (15, 17, 116, 120, 122, 301)** while using hazardous materials always involves risk. Work with hazardous substances or processes must be done only when there is at least one other person present who is familiar with the work being done. A small accident has the potential of becoming a catastrophe if you are alone and isolated when things go wrong.
- B. **Eye and Face Protection (108)**: You must always wear appropriate eye protection whenever anyone (even someone else) is working with hazardous materials or processes in the laboratory. Appropriate eye protection worn when working with chemicals shall meet the requirements of the current American National Standards Institute (ANSI Standard Z87.1). Appropriate protective eyewear will be marked with "Z87.1" or "Z87+" as an indication of **impact resistance**, prescription eyewear will be marked with the suffix -2 (e.g. Z87-2+); sufficient protection against **liquid splash** is provided by ANSI Z87.1 (or Z87+) rated **goggles**, not safety glasses. Goggles that are vented must be indirectly vented to provide adequate splash protection.

Note: the ANSI Z87.1 standard does allow for the wearing of contact lenses if approved chemical splash **goggles** are worn over the eyes at the same time.

- C. When working with **Flammable Materials (127)**, be certain that there are no sources of ignition near enough to cause a fire or explosion in the event of a vapor release or spill.
- D. Use **Shields (131)**, for protection whenever:
 - i. an explosion is possible (for example, when your work involves a potentially explosive
 - ii. or violently reactive material,
 - iii. or when your apparatus - especially if glass - is under pressure) or implosion is possible (when your glass apparatus is under vacuum).
- E. Don't underestimate the risks of materials you use. The hazardous properties of each material / ingredient used in a procedure must be determined before the first time it is used. **Be aware of the chemical hazards (107)** as determined from the SDS or other appropriate reference, and protect yourself more, rather than less. Assume a mixture to be more toxic than any of its components.
- F. Use proper **protective equipment (108-109)**, **every time** you use materials requiring it. Make sure the equipment is not damaged and that you know how to use it.
- G. Know the location and proper use of **emergency equipment (120-122)** and be familiar with emergency procedures see ("Chemical Spill Procedures" this appx, sec 7, "Fire Emergency Procedures" this appx, sec 8, and "Medical Emergency Procedures", this appx, sec 9.)
- H. Don't use equipment or machinery (especially equipment powered by 115 volt AC power) unless you know how to use it properly, and use it only for its intended purpose.

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Repair of non-functioning electrical laboratory apparatus, should be performed only by someone qualified to do such work. **(149-152)**.

- I. **Minimize all chemical exposures.** Avoid all skin contact with chemicals. Wear gloves appropriate for the material. Consult the manufacturer glove guide for chemical resistance, permeation and degradation data.
- J. **Chemical Containers:** Keep chemicals in tightly closed containers with readable and accurate labels.
- K. **Fume Hood Use:** Use hazardous chemicals which may produce gases, fumes, or hazardous vapors in a **fume hood (221-236)**, and know how to use the hood properly. Never use highly toxic agents, carcinogens, or reproductive toxins outside the hood. The room and hood should be labeled as a "Controlled Work Area" if these chemicals are in use.
- L. Dispose of cracked or **broken glassware** immediately into an appropriate container labeled for "Broken Glass Disposal". Lubricate glassware with an appropriate lubricant such as water or glycerol when inserting glass tubing or glass thermometers through a tight fitting hole. Protect your hands with a cloth towel or leather gloves when inserting or attaching such glassware. Grasp the glass tube or thermometer near the tight fitting hole (**not** at the opposite, distant end) and push and twist the glass into the hole gradually.
- M. **Unattended Operations (39, 116):** An experiment is "unattended" if there is no one immediately present who fully understands the operation and shutdown procedure to be used in the event of an emergency. These circumstances require special precautions:
 - i. Prominently label the apparatus with your name, start date and time, intended stop date and time, how to contact you (and your faculty advisor, if applicable) in case of emergency (e.g. names and telephone numbers).
 - ii. Unattended operations that could result in fire or explosion should be equipped with the necessary automatic shutdown controls. Examples of circumstances which can develop during unattended operations include loss of cooling water, overheating, flooding, power interrupt, loss of inert atmosphere, etc. (Ask yourself, "What is the worst thing that can go wrong?")
 - iii. Post warning signs for radioactive, chemical, biological, flammable, reactive, explosive, or other hazard(s).
 - iv. Use necessary shields and barriers to contain splashes, explosions, or other releases.
 - v. Be aware that the need for water campus wide decreases generally late in the day or at night. Increased water pressure may occur in the few areas that are using it. Poorly attached or unclamped cooling hoses may come loose with vibration, lubricating character of the water in the hose, and/or pressure changes in the hoses. (What will your apparatus do if cooling water is lost in the middle of the night?)

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2. Personal Hygiene

- A. Wash promptly whenever a chemical has contacted your skin.
- B. Avoid inhalation of chemicals; do not smell or taste chemicals, especially not for identification of an unknown material.
- C. Never mouth pipette anything or use mouth suction to start a siphon.
- D. Never bring food, cigarettes, chewing gum, beverages, or food containers into a laboratory.
- E. Never eat, drink, smoke, bite fingernails apply cosmetics or handle contact lenses while in laboratory.
- F. Always wash your hands with soap and water before leaving the laboratory and before eating, drinking, smoking, using the restroom, applying cosmetics, or handling contact lenses.
- G. Never store food in a refrigerator in a laboratory or in any refrigerator (inside a laboratory or not) which is used to store chemicals. Never put chemicals into a refrigerator which is used for food storage.
- H. Never use laboratory glassware for drinking vessel, whether inside or outside the laboratory.

3. Protective Clothing and Equipment

- A. Eye protection worn when working with chemicals shall meet the requirements of the current American National Standards Institute (ANSI Standard Z87.1). Appropriate protective eyewear will be marked with "Z87.1" or "Z87+" as an indication of impact resistance, prescription eyewear will be marked with the suffix -2 (eg Z87-2+). Sufficient protection against liquid splash is provided by ANSI Z87.1 (or Z87+), rated goggles, not safety glasses. Goggles that are vented must be indirectly vented to provide adequate splash protection.
- B. Eye protection should include a face shield when the chemical hazard warrants it. Goggles will protect your eyes but not the rest of your face and head.
- C. When working with hazardous chemicals, wear gloves made of a material that is resistant to permeation by that chemical. Such gloves are usually made of "plastic" or "rubber" (not leather).
- D. When working with hazardous chemicals (chemicals which will cause temporary or permanent skin damage on contact), wear an impervious lab coat or apron (such as a "rubberized" apron.) Examples of such chemicals are sulfuric acid and most of its solutions, and sodium hydroxide and most of its solutions (and there are many more).
- E. A lab coat or other appropriate protective garment must be worn at all times while you are working with hazardous chemicals in the laboratory. Remove your lab coat when you leave the laboratory at the end of your lab period or work day. If your lab coat becomes contaminated by a hazardous chemical, remove it immediately, and discard it or wash it thoroughly before using it again.

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- F. Protect your skin and feet with adequate clothing and footwear. Shorts or short skirts must not be worn in the laboratory. Open toed shoes or sandals, or shoes without firm footing (i.e. shoes with wheels on the bottom) must not be worn in the laboratory.
 - G. Confine loose hair and clothing while working in a laboratory. Long, loose hair and long, flowing garments (especially sleeves) can easily be dragged over chemical apparatus or spills, and can be ignited if open flames are in use.
 - H. Whenever exposure to a toxic material by inhalation is likely to exceed the Permissible Exposure Limit (as described in the SDS or other information source), use a fume hood for work with that material. As a general rule, if the PEL for a material is less than 50 ppm, work with that material should be done in a fume hood or with the use of some other engineering control (**219**).
 - I. Exposure to toxic air contaminants should always be controlled primarily by the use of a fume hood or other engineering control to prevent the release of vapors or fumes into the laboratory. You should use a respirator only if a hood or other engineering control is not feasible. (See [Respiratory Protection Plan](#).)
4. Housekeeping (113)
- A. Access to emergency equipment, eye washes, safety showers, fire extinguishers, circuit breakers, fire alarm pull boxes, emergency spill equipment, and exits must never be blocked by anything - not even a temporarily parked lab cart or bicycle.
 - B. **Container labeling** is important to minimizing accidental contact (exposure) to hazardous materials and to prevent accidental mixing of the wrong ingredient(s). All chemical containers must be labeled with at least the identity of the contents and the hazards those contents present to users. Always use and store containers in a manner which preserves the labels in good condition, keeps labels attached to the container(s), and insures the label(s) will continue to be readable. Such containers must be stored in a dry location and out of direct sunlight whenever possible. A container **you** fill must always be labeled with all the information necessary for **someone else** to identify the contents.
 - C. Keep all work areas, especially laboratory benches, chemical fume hoods, etc clear of clutter.
 - D. Keep all aisles, hallways, exits, and stairs clear of all chemicals.
 - E. All chemicals should be placed in their assigned storage areas at the end of each workday.
 - F. At the end of each workday, the contents of all unlabeled containers are to be considered hazardous waste if the contents are unknown. Containers with **known** contents should be **labeled** as you make them, to prevent them from becoming hazardous waste.
 - G. Waste should be properly labeled and kept in proper containers. (See this Appx, sec. 6)
 - H. Promptly clean up all spills; properly dispose of the spilled chemicals and clean up all surfaces and equipment.

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- I. All working surfaces and floors should be cleaned regularly. Bench tops should be cleaned at the end of a particular operation or experiment or at the end of each workday.
 - J. Extraneous material should not be stored in a fume hood because it can interfere with the air flow in the hood and jeopardize the safe operation of the hood.
 - K. Chemicals should be stored in an earthquake safe manner - in closed cabinets or on shelves with adequate barriers to prevent objects (bottles) falling from the edge of the shelf.
5. Chemical Storage
- A. **Inventory-** The inventory of chemicals kept on hand should be not more than will be consumed by the department/laboratory in two (2) years. For some chemicals, a supply lasting only one (1) year is recommended. The expiration dates which appear on labels made by chemical manufacturers should be adhered to. Many chemicals lose their usefulness over time due to program changes or degradation with age (shelf life). Economies of scale - buying large or bulk amounts - are usually more than offset by the cost of disposing of old, unwanted chemicals as hazardous waste.
 - i. A physical inventory of chemicals on hand should be conducted at least annually
 - a. to identify containers which are leaking,
 - b. to identify containers which are damaged (corroded, cracked, or dented) and may begin leaking;
 - c. to identify materials which are unknown (labels missing or illegible);
 - d. to identify chemicals which are no longer needed . The older the chemical is, the harder it is to find a potential alternate user.
 - ii. Chemicals in damaged or leaking containers should be re-packaged into new, sound containers and relabeled.
 - iii. Fading or damaged labels need to be re-attached or replaced before the material(s) become unknown. A list of un-wanted chemicals should be submitted to Environmental Health and Safety for pick up and possible distribution to other programs on campus.
 - B. **Compatible Storage-** Chemicals should be stored according to their chemical compatibility (their ability to react with each other) rather than strictly by another organizational pattern, such as alphabetical. Chemicals which can react with each other and create a hazardous condition, such as fire or the generation of a toxic or flammable gas, should be stored apart from each other. The separation should be sufficient to prevent the accidental mixing of materials in case of catastrophic spill. Appendix D is a guideline for the storage of hazardous chemicals by compatibility.
 - C. **Seismic Safety-** Chemicals should be stored on shelves or in cabinets which prevent the containers from falling in the event of earthquake.
 - i. Cabinet doors should close and latch securely so as not to spring open during an earthquake nor be pushed open by objects moving inside.

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- ii. Shelves holding chemical containers should have a sturdy lip or rail at the front of each shelf which is capable of preventing the containers from being shaken off the shelves.
 - iii. Heavy items and containers of corrosive material (concentrated acid and alkali) should be stored on shelves near the floor.
- D. **Spill Response and Clean-up materials**- Every location where chemicals are stored should have available a supply of equipment and materials for use in the event of a chemical spill. A good rule of thumb is that the quantity of spill response material should be sufficient to handle a spill the size of two (2) of the largest container of material in storage.
- E. Spill response materials should include:
- i. Absorbent (granular or "pillows"). (see Section 3.7, "Chemical Spills/Releases", in this CHP);
 - ii. Personal protective equipment (Minimum: rubber gloves and protective eyewear);
 - iii. scoops and/or pans for picking up granular solids; plastic is recommended;
 - iv. plastic bags to contain contaminated absorbent (use heavy bags, such as "trash compactor" bags, white or clear);
 - v. permanent marker to use for labeling the bag of contaminated clean-up material.
6. Guidelines for Chemical Waste
- A. Chemical Wastes (hazardous waste) must be kept in closed, appropriately labeled containers which are in good condition.
- B. A correct **hazardous waste label** must contain 6 pieces of information:
- i. The label must bear the words "HAZARDOUS WASTE"
 - ii. The label must contain A DESCRIPTION OF THE WASTE:
 - i.) the **chemical name or common name** of the waste material (EPA and Cal Poly's Chemical Hygiene Officer is looking for recognized chemical or "material" names, not acronyms or abbreviations, and certainly **not** something like "RG-17 Waste" or "Fred's Waste" or merely the word "Waste".),
 - ii.) a statement of the **proportions of constituents**, if a mixture- percents, parts per million, molarity, etc.. An estimate of the proportions is OK, based on knowledge of the process that made the waste.
 - iii. The label must contain a STATEMENT OF WHAT THE HAZARD IS. This means the label must say the word(s) "TOXIC", "CORROSIVE" (Please specify acid or alkaline), "REACTIVE", "FLAMMABLE", and/or "COMBUSTIBLE" These are the ones which usually
 - iv. apply. There are a few additional characteristics less often encountered, such as radioactive waste.
 - v. The label must SAY whether the waste in the container is SOLID, LIQUID, or GAS.

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- vii. The label must contain the START DATE for that container of waste. That is the date when the first amount of the waste is added to the empty container. It is legal to specify the date when the empty waste container is put in place, even though the first drop of waste might not go in until a few days later.
- viii. The label must state the NAME AND ADDRESS OF THE GENERATOR. At Cal Poly this means: "CAL POLY STATE UNIVERSITY, SAN LUIS OBISPO, CA 93407". It is necessary for Cal Poly's record keeping functions to identify which department or program generated the waste in the container(s). It is also common for questions to arise about the nature of a specific hazardous waste, and the Environmental Health and Safety (Eh&S) Office needs to know who to ask.

NOTE: Campus departments need not wait for EH&S to arrive and attach such labels. These labels may be commercially printed labels or hand-made labels attached with tape or anything in between, and should be prepared and attached by the person who generated the waste.

- C. A frequently cited detail of hazardous waste handling concerns the containers themselves. The regulations require that hazardous waste **containers**:
 - i. be of sound construction and in good condition (not leaking). This means **not** using the oldest, rustiest, most beat-up container available in which to keep hazardous waste.
 - ii. be constructed of material compatible with the waste being stored. It is **NOT** O.K. to store something in a drum which will eventually eat a hole in the drum.
 - iii. be kept **CLOSED AT ALL TIMES** except when material is being added or removed. This means with an appropriate screw cap or bung screwed on tight enough not to leak if the container is inverted. A waste drum or bottle which is left open is a citable EPA violation.
 - iv. be kept in a secondary containment - a tray or outer container which will prevent leaking or spilled waste material from escaping (to land or water) or from coming into contact with nearby incompatible material.
- D. d. **Chemical Waste (Hazardous Waste) Removal Procedure-** If your department has no location specified for the accumulation of hazardous waste, such material can be picked up by an employee of the Environmental Health and Safety Office upon sufficient notification. The procedure for having hazardous waste picked up requires the disposing department/individual do at least **one (A or B)** of the following:
 - i. Place a telephone call to the Environmental Health and Safety Office (extension 6661 or 6662) and be prepared to provide the following information:
 - ii. the trade name and manufacturer (if known) of the material
 - iii. the chemical constituents of the material (if not discernible from the trade name)
 - iv. the size(s) of the container(s)
 - v. the number of containers

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or

- vi. Send to the Environmental Health and Safety Office a filled out form ("Hazardous Waste Pick-up/Disposal Request) detailing the nature and quantity of the waste.

A request to pick up hazardous waste may also be made electronically by accessing the form found on the internet at <http://www.afd.calpoly.edu/ehs/hazwastepickup.asp>

NOTE: All containers of hazardous waste must be kept in closed, non-leaking containers to comply with hazardous waste management regulations and to allow for the safe transport of containers without having waste material leak into the vehicle or onto the roadway.

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7. Chemical (Hazardous Material) Spills/Releases Cleanup Procedures

Notes and Precautions: The range and quantity of chemicals in the laboratory requires pre-emergency planning to respond safely to chemical spills. The cleanup of a chemical spill should be done only by workers who are familiar with the material and its hazards. Chemical spill cleanup guidance and instructions are available from the Environmental Health and Safety Office, extension 6661 or 6662. In this section, the terms “chemical” and “hazardous material” are synonymous.

Emergency assistance, if you need it, can be reached by calling 911 on any campus telephone.

A. A MINOR CHEMICAL SPILL is a spill or release of hazardous material that **laboratory personnel are capable of handling safely** without the assistance of safety or emergency personnel. Usually, this is less than 1 liter, however if the material is toxic, produces a toxic or corrosive vapor, or circumstances change so that laboratory personal can no longer safely handle the situation (i.e. flammable material spill ignites). it becomes a MAJOR CHEMICAL SPILL.

Responding to a MINOR SPILL:

- i. Alert people in the immediate area of the spill.
- ii. If the spilled material is flammable, turn off all sources of ignition which may cause the spilled material to ignite.
- iii. Wear protective equipment appropriate for the spilled material and /or the location of the spill. Protective equipment includes, but is not limited to; eye/face protection, gloves (rubber and/or leather, as appropriate) and a lab coat, apron, or other “coverall” garment, boots or other impermeable shoe covers.
- iv. Avoid breathing any vapors, fumes, or dust from the spilled material.
- v. Confine the spill to as small an area as possible.
- vi. If the spill is a liquid:
 - a. Use appropriate absorbent material (sponge, spill pillow, spill pad or socks, disposable rags or towels, or granular absorbent) to absorb and/or pick up the spill. A list of common spill clean-up absorbents and their appropriate use follows this section.
 - b. Begin at the outer edges of the spill area, surround the spilled material and work toward the center.
 - c. Allow the liquid to be completely absorbed into the pick up material (absorbent).
 - d. Absorb (and neutralize, if appropriate and safe to do) the spilled chemical with effective and compatible spill cleanup materials.
- vii. If the spill is a solid
 - a. material can usually be picked up without the aid of an absorbent.

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- b. Collect the residue, used absorbent (if any), rinse water (if any), and any contaminated gloves, suits, etc. which are to be discarded.
- viii. Place all the spill clean-up material in a container(s) for disposal as hazardous waste. As a minimum, the container may be (temporarily) a heavy plastic bag, 4 mil thickness or more. "Trash Compactor Bags" are adequate and readily available.
- ix. Do not place hazardous chemicals or spill cleanup material from such a spill into the normal trash nor flush down the drain.
- x. Notify the Environmental Health and Safety Office of the spill cleanup and arrange for pick-up of the used absorbent and collected residues. See also Hazardous Waste Procedures, Sec. 3.7 for Hazardous Waste Removal Procedures.

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Table 1: Some Common Absorbents for Hazardous Material Spill Clean-up

Strikethrough type is used here only to emphasize spilled chemicals not to be absorbed into the indicated absorbent.

ABSORBENT MATERIAL:	USES:	LIMITATIONS:
common sand or soil	Works for organic and aqueous (water born) liquids. Moderate capacity. Usually inexpensive and available in large quantities.	NOT RECOMMENDED FOR: nitric, hydrochloric, sulfuric, or hydrofluoric acids. Heavy material - affects disposal cost and handling in large amounts
diatomaceous earth, "Superfine", kitty litter, etc.	Works for organic (oil) and aqueous (water born) liquids. Good capacity. Moderate weight	NOT RECOMMENDED FOR: hydrofluoric acid, hydrogen peroxide
sawdust, sweeping compound, "Sphagsorb", etc.	Works for Oil and Organic Liquids Light Weight	NOT RECOMMENDED FOR: aqueous (water born) liquids, acids, oxidizing materials
paper towels, sponges	Works for SMALL SPILLS of organic (oil) or aqueous (water born) liquids. Wear rubber gloves when using for Hazardous Material clean-up. May require disposing of used sponge as Hazardous Waste.	NOT RECOMMENDED FOR: concentrated acids (sulfuric, nitric, hydrochloric), oxidizing materials, spills containing sharps (broken glass)
Spill-Specific Absorbent Pillows, Socks, Granular Material (Many types are available.)	Follow Manufacturer's Instructions.	Designed for cleaning up spills of a <u>specific</u> chemical.

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- B. A MAJOR CHEMICAL SPILL- is spill or release of hazardous material that cannot be safely handled by laboratory personnel.** The steps below are best carried out by more than one person and should be done as quickly and safely as possible:
- i. Attend to injured or contaminated persons, if any, and remove them from exposure if you can do so safely without endangering yourself.
 - ii. Alert people in the laboratory to evacuate. Notify your supervisor/lab instructor immediately or as soon as safely possible. If necessary, initiate evacuation of the building (send someone door to door or pull fire alarm box).
 - iii. If the spilled material is flammable, turn off ignition and heat sources if you can do so safely without endangering yourself or others.
 - iv. From a **safe** but nearby location, call the Cal Poly emergency number 911, and tell the dispatcher who answers that you have a chemical emergency (and/or medical emergency, if any). The dispatcher will ask you for more information. Stay on the telephone until you are asked to hang up.
 - v. Close doors to the affected area. Until emergency help arrives, have someone stay nearby but in a safe location to warn away others who may wish to enter the area.
 - vi. Have a person knowledgeable of the incident and the laboratory stand by to assist by providing information to emergency personnel when they arrive.
- C. BIOLOGICAL SPILL-** see campus [Biosafety Program](#), Sec XI
- D. RADIOLOGICAL SPILL**
- i. In the case of a spill of radioactive material, immediately contact Environmental Health and Safety at extension 6661 or 6662, or the Emergency dispatcher at extension 911.
 - ii. Notify the Radiation Safety Officer in the Environmental Health and Safety as soon as possible at extension 6628.

8. Fire Emergency Procedure

- A. If there is a fire in your lab, immediately notify those nearby, e.g. YELL FIRE!
- B. Immediately evacuate the room (all occupants).**
- C. Close the door(s).
- D. Pull the nearest fire alarm box on your way out of the building.
- E. If there is no fire alarm pull box in the area, call **911** from a telephone at a nearby but safe location to report the fire. The dispatcher will ask you for more information. Stay on the telephone until you are asked to hang up.
- F. If you do use a fire extinguisher, call the Environmental Health and Safety at extension 6661 or 6662, soon afterwards to report the fire, even if the extinguisher's contents were only partially expended. This will allow a replacement extinguisher to be delivered as soon as possible. The rule of thumb is: A used extinguisher is the same as an empty extinguisher."

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9. Medical Emergency Procedure

- A. If someone in your area is injured or becomes ill, and it appears that **treatment or intervention by a medical professional (doctor, nurse, etc.) is required, call 911, the Cal Poly Emergency number**, and tell the dispatcher who answers that you have a medical emergency. The dispatcher will ask you for more information. Stay on the telephone until you are asked to hang up.
- B. If the injury is the result of contact with chemical(s), very hot or very cold liquid, or burning (flaming) material, **immediately flush the affected area with WATER ONLY -- faucet, eyewash, or shower as necessary, depending on location and area of injury --, and keep flushing for 15 minutes.**
- C. Further medical treatment (other than any first aid given immediately) or transport to the hospital, if needed, will be arranged by the police officer who will respond and/or the ambulance personnel if an ambulance is summoned.
- D. Laboratories and departments which use materials or processes which have the potential to cause serious physical harm such as, the potential for involvement in incidents requiring **treatment or intervention by a medical professional**, (doctor, nurse, etc.) should maintain a basic first aid equipment and materials, (see List of Basic First Aid Equipment and Materials below).

10. List of Basic First Aid Equipment and Materials:

- A. A Lab First Aid kit should contain at a minimum:
 - i. Sterile compresses or pads (commonly called 4 x 4 's) to stop bleeding (10 each)
 - ii. Band-aids – 1 inch wide (10 each). 1-inch band aids are more universal than ¾-inch size.

Note: INVENTORY THE FIRST AID KIT OFTEN. BANDAIDS WILL BE THE FIRST TO DISAPPEAR.

- iii. Rubber gloves (medical latex gloves) to be worn as needed by the care giver.

Note: Burn medication, ointment, spray, etc. is not included:

BURN MEDICATION – SPRAY OR OINTMENT – IS NOT RECOMMENDED IF THE VICTIM WILL BE GETTING FURTHER TREATMENT. Medical personnel – ambulance EMT and/or ER doctors - will treat a burn patient by first removing (scrubbing off) all First Aid burn medications that have been applied by first aid givers.

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- B. If the burn victim will be **getting further medical treatment** for the burn, recommended first aid for thermal burns (and completely decontaminated chemical burns) is:
 - i. sterile gauze or 4x4 pad (or other clean fabric)
 - ii. soaked in clean, room temperature water
 - iii. applied to the burn area.
 - iv. Seek medical attention promptly.
- C. A minor burn (heat burn) can be treated by running cold water over the burned area. The use of ice is not recommended as this can cause frostbite. Time recommended for cold applications (cold water straight from the tap) varies from 10 to 30 minutes or until the pain does not recur after the cold water is stopped.

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Appendix D: Compatible Chemical Storage Pie Chart

The pie chart on the next page (see below) illustrates one suggested plan for the correct storage of incompatible chemical materials. The plan depicted should be considered a starting point. There will always be refinements and special cases that will apply to a specific storage site.

The relative sizes of the wedges in this pie are not meant to determine how much room should be allowed for the listed categories. The sizes of the wedges in this pie are determined by the amount of text that appears in these wedges. The actual sizes of specific storage categories and locations will be determined by the amount and variety of material to be stored at a site.

The wedge labeled "OTHERS" indicates the possibility of storage categories which are more than / different than chemical categories. Examples are: radioactive material, biological material (animals or microorganisms), compressed gases, foodstuffs (not a hazardous material, but must be kept away from chemicals). These materials and others may require more than simple physical separation.

The **SHADED AREA (GRID)** indicates physical separation - as much as can be arranged in a given space. Separate rooms are ideal in many cases. The storage plan should be such that if most or all of the stored containers were to fall to the floor and break open, the resulting mixtures **would not** result in fire, explosion, or the generation of a hazardous gas. The accidental mixing of materials which would result in such undesirable reactions can be prevented by

- **distance** (keeping them far enough apart to prevent spilled material - usually liquids - from running together) and/or
- by using **secondary containment** (inserting a berm or wall or other barrier to keep incompatible materials - spills - from mixing. Storing bottles of chemicals in plastic tubs (restaurant "bus bins" work well) is an effective way to prevent accidental mixing and to simplify the clean up of a broken or leaking container. Be sure to restrain the bins that are on shelves, and heavy material (usually mercury) and very aggressive material (usually mineral acids) should be kept on a bottom shelf.

OPPOSITE WEDGES indicate storage which needs the greatest separation. These are things most unfriendly with each other (most likely to react violently) and need the most protection from accidental mixing.

Inert (non-reactive) material will undoubtedly be part of any chemical inventory. This category of material can be stored "between" categories of incompatible chemicals. This is one technique that will optimize a compatible storage plan in a storage location with limited space. There is no pie wedge for this category of Inert materials. Examples of Inert materials that can be stored next to almost anything are:

calcium chloride, diatomaceous earth (filter cel), ferric oxide, lead sulfate, magnesium sulfate, potassium iodide, heavy metal elements (copper, nickel, lead, tin, etc.) , sodium bicarbonate, sodium phosphates, etc.

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Note: There is no reactive category (compatible/incompatible) called "Toxic"

Note: Nitric Acid is an "Acid" and an "Oxidizer". Its location will be a judgment call.

Perchloric Acid and it's salts can react with so many other things that it merits storage by itself (dedicated containment).

Zinc metal is also not compatible with ammonium hydroxide

