HAZARDOUS MATERIALS MANUAL

HAZARDOUS MATERIALS MANUAL

AND
CHEMICALS HYGIENE PLAN

Policy for the safe use of hazardous materials and proper management of hazardous waste

Administered by the Manager of Environmental Health and Safety,
Facilities Management and Planning

Latest revision: 2009
Also available on-line at
http://www.unk.edu/offices/facilities/health_and_safety/index.php

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A. GENERAL INFORMATION

The safety and health of each person on campus; whether an employee, a contracted worker, a student or a visitor is of primary importance. Prevention of injuries and illnesses is one of the goals of UNK's Department of Environmental Health and Safety (EHS). The EHS Department strives to provide appropriate instruction on standards for personal safety and health. The Department encourages prudent and generally accepted safe handling practices for the use of hazardous materials. We promote safe storage of hazardous materials and proper management of hazardous waste. The University is also committed to careful stewardship of the environment and excellence through compliance with all applicable laws and regulations. The University strives to continually improve environmental protection and pollution prevention.

The Hazardous Materials (Haz Mat) Manual is an integral part of the Injury and Illness Prevention Plan (Workplace Safety Plan) at the University of Nebraska at Kearney (UNK). The Hazardous Materials Manual supplements the UNK Injury and Illness Prevention Plan by providing specific standards applicable to hazardous materials and hazardous waste. The UNK Injury and Illness Prevention Plan (Workplace Safety Plan) is provided in Appendix A1 of this Hazardous Materials Manual.

This Hazardous Materials Manual serves as UNK's Chemical Hygiene Plan for campus laboratories. This Hazardous Materials Manual expands on the applicability of chemical hygiene concerns to include requirements pertinent to all users of hazardous materials on campus, such as service and maintenance areas.

The requirements of this Hazardous Materials Manual apply to all UNK personnel, including faculty and staff who use or work in areas containing hazardous materials. Compliance with this Hazardous Materials Manual is a requirement of the Injury and Illness Prevention Plan. UNK frequently contracts with private companies to do work on campus. Appendix A2 provides guidelines for contracts involving waste and known hazards.

1. INTRODUCTION

This Hazardous Materials Manual provides campus individuals with UNK's standards and policies for the safe use and storage of hazardous materials and the proper management of hazardous wastes. This Hazardous Materials Manual was developed in order to achieve the following goals:

1. Provide protection to personnel, property and the environment;

2. Ensure compliance with environmental regulations; and

3. Encourage prudent and generally-accepted safe-handling practices.

a. Summary of Contents

To provide the guidance necessary to support these goals, this Hazardous Materials Manual is comprised of four sections. Each section is subdivided into subsections, each pertaining to a specific health and safety topic.

Part A: General Information contains a statement by the Chancellor regarding the expectations for compliance with this Hazardous Materials Manual. Part A also lists the responsibilities of campus individuals with respect to achieving a safe working environment at UNK. Part A includes definitions of terminology and the regulatory requirements that form the basis of this Hazardous Materials Manual.

Part B: Hazardous Materials identifies types of hazardous materials and specifies safe-handling procedures to be followed by those using these materials. Part B lists requirements for the safe and compatible storage of hazardous materials, including container labeling standards. Part B also contains procedures for the purchase and distribution of hazardous materials and establishes a registration requirement for individuals who use or store acutely toxic chemicals.

Part C: Used and Excess Chemicals provides an overview of hazardous waste regulations and lists the regulatory requirements for persons who produce used, or have unwanted, chemicals. Part C includes UNK's plan for minimizing the generation of hazardous waste, procedures for the collection of hazardous waste from campus areas and procedures for the collection or disposal of common wastes (e.g., paints, batteries, and used oils).

Part D: Protection of Personnel, Property and the Environment lists requirements for providing safe working conditions through design standards and the use of safety and protective equipment. Part D contains the procedures for ensuring that personnel are informed of applicable chemical hazards. Part D also includes policies for emergencies involving hazardous materials and for monitoring personnel for exposures to chemicals.

To be able to distribute specific sections of this Hazardous Materials Manual to users as needed, some procedures are provided in appendices. Several of these appendices are designed to be posted in convenient locations as quick references.

b. Updates and Formatting

Updates

Policies and guidelines are occasionally revised as the result of changes in regulations and in light of more prudent and practical procedures. Updates will be mailed to all recipients of this Hazardous Materials Manual and posted to the web site as necessary.

Updates will consist of the revised pages, an updated Table of Contents, and instructions for inserting the updates into this Hazardous Materials Manual.

A mailing list of those who have copies of the Hazardous Materials Manual will be maintained at the Facilities Management and Planning Office to help ensure that all manuals are updated as necessary. Please ensure that your name is on this mailing list if you make your own copy of the Hazardous Materials Manual. Your cooperation in keeping your Hazardous Materials Manual current is appreciated. A current copy of the Hazardous Materials Manual will be maintained at the Facilities Management and Planning Office for review.

Formatting

This Hazardous Materials Manual has been designed to be easily updated without reprinting the entire manual. Pages are numbered with the section letter and page number within that part (e.g., B-5 for page 5 of section B). Updated pages may include page numbers with letters (for example, B-5a for the page following B-5) if necessary to avoid reprinting the entire section. Each page will include a revision date. Appendices pertaining to each section within this Manual are included at the back. Each appendix is numbered according to the letter of the section in which it is discussed.

There is some overlap of information in this Hazardous Materials Manual (e.g., several procedures for hazardous materials also apply to the management of used chemicals.) In order to keep this Hazardous Materials Manual as short as possible, references are provided to other sections instead of duplicating the information. To eliminate errors resulting from outdated page numbers, references are made to the sections and section numbers, instead of to a page number. (Page numbers for the referenced section are found in the Table of Contents.)

June 18, 2002

To Faculty, Staff and Administration:

The University of Nebraska at Kearney is responsible for the health and safety of its community members. UNK also needs to comply with all applicable local, state and federal regulations. Because of the importance of providing a safe working environment, the administration requires employees at all levels to promote positive attitudes regarding safety, to incorporate safety into their work practices, and to cooperate fully in the development and implementation of safety programs, including those specified in the UNK Hazardous Materials Manual.

The handling of hazardous materials and the generation of hazardous wastes necessitate the cooperation of the entire UNK community in providing for safe use and appropriate disposal. The guidelines given in the UNK Hazardous Materials Manual are intended to provide the framework and structure necessary to ensure the University's full compliance with the spirit and letter of the regulations governing the transportation, storage, treatment, and/or disposal of hazardous materials and hazardous wastes.

The UNK Hazardous Materials Manual has been provided to department chairpersons, division supervisors, and others in charge of areas where hazardous materials are used or stored. The Manual is also available on the web at http://rip.physics.unk.edu/hazmat/ Employees at all levels are expected to comply with regulations that govern their specific work activities. Persons who refuse to comply with these UNK policies will be reprimanded in accordance with UNK procedures regarding unsatisfactory performance.

There are many wastes generated at UNK that must not go to the local landfill. Flammable substances, corrosive substances and poisons are general categories of hazardous wastes. A detailed description of what is hazardous waste is given in the Manual, however, examples include: unwanted paint and many paint-related materials, many laboratory chemicals, mercury thermometers, mercury-containing lamps such as fluorescent lamps, electronic equipment containing circuit boards with lead and/or silver, batteries containing lead, cadmium, silver or mercury, and aerosol cans.

Your cooperation in implementing these requirements is appreciated. I know you will all work hard to achieve the goals of the Hazardous Materials Manual.

Sincerely,

Douglas Kristensen
Chancellor

3. REGULATORY BASIS

a. Applicable Regulations

The policies within this Hazardous Materials Manual are modeled after universally accepted and prudent safety practices, as well as after several applicable federal (and associated state) regulations.

Occupational Safety and Health Administration (OSHA)

This Hazardous Materials Manual has been written to meet the intent of regulations pertaining to employee occupational health and safety with respect to hazardous materials. These regulations are found in Title 29 Code of Federal Regulations (29 CFR) Sections 1910.1200 - *Hazard Communication Standard*, and 1910.1450 - *Laboratory Standard*, issued by the U.S. Occupational Safety and Health Administration and associated Nebraska Department of Labor requirements. (Researchers who receive federal funding are required to fully comply with 29 CFR 1910 as a condition for receiving these grant funds.)

Environmental Protection Agency (EPA)

This Hazardous Materials Manual has also been written to meet all regulatory requirements pertaining to hazardous waste treatment, storage and disposal. These regulations are found in Title 128 - Rules and Regulations Governing Hazardous Waste Management, administered by the Nebraska Department of Environmental Quality (NDEQ), and in Title 40 Code of Federal Regulations (40 CFR) Parts 260 through 271, issued by the U.S. Environmental Protection Agency.

National Fire Protection Association (NFPA)

All procedures in this document that relate to the use and storage of flammable liquids and fire protection adhere strictly to the rules of the Nebraska Fire Marshal's Office.

b. Availability of Regulations

All federal, state and local regulations relating to procedures in this document are available for review through UNK's Environmental Health and Safety office.

4. RESPONSIBILITIES OF CAMPUS PERSONNEL

a. Administrators

Each campus unit (academic, administrative, research and service areas) involved in the use of hazardous materials is responsible for the implementation of this Hazardous Materials Manual within all areas under its administrative control. Overseeing these functions will be the responsibility of the campus unit's department head, chair, manager or supervisor. Working jointly with the Environmental Health and Safety office, these individuals are responsible for ensuring the implementation of this Hazardous Materials Manual as it pertains to their area.

Chancellor

The UNK Chancellor has the overall responsibility for ensuring that hazardous materials policies are developed and implemented throughout the UNK campus. The Chancellor is also responsible for ensuring that sanctions are placed on those not following UNK policies.

Vice Chancellors

Vice Chancellors are responsible for implementing programs that satisfy the requirements of this Hazardous Materials Manual within their reporting units.

Deans and Directors

In this document, the term "Deans and Directors" refers to all persons serving as deans of colleges or directors of college-equivalent units. The deans and directors are responsible for implementing programs that satisfy the requirements of this Hazardous Materials Manual. The deans and directors are also responsible for monitoring compliance with the unit program and for allocating adequate resources for program development.

Unit Administrators

In this document, the term "Unit Administrators" refers to all persons serving as chairpersons of departments, directors of schools or college sub-units, or supervisors of service departments/units. Each of these persons is responsible for the following:

1. Implementing a program within their reporting unit that satisfies the requirements of this Hazardous Materials Manual.

2. Appointing, where applicable, a unit safety committee to facilitate compliance with the unit program. If no such committee is appointed, the unit administrator or his/her designee (with appropriate credentials) shall act in the capacity of the unit safety committee.

3. Ensuring that all principal investigators, faculty, and staff members using hazardous materials are qualified by training or experience and have available the equipment and facilities for handling the materials safely.

4. Identifying and correcting problems in areas not complying with this Hazardous Materials Manual.

5. Ensuring the compliance of unit personnel with all regulations pertaining to hazardous waste.

6. Cooperating in the investigation and reporting of all accidents.

7. Including in their budget requests those resources necessary to comply with this Hazardous Materials Manual.

8. Encouraging the development of practices and procedures that promote waste minimization, the use of safer methods, and the continual improvement of current practices and procedures.

Principal Investigators and Supervisors

Prior to the use of hazardous materials in a work area, supervisors must ensure that all students and employees involved in the work area have received the required instruction and training in the handling of these materials. Supervisors are also responsible for monitoring the workplace activities to ensure adherence to all prescribed safety precautions.

Wherever possible, hazardous materials should be replaced with non-hazardous analogs. If hazardous materials must be used, the user must be informed of the potential hazards and safety practices required to eliminate or reduce the risk of exposure.

In addition, these persons are responsible for the following:

1. Preparing, if necessary, a written project specific safety plan prior to the use of any hazardous material not covered in an existing safety plan, and providing copies of the plan and training to all persons working or studying under their supervision on such projects.

2. Maintaining an inventory of all chemicals being used or stored in their laboratory or workplace as described in this Hazardous Materials Manual.

3. Ensuring the timely and periodic removal of excess or unwanted chemical materials to avoid potential regulatory violations related to hazardous wastes.

4. Ensuring, in consultation with EHS, that appropriate documented disposal

practices are in place for all wastes generated within a work area.

5. Ensuring the accurate maintenance and accessibility of records pertaining to waste generating activities for a minimum of five (5) years.

6. Evaluating, in consultation with the Safety Committee, potential chemical exposures; and, selecting appropriate administrative and engineering controls to minimize chemical exposures and promote safety.

7. Supervising the safety performance of persons working or studying under their supervision.

8. Arranging for immediate medical attention and reporting any accident that results in exposure of personnel or discharge of a hazardous material to the environment.

9. Cooperating in any applicable program of medical surveillance as deemed necessary by the University.

10. Assisting in the investigation of accidents.

11. Investigating and reporting problems pertaining to administrative and engineering controls necessary for minimizing exposures to chemicals.

12. Investigating and implementing all reasonable measures to support waste minimization efforts.

13. Ensuring that no treatment or disposal of hazardous materials occurs in any area for which they are responsible without the prior written consent of the EHS office.

14. Ensuring that appropriate placards are installed in all work locations.

b. Environmental Health and Safety

The Environmental Health and Safety (EHS) office is responsible for the management of chemical disposal programs at UNK. In partial fulfillment of this responsibility, EHS prepared this Hazardous Materials Manual and will oversee its adoption and implementation throughout the campus community. EHS will update this Hazardous Materials Manual as necessary and provide supplemental information and direction to appropriate supervisors. The EHS Manager is designated as the Chemical Hygiene Officer (CHO) and assumes the responsibility for carrying the chemical hygiene elements of this Hazardous Materials Manual to the campus.

Vice Chancellor for Business and Finance

The UNK Vice Chancellor for Business and Finance is responsible for the overall administration of the UNK program for the use of hazardous materials and the disposal of hazardous wastes. The Vice Chancellor is responsible for determining the resources required to support and comply with this Hazardous Materials Manual and will recommend appropriate University budget allocations to the Chancellor.

Environmental Health and Safety

The Environmental Health and Safety office is a functional unit within Facilities Management and Planning and is supervised by the Director of that office. The EHS is responsible for administering the programs necessary to ensure the safe and legal management of hazardous materials use and hazardous waste disposal. The EHS is responsible for maintaining and updating UNK policies to ensure compliance with the requirements of the various regulatory agencies, and for providing specific direction to the campus community. EHS staff members are charged with the responsibility of ensuring that incidents of noncompliance are corrected and with reporting these problems to the respective supervisors.

The Environmental Health and Safety office consists of the position of Hazardous Materials Technician and the Manager of Environmental Health and Safety. The EHS is responsible for managing and/or performing the following specific activities, as well as any other activities deemed necessary to maintain compliance with federal, state, local regulations and UNK policies:

1. Establishing, supervising, and maintaining an overall program for the handling and disposal of hazardous wastes.

2. Monitoring work in response to requests from concerned faculty or staff members with regard to potential or actual hazardous materials, or as part of the periodic review of compliance with the Hazardous Materials Manual.

3. Advising the campus community of current federal, state and local regulations governing the use of hazardous materials and disposal of hazardous wastes.

4. Providing leadership and assisting in the preparation of educational programs, unit and lab safety plans, and training programs.

5. Assuring that approved safety plans are on file for each unit that uses, stores, or disposes a substance covered by this Hazardous Materials

Manual.

6. Providing for the off-site, legal disposal of hazardous wastes generated by UNK through EPA-permitted, hazardous waste disposal facilities.

7. Collecting used or excess chemical materials from all University locations and transporting them to centralized campus accumulation areas.

8. Making "hazard" determinations and assigning appropriate storage classes based upon compatibility characteristics of chemicals collected for disposal.

9. Preparing or supervising the preparation of hazardous waste manifests and signing necessary documents.

10. Managing, maintaining and preparing all necessary records, reports, permits and documents as required by federal, state and local regulations.

11. Investigating all accidents, spills or releases involving hazardous materials, and providing guidance for clean-up.

12. Responding to and assisting with emergencies involving hazardous materials.

13. Acting as a liaison between UNK and federal, state and local regulatory agencies.

c. Faculty, Staff and Students

It is the responsibility of each faculty and staff member and of each student to follow and observe all appropriate practices and procedures contained in this Hazardous Materials Manual, including required attendance at training sessions and the reporting of unsafe conditions to their supervisor.

The responsibilities of all UNK faculty, staff and students are as follows:

1. Observing and adhering to approved chemical handling and disposal practices.

2. Ensuring, to the extent required by the supervisor, the maintenance of accurate records with regard to waste generating activities.

3. Reporting immediately leaks, spills and accidents involving hazardous materials by contacting the University Operator ("0") or "911," if

necessary. Implementing pre-determined emergency response plans.

4. Cooperating in any applicable program of medical surveillance as mandated by the University.

5. Assisting University organizations involved with the investigation of accidents.

6. Ensuring that work areas are clean and uncluttered.

7. Reading, understanding and observing all applicable unit, laboratory and University safety policies and procedures.

d. Chain of Command

If situations arise where the requirements of this Hazardous Materials Manual are not being implemented in the work area, or if unsafe working conditions are observed, it is the duty of the person aware of such situation to report the matter to their supervisor. The supervisor is expected to investigate, notify the EHS and correct any problems within a reasonable period of time. Situations posing imminent danger to human health or the environment must be reported immediately to the first-line supervisor and to the EHS personnel.

If the problem is not addressed in a timely manner, or if the remedy of the problem can not be agreed upon between the person and their supervisor, the EHS will notify the Vice Chancellor for Business and Finance for appropriate resolution.

5. DEFINITIONS OF TERMS

The following definitions of terms apply when used in this Hazardous Materials Manual unless further defined elsewhere in this Manual. A list of common acronyms is provided in Appendix A3 of this Manual.

Excess Chemicals means chemicals for which there is no expected future use in a work area. Examples include chemicals that are no longer used in laboratory processes, chemicals that have been abandoned by a former professor or employee, and pesticides that are banned from use. The EHS office will determine whether excess chemicals are *hazardous wastes*.

Hazard Information means both the physical and health hazards of a chemical. A chemical presents a physical hazard if it is flammable, reactive, a compressed gas, explosive, organic peroxide, pyrophoric, or an oxidizer. A chemical presents a health hazard if it is corrosive, toxic, a carcinogen, an irritant, or a sensitizer.

Hazardous Material means any substance capable of posing a risk to human health, the environment, and/or property. Hazardous materials include chemicals for which there is statistically significant evidence that acute or chronic health effects may occur in exposed individuals. In addition, hazardous materials are defined as such by several regulatory agencies and councils. Hazardous materials are described in more detail in Section B of this Hazardous Materials Manual.

Some hazardous materials (e.g., radiological substances, biohazards, controlled drugs) may be subject to other UNK policies. In general, the use, storage, and disposal of these materials are not governed by this Hazardous Materials Manual until such time as the materials are determined to be hazardous wastes by the EHS (unless such substances demonstrate a hazardous characteristic in conjunction with a radioactive, biohazard, or controlled drug component).

Hazardous Waste means any material that is recycled, inherently waste-like, disposed of, accumulated, stored, treated or used in a manner constituting disposal, and that meets the definition of solid waste and is "hazardous" as defined in Title 128 or 40 CFR Part 261. Wastes are defined as "hazardous" if specifically listed as such, or if a hazardous characteristic is exhibited, as defined by regulation. Lists and characteristics of hazardous waste are described in more detail in Section C, *Overview of Hazardous Waste Regulations*, of this Hazardous Materials Manual.

Hazardous Waste Discharge or Release means the accidental or intentional spilling, leaking, pumping, pouring, emitting, emptying, or dumping of hazardous waste into or on any land or water.

Hazardous Waste Disposal means the discharge, deposit, injection, dumping, spilling, leaking, or placing of any hazardous waste into or on any land or water so that such hazardous waste constituent thereof may enter the environment or be emitted into the air

or discharged into any waters, including groundwater. **The disposal of hazardous waste by employees and students is strictly prohibited.**

Hazardous Waste Generator means a person or institution that produces a hazardous waste or first causes a material to become a regulated hazardous waste. The EHS fulfills many of the regulatory requirements for hazardous waste generators. Campus personnel and students are required to fulfill the remaining requirements, which are described in this Hazardous Materials Manual.

Hazardous Waste Treatment means any method, technique or process, including neutralization, designed to change the physical, chemical or biological character or composition of any hazardous waste so as to neutralize such wastes, or to recover energy or material resources from the waste, or to render such waste non-hazardous, or less hazardous, or safer to transport, store, or dispose, or amenable to recovery, storage, or reduction in volume. **The treatment of hazardous waste (including evaporation, dilution, drying and chemical destruction) by employees and students is strictly prohibited.**

Permissible Exposure Limit (PEL) means the airborne concentration of a substance in the workplace that is considered a safe level of exposure for an 8-hour shift, 40 hours per week, as established by OSHA.

Solid Waste means a discarded material that is abandoned, recycled, or inherently waste-like. A solid waste is abandoned if it is burned or incinerated, or if it is accumulated, stored or treated before or in lieu of being abandoned by being disposed of, burned or incinerated.

Short Term Exposure Limit (STEL) means the employee's 15-minute time weighted average exposure which shall not be exceeded at any time during a work day, as established by OSHA.

Source Reduction means the reduction or elimination of hazardous waste at the source, usually within a process. Source reduction measures include process modifications, feedstock substitutions, improvements in feedstock purity, housekeeping and management practices, increases in the efficiency of machinery, and recycling within a process. Source reduction implies any action that reduces the toxicity or the amount of waste exiting a process.

Threshold Limit Value (TLV) means the airborne concentration of a substance under which it is believed that nearly all workers may be repeatedly exposed, day after day, without adverse effects.

Time Weighted Average (TWA) means the employee's average airborne exposure in any 8-hour work shift of a 40-hour week which shall not be exceeded, as established by OSHA.

Used Chemicals means chemicals that have been through a process and, as a result, are no longer usable. Examples include a solvent that has been used to clean an item, paint thinner that has been used to clean brushes and a chemical that has been used in a laboratory procedure.

Waste Minimization means the reduction, to the extent feasible, of any solid or hazardous waste that is generated or subsequently treated, stored or disposed. It includes any source reduction or recycling activity undertaken by a generator that results in: (1) the reduction of total volume or quantity of hazardous waste; (2) the reduction of toxicity of hazardous waste; or (3) both, as long as the reduction is consistent with the goal of minimizing present and future threats to human health and the environment.

Universal waste means certain wastes such as batteries containing lead, acid, cadmium, or silver; pesticides that have been recalled, suspended, canceled or banned; thermostats containing mercury; and mercury containing fluorescent lamps. These wastes must be managed in accordance with the Nebraska Department of Environmental Quality, Title 128 Chapter 25.

B. HAZARDOUS MATERIALS

The term "hazardous material" is commonly used to designate a substance as a potential health hazard or to categorize a chemical into a specific listing for regulatory purposes. For the purposes of this Hazardous Materials Manual, the term "hazardous materials" also means chemicals for which there is statistically significant evidence that acute or chronic health effects may occur in exposed individuals or any chemicals identified in the following sources:

- OSHA, 29 CFR Part 1910 Subpart Z, Toxic and Hazardous Substances. This list is provided in Appendix B1 of this Hazardous Materials Manual.
- ACGIH (American Conference of Governmental Industrial Hygienists), Threshold Limit Values for Chemical Substances and Physical Agents in the Work Environment.
- NIOSH (National Institute for Occupational Safety and Health), The Registry of Toxic Effects of Chemical Substances (RTECS).
- EPA, 40 CFR Part 261 - Listed Hazardous Wastes and Characteristics of Hazardous Wastes.

1. IDENTIFICATION AND SAFE-USE PRACTICES

a. General Identification

In most cases, the label on a chemical container will indicate if the chemical is a health hazard. Look for key words such as "CAUTION," "HAZARDOUS," "TOXIC," "DANGEROUS," "POISON," "IRRITANT," or "CARCINOGEN." Be aware, however, that almost any chemical, at certain concentrations, can be harmful to your health. Some chemicals also present a collective health and physical hazard. Keywords for physical properties include: "FLAMMABLE," "COMBUSTIBLE," "PYROPHORIC," "UNSTABLE," "WATER REACTIVE," OXIDIZER," or "ORGANIC PEROXIDE." These and other specific hazardous materials are discussed below.

b. Specific Hazardous Materials and Associated Handling Practices

The following types of hazardous materials are commonly recognized as requiring special handling and storage procedures. Information is presented only for types of materials. The Material Safety Data Sheet (see Section D of this Hazardous Materials Manual) must be consulted to determine hazards specific to individual chemicals. Where procedures are not specified for a hazard class, assume at a minimum that exposures must be prevented or minimized.

Flammables/Combustibles

Flammable and combustible materials are those which, under standard laboratory or other work area conditions, can generate sufficient vapors to cause a fire in the presence of an ignition source. Materials which generate sufficient vapors to ignite at temperatures below 100° F (38° C) are "FLAMMABLE," whereas materials, which require temperatures above 100° F, but below 200° F, to provide sufficient vapors for ignition, are "COMBUSTIBLE." (The temperature at which a vapor will ignite upon addition of a spark is termed the "flashpoint.")

Typical flammable liquids, by National Fire Protection Association (NFPA) ratings IA, IB, and IC, are provided in Appendix B2 of this Manual. Vapor trails from flammable liquids can rise, sink, or traverse horizontally to reach an ignition source, resulting in a flashback fire. Fire can also result from reactions between flammables or combustibles and oxidizers.

Procedures

- Flammable and combustible liquids used in the laboratory that are in glass containers shall not exceed 1 (one) liter unless the chemical purity must be protected. In that case, 4-liter quantities are permissible.

- Secure screw caps on containers immediately following dispensing. Do not dispense into beakers and allow to sit uncovered for longer than necessary. Flammable and combustible materials should be dispensed in a hood and used up in a reasonable time normally allotted for the particular activity.

- **Do not allow flammable liquids to evaporate in a fume hood as a means of disposal. This is specifically forbidden in the regulations.**

- Eliminate ignition sources such as open flames, hot surfaces, operation of electrical equipment, and static electricity from areas in which flammable or combustible materials are used or stored.
- Segregate flammables from oxidizing acids and other oxidizers.

- Refrigerators and freezers used for the storage of flammable and combustible liquids must be specifically designed for the storage of these materials. Ordinary refrigerators have been known to generate enough of a spark or heat sufficient to ignite flammable vapors. Flammable liquid refrigerators and freezers must be placarded as such.

- Ensure that there is proper bonding and grounding when transferring between metal containers or dispensing a flammable liquid from a large container or drum.

- Used flammable and combustible liquids should be kept in containers similar

to the original with an appropriate label giving the exact contents of the container.

Oxidizers

These chemicals are fire and explosion hazards when they come in contact with organic compounds or strong reducing agents.

Examples: perchloric acid, chromic acid and fuming nitric acid.

Procedures

- Oxidizers should be stored and used in glass containers with tight fitting screw-top lids.

- Oxidizers must be store away from organics, flammable materials, and reducers.

Corrosives

Corrosives are materials that destructively attack organic tissues (most notably the skin, but also mucous membranes and lungs if inhaled, or the stomach if taken internally). Corrosive chemicals are generally acids and bases, oxidizing agents, and some dehydrating agents.

Examples: acetic anhydride, acetic acid, bromine, hydrochloric acid, hydrofluoric acid, potassium hydroxide, nitric acid, sodium hydroxide, chlorine, and sulfuric acid.

Procedures

- Segregate acids from bases.

- Use bottle carriers for transporting bottles of corrosives.

- Store large bottles of acids on a low shelf or in acid cabinets.

- Corrosives react with the skin and are particularly damaging to the lungs and eyes. Therefore, personal protective equipment is important when working with corrosives. Neoprene gloves, a face shield, rubber apron, and rubber boots should be considered.

- Always add acid to water (never the reverse) to avoid violent reaction and splattering.

- Wherever corrosives are used or stored, be sure that a working safety shower and eyewash are readily accessible. Should there be contact between corrosives and any body tissue, particularly the eyes, immediately flush the

area of contact with cool water for fifteen (15) minutes. Remove all affected clothing and immediately get medical assistance.

Reactives

These chemicals can release energy quickly and forcefully, depending on various environmental conditions. In some cases the release of energy may result in a detonation. Some of the common classes of reactives, with examples and precautions for handling, are as follows:

Water-reactives

These chemicals react with water to form heat and flammable or explosive gases (hydrogen).

Examples: potassium and sodium metals and many metal hydrides, aluminum alkyls, acid anhydrides, and acid chlorides

Procedures

- Do not handle in the presence of water. Store in an area free from water contact and be especially careful in humid weather. Check all apparatus and water hoses for potential leaks.

- Use dry sand to smother fire.

Pyrophorics

In contact with air, these chemicals ignite spontaneously.

Examples: finely divided or activated magnesium powder, activated zinc dust, phosphorus, and metal alkyls.

Procedures: Store and use in inert environments.

Peroxide-formers

Organic peroxides are a class of compounds with unusual stability problems and, as such, are one of the most hazardous classes of chemicals regularly handled in the laboratory. Many common laboratory chemicals can form peroxides when exposed to air, so even opening the container to remove some of its contents can allow the formation of peroxides to take place. Some compounds form peroxides, which are violently explosive in concentrated solutions or as solids. Others are polymerizable unsaturated compounds

which can initiate a runaway, explosive polymerization reaction.

Procedures

- Never allow peroxides to become dry through evaporation.
- Store all peroxide-forming compounds away from heat and light.
- Protect peroxides from physical damage and ignition sources.
- Maintain a record of all peroxide-forming compounds present in the area; including the date of receipt and the date the container was first opened.
- Arrange for the disposal or test all peroxide-forming chemicals within the recommended timeframe. Appendix B3 of this Manual provides specific examples of common chemicals that present a serious hazard due to peroxide formation. Time limits from the date when the original container is first opened are given as guidelines for testing or discarding of these compounds.

Shock-sensitive materials and Explosives

Shock-sensitive materials are capable of exploding when subjected to shock or friction. Extreme care must be taken when handling these materials to avoid jarring or dropping the containers. In some cases, water must be added by prescribed methods in order to stabilize the chemical for transportation. A list of common shock-sensitive compounds is provided in Appendix B4 of this Manual.

Irritants

Irritants are materials that cause inflammation of the body surface with which they come in contact. The inflammation results from concentrations far below those needed to cause corrosion.

Examples: alkaline dusts and mists, hydrogen fluoride, ammonia, nitrogen dioxide, arsenic trichloride, ozone, halogens, hydrogen chloride, and phosphorus chloride.

Irritants can also cause changes in the mechanics of respiration and lung function.

Examples: acetic acid, halogens, acrolein, sulfur dioxide, formaldehyde, sulfuric acid, formic acid.

Long-term exposure to irritants can result in increased mucous secretions and chronic bronchitis.

Primary Irritant

A primary irritant exerts no systemic toxic action, either because the products formed on the tissue of the respiratory tract are non-toxic or because the irritant action is more severe than any systemic toxic action.

Example: hydrogen chloride.

Secondary Irritant

A secondary irritant's affect on mucous membranes is overshadowed by a systemic affect resulting from absorption. Exposure to a secondary irritant can result in pulmonary edema, hemorrhage, and tissue necrosis.

Examples: aromatic hydrocarbons, and hydrogen sulfide.

Asphyxiants

Substances that can cause unconsciousness or death by suffocation are called asphyxiants. Those which have no other effects are sometimes called simple asphyxiants. Examples include carbon dioxide, nitrogen, helium, and nitrous oxide. They work by displacing so much oxygen from the ambient atmosphere that the hemoglobin in the blood can not pick up enough oxygen from the lungs to fully oxygenate the tissues. As a result, victims slowly suffocate. Asphyxiation is an extreme hazard when working in enclosed spaces. Be sure you are trained in confined space entry before working in steam tunnels and mechanical rooms.

Chemical asphyxiants render the body incapable of maintaining an adequate oxygen supply. They are active at very low concentrations (few ppm). Examples include carbon monoxide, and cyanides.

Primary Anesthetics

Primary anesthetics have a depressant affect upon the central nervous system, particularly the brain.

Examples: alcohols, and halogenated hydrocarbons.

Sensitizers

A sensitizer causes a majority of the exposed population to develop an allergic reaction in normal tissue after repeated exposure to the chemical. The reaction may be as mild as a rash (contact dermatitis) or as serious as anaphylactic shock.

Specific Toxins

Hepatoxins or hepatotoxins

Hepatic means "pertaining to the liver." Hepatitis is inflammation of the liver. Hepatotoxic agents cause damage to the liver usually as a result of chronic exposure. Liver disorders are sometimes marked by jaundice, a yellowish coloration to the whites of the eyes and skin.

Examples: carbon tetrachloride, nitrosamines, and tetrachloroethane.

Nephrotoxins

Nephrotoxic agents damage the kidneys. Inflammation of the kidneys is called nephritis. Something that pertains to the kidneys is called nephritic or renal. Besides causing direct damage to kidneys, nephrotoxins can worsen or aggravate other conditions such as diabetes, hypertension (high blood pressure), and cardiovascular (heart) disease.

Examples: halogenated hydrocarbons such as carbon tetrachloride and chloroform and heavy metals such as lead, cadmium and mercury.

Neurotoxins

Neurotoxic agents damage the nervous system. The nervous system is especially sensitive to organometallic compounds and certain sulfide compounds. Both acute and chronic (short and long-term) exposure to certain organic chemicals can cause a variety of health problems including central nervous system depression, heart attack, unconsciousness, coma and death.

Examples: carbon disulfide, organic phosphorus, insecticides, tetraethyl lead, manganese, thallium, methyl mercury, and trialkyl tin compounds.

Hematotoxins

Some toxic agents act on the blood or hematopoietic system. The blood cells can be directly affected or the bone marrow can be damaged.

Examples: aniline, nitrobenzene, benzene, toluidine, and nitrites.

Carcinogens

A carcinogen commonly describes any agent that can initiate or speed the development of malignant or potentially malignant tumors, malignant neoplastic proliferation of cells, or cells that possess such material.

Examples: benzene, ethylene oxide, chloroform, formaldehyde, and ethylene amine.

Select Carcinogens

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

- Regulated by OSHA as a carcinogen.
- Listed under the category "known to be carcinogenic" in the National Toxicology Program (NTP), "Annual Report of Carcinogens."
- Listed under Group 1, "carcinogenic to humans" by the International Agency for Research on Cancer Monographs (IARC).
- Listed under Group 2A or 2B by the IARC or under the category "reasonably anticipated to be carcinogenic" by the NTP and causes statistically significant tumor incidence in experimental animals, according to 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 doses of less than 10 mg/m3.
    - After repeated skin application of 300 mg/kg of body weight per week.
    - After oral doses of less than 50 mg/kg of body weight per day.

There are numerous chemicals that are classified as carcinogenic. It is important to designate appropriate areas for the storage and use of these toxic chemicals. Development of appropriate decontamination procedures in the laboratory is also necessary. It is also important to post appropriate signage. The EPA-listed carcinogens are given in Appendix B5 of this Manual.

Reproductive Hazard

Chemicals that increase the potential for mutation (mutagens) or tend to cause developmental malformations (teratogens) need to be controlled with specific procedures. Elimination of potential ingestion, inhalation, and skin contact is important. Follow standard laboratory safety practices listed throughout this Manual, including training and information about the specific chemical involved.

The term "reproductive hazard" means substances that affect the reproductive capabilities, including chromosomal damage (mutagens) and effects on the fetus (teratogens).

Mutagens

A mutagen affects the chromosome chains of exposed cells. The effect is hereditary and

becomes part of the genetic pool passed on to future generations.

Teratogens

A teratogen (embryotoxic or fetotoxic) agent interferes with normal embryonic development without damage to the mother or lethal effect on the fetus. The effects are not hereditary.

Acutely-toxic

Acutely toxic chemicals are substances falling into the following categories:

- A chemical that has a median lethal dose (LD50) of 50 milligrams or less per kilogram of body weight, when administered to albino rats weighing 200g to 300g each.

- A chemical that has a median lethal dose (LD50) of 2000 milligrams or less per kilogram of body weight, when administered by continuous contact for 24 hours (or less, if death occurs within 24 hours) to the bare skin of albino rabbits weighing between two and three kilograms each.

- A chemical that has a median lethal concentration (LC50) in air of 200 parts per million or less by volume of gas or vapor or 2 milligrams or less per liter of mist, fume, or dust when administered by continuous inhalation for one hour (or less, if death occurs within one hour) to albino rats weighing 200g to 300g each.

Cholinesterase Inhibitors

Workers using pesticides need to be aware of the procedures for personal protection when using these chemicals. Always follow the recommendations of the MSDS or container label.

Procedures for Acute Toxics

- Work with acute toxic chemicals needs to be restricted to employees who have been specifically trained to work with these chemicals.

- These chemicals should be used within designated areas in minimum quantities. Prior approval is required by supervisory personnel.

- Acute toxic chemicals need to be stored appropriately and securely.

- Always refer to the MSDS for information on personal protection and containment devices.

- Identify work areas with signs.

Compressed Gases

There are over 500 kinds of gases available in compressed gas cylinders. Most of them are available in commercial or lecture size cylinders. The Compressed Gas Association publishes monographs for all aspects of operation and safety related to the design, valves, gauge fittings, and labels. Department of Transportation (DOT) regulations cover materials in transportation.

Procedures

- Inspect all cylinders upon delivery for valve protection and hydrostatic test date. The cylinder should indicate testing within the past 5 years.
- Do not remove the cylinder cap until the cylinder has been secured at the point of use.
- Be sure that the valve and fixture assembly are not damaged.
- Cylinders, full or empty, should be securely strapped in an upright position.
- Mark all empty cylinders as "empty."
- Do not roll cylinders or permit them to drop. Always transport them on a hand truck, firmly secured.
- Be especially careful with cylinders of corrosives (e.g., hydrogen chloride) as the entire valve can come off if improperly maintained.
- Provide training on the installation and use of fittings, valves, and regulator mechanisms.
- Should there be a suspected leak, it is suggested that all regulator valves be closed and the packing nut tightened. If the leak continues, the supplier should be notified and the following emergency procedures initiated:
    - If the leak is minor, secure the cylinder next to a fume hood.
    - If the leak is major, evacuate the building by pulling the fire alarm and call 911.

Mercury

Mercury is a poison that affects the central nervous system. The poisoning can be

progressive unless the mercury is removed from the environment.

Procedures

- Do not use mercury-containing instruments or elemental mercury in carpeted areas. Spilled mercury on carpet cannot be vacuumed.

- Always keep mercury in tightly closed containers and stored in secondary containment.

- Occasionally, mercury compounds are used in fungicides. These mercury compounds are likewise a long-term health risk and areas of application should be well ventilated before entrance.

c. General Safe-use Procedures

These general safe-use procedures are to be followed when working with any chemical. Following these procedures will help to maintain a safe working environment and to protect the health of individuals when handling chemicals.

- Keep an up-to-date and accessible inventory for each material stored and used in the laboratory.

- Know the general properties associated with the materials you are using. Always use the MSDS to determine chemical properties.

- An MSDS is required to be accessible for each chemical used/stored in the work area.

- Always wear appropriate personal-protection apparel, including eye protection, lab coat, and gloves.

- Conduct all processes that may result in the release of hazardous vapors or mists within a functional fume hood or other adequate containment device.

- Wear appropriate respiratory equipment when air containment concentrations cannot be sufficiently restricted by engineering controls. The EHS Department can help choose the appropriate respirator

- Review emergency procedures and ensure that necessary supplies and equipment for spill response are available in the workplace.

- Know the location of safety equipment such as the emergency shower, eyewash, fire extinguisher, fire alarm, and evacuation routes. Know the emergency phone numbers and have them posted near the telephone.

- Try to avoid working alone in the laboratory and/or leaving chemical processes unattended.

- Keep work areas clean and uncluttered. Make sure chemicals and equipment are properly labeled and stored. Good housekeeping prevents accidents.

- Do not eat, drink, smoke, apply cosmetics, chew gum, or store food, beverages, tobacco, cosmetics or medications in areas where laboratory chemicals are used or stored.

- Confine long hair and loose clothing when using chemicals. Always wear shoes. Do not wear sandals or open-toed shoes.

- Be very careful when smelling chemicals. Do not taste chemicals. Always use mechanical pipettes. Never use mouth suction.

- Handle and store glassware with care. Never use cracked or chipped glassware. Properly dispose of damaged or broken glassware in broken glass receptacles, not the trash container.

- Always wash hands and other exposed skin areas after using chemicals and before eating or drinking.

2. PURCHASING AND DISTRIBUTION

The ordering, receipt, storage, and use of chemicals at UNK is a common, daily activity. The procedures in this section are to be followed to prevent the over-purchase of chemicals, and to prevent accidents during receipt and distribution of chemicals. Department and/or units should develop additional procedures specific to their activities for inclusion in the Unit Safety Plan. The purchase of certain acutely toxic chemicals must be registered with the EHS office.

a. Ordering Chemicals

Good chemical management and safety practices begin with the purchase of chemicals. The following procedures can assist in ensuring responsible chemical procurement.

- Preplan all laboratory and work activities and carefully estimate the amount of each chemical required.
- Determine that adequate storage room is available.
- Ensure that adequate ventilation is available in the workplace for each chemical selected.
- **Check with the EHS office to see if the materials are available through the recycling program.**
- **Order chemicals in the smallest quantity necessary to fulfill the estimated need. Money saved by purchasing bulk quantities is often lost if the excess must be disposed of as a hazardous waste.**
- **Always check to determine if unused quantities can be returned to the manufacturer. (Pesticide manufacturers are particularly helpful in this regard.)**
- If adequate information is unavailable before ordering new or unusual chemicals, contact the manufacturer for necessary information.
- Request MSDSs from vendors when chemicals are ordered and forward copies to the EHS office when received.
- Prepare the work area for the arrival of the chemical (e.g., identify a proper storage location, ensure proper labeling exists on the container, post appropriate signs, obtain and check personal protective equipment).

b. Receipt and Distribution of Chemicals

- Observe all warnings on the package label. If the chemical is not properly labeled, or if the container appears to be damaged, do not accept the chemical. (Some persons who receive hazardous materials are required by the Department of Transportation to receive training. Contact the EHS office for more information.)

- Review and observe information on the safe handling and storage of the chemical.

- All carts for transporting chemicals should have side rails and wheels large enough to negotiate uneven surfaces. All out-of-door cart deliveries from one building to another must have two operators; one to manually operate the cart and one to assure the load is stabilized.

- All hand deliveries must be in shock-resistant carrying containers or buckets.

- Whenever possible, transport chemicals on freight-only elevators to avoid potential exposure to passengers.

- When transporting gas cylinders, use an appropriate hand truck and strap the cylinder down. Never drag or roll cylinders. Leave the valve cover cap on until the cylinder is located in its area of intended use.

- Do not leave carts with chemicals unattended in hallways or walkways.

- Do not stack boxed chemicals beyond two levels on a delivery cart.

c. Registration of Certain Acutely-Toxic Chemicals

Due to the strict regulation by EPA of some acutely toxic chemical wastes, registration with the EHS office is required in order to maintain compliance with these requirements. **Specifically, if more than 1 kilogram (about a quart) of P-listed chemicals is present on campus, UNK loses its "small quantity generator exemption" under the hazardous waste regulations. The loss of this exemption subjects UNK to several additional requirements, which increases costs to UNK.** P-listed chemicals are identified in Appendix C4.

The registration is a planning procedure to help the EHS office determine if the one-kilogram threshold will be exceeded. (The one-kilogram limit applies to the campus as a whole. Therefore, if five departments on campus each have 0.25 kilograms, the threshold has been exceeded.) Registration is required only for those chemicals on the EPA "P" list.

Campus personnel who use, store or wish to purchase these chemicals are required to complete the form found in Appendix B6 of this Hazardous Materials Manual. One form must be completed for each work area where the chemical(s) is used. The form must be submitted to the EHS office and updated whenever information on the form changes. The EHS office will request that updates be provided at least quarterly.

3. STORAGE

Due to the diverse properties of chemicals that may be located in a chemical use area, proper storage is necessary. General procedures for chemical storage are listed below, but are not all-inclusive. Instructions on chemical storage may be obtained from the MSDS, container label, or by contacting EHS. Specific procedures should be established for each work area.

a. General Storage Procedures

The following general procedures apply to the safe storage of chemicals:

- Ensure that all containers are in good condition, properly capped, and properly labeled. There should be no unlabeled containers. Unlabeled containers are considered to be wastes.

- Store incompatible chemicals separately. Chemicals should not simply be stored in alphabetical order without regard to compatibility. Segregate chemicals according to compatibility class to avoid reactions if the containers leak or break (see Compatibility below).

- Ensure that storage areas are dry and adequately ventilated. Do not store chemicals above eye level nor on the floor.

- Secure gas cylinders away from heat sources.

- Store highly reactive or corrosive liquids in spill trays.

b. Chemical Compatibility

Heat generation, fire, container corrosion, poison gas evolution, explosions and violent reactions can occur when incompatible chemicals contact each other. Knowledge of general incompatibilities and of the specific incompatibilities for a chemical is crucial for avoiding these reactions.

General compatibility classes are listed below. Specific incompatibilities for a chemical are usually provided on the MSDS. Examples of specific incompatibilities are provided in Appendix B7 of this Manual. Examples of potentially explosive combinations of common reagents are provided in Appendix B8 of this Manual.

A comprehensive means of classifying chemicals is given in "A Method for Determining the Compatibility of Hazardous Waste", EPA document number 600/2-80-076. This publication lists forty-one classes of chemicals by compatibility. A table, extracted from this reference, listing the classes and compatibilities is provided in Appendix B9 of this Manual.

Based on this information, eight general compatibility categories have been developed for use at UNK. Incompatibilities within those categories are broken down into storage classes. These compatibility storage classes are described below.

The compatibility storage classes are prioritized based on the potential for reaction and severity of the hazard posed (e.g., explosive chemicals will generally pose a more serious threat to human health than acids, and therefore have a higher priority). Chemicals that meet the definition of more than one compatibility storage class should be placed in the class having the highest priority. Each compatibility storage class includes a shorthand code that can be used as a quick method for marking containers or storage areas. A one-page summary of the compatibility classes, with associated storage class code, is provided in Appendix B10 of this Manual. (If codes are used, the summary in Appendix B10 or a key to the full name of the compatibility class must be posted in the area.)

Explosive and Shock-sensitive Storage Class

Explosive (EX) and Shock-sensitive (SS)

Example: dry picric acid

These should be isolated from all other chemicals.

Flammable/Combustible Liquid Storage Class

Flammable and combustible liquids are chemicals that have a flashpoint of 200° F or below. Five general groups of flammable/combustible liquids are listed below.

Flammable/Combustible Liquid - Organic Group One Materials (FL)

Alcohols, glycols, aldehydes, amides, esters, ethers, aromatic hydrocarbons, halogenated organics, ketones and aliphatic saturated hydrocarbons.

Examples: isopropanol, acetaldehyde, ethyl acetate, xylenes, acetone, hexanes, mineral spirits, paint thinners

Flammable/Combustible Liquid - Organic Group Two Materials (FL-2)

Aliphatic and aromatic amines, dithio-carbamates, carbamates, mercaptans and other organic sulfides, nitriles, organic nitro compounds, and unsaturated aliphatic hydrocarbons.

Examples: ethanolamine, ethyl mercaptan, acetonitrile, ethyl nitrate and butadiene

Flammable Combustible Liquid - Hydrazines (FL-HYZ)

Example: methyl hydrazine

Flammable/Combustible Liquid - Organic Acids (FL-A)

Examples: glacial acetic acid, propionic acid

Flammable/Combustible Liquid - Bases (FL-B)

Example: Base-bath solution (isopropyl alcohol and sodium hydroxide)

Flammable Solid Storage Class

Flammable Solids (FS)

These are powdered metals, water reactive metals, metal hydrides, and some organics.

Examples: powdered zinc, sodium metal, sodium hydride, calcium carbide, sodium hydrosulfite, sodium methacrylate

Oxidizer Storage Class

Chemicals that can supply oxygen or an analog to either initiate or enhance the combustion of other material.

Oxidizer - Inorganic Acids (OX-A)

Examples: nitric acid, sulfuric acid, perchloric acid, potassium dichromate, chlorine gas

Oxidizer - Basic and Other Inorganic Materials (OX-B)

Some chemicals that are stabilized with sodium hydroxide, nitrates, bromates, iodates, permanganates, and chlorates.

Examples: sodium hypochlorite (strong bleach), ammonium nitrate, silver nitrate, potassium permanganate

Oxidizer - Organic Materials (OX-O)

Examples: benzoyl peroxide, tetranitromethane

Acid Storage Class

Liquids having a pH less than 4, and solids, which if dissolved, would be acidic.

Acid - Inorganic (AC-I)

Example: hydrochloric acid, hydrofluoric acid, phosphoric acid

Acid - Organic (AC-O)

Example: acetic acid (non-glacial), formic acid, benzoic acid

Base Storage Class

Liquids having a pH greater than 9.5, and solids, which if dissolved, would be basic.

Base - Inorganic (BS-I)

Examples: sodium hydroxide, potassium hydroxide

Base - Organic (BS-O)

Cyanide and Sulfide Storage Class

Cyanide (CN) and Sulfide (SU)

Chemicals that can release toxic cyanide or sulfide gases if exposed to acidic conditions (i.e., pH below 7).

Examples: potassium cyanide, ferric sulfide

Poison Storage Class

Poison is the default class for chemicals not defined by another compatibility class.

Poison - Organic Group One Materials (PO-O)

Alcohols, glycols, aldehydes, amides, esters, ethers, aromatic hydrocarbons, halogenated organics, ketones, and aliphatic hydrocarbons.

Examples: ethylene glycol, glutaraldehyde, formamide, dichlorobenzene, quinone, petroleum oils, carbon tetrachloride

Poison - Organic Group Two Materials (PO-2)

Aliphatic and aromatic amines, dithio-carbamates, carbamates, mercaptans and other organic sulfides, nitriles, organic nitro groups, unsaturated aliphatic hydrocarbons, and all other miscellaneous organic and inorganic compounds.

Examples: amino acids, aniline, aldicarb, chloropicrin, linseed oil

Poisons - Inorganic (PO-I)

Inorganic poisons generally can be placed with either Group One or Group Two poisons.

Examples: sodium bromide, calcium chloride, sodium phosphate

The compatibility storage classes define types of chemicals that must be physically separated. Some chemicals are incompatible with almost everything, and should be stored alone.

c. Containment Units

Whenever possible, chemicals should be placed in containment units to prevent releases should a container spill or leak. Containment units can be in the form of trays, dish tubs, or even beakers for small containers. The containment unit must be compatible with the chemical stored within (e.g., use plastic containment for acids). All chemicals within a containment unit must be compatible with each other. Containment units should be able to contain 10% of the total contents, or the volume of the largest container, whichever is larger.

Containment units are relatively inexpensive when compared to the benefits received by preventing releases. Contact the EHS office if help is needed.

d. Special Storage Requirements

Flammable/Combustible Liquids

Flammable liquid storage cabinets must be provided when volumes above 4 liters and below 40 liters cannot be stored in an approved NFPA safety container. Volumes greater than 40 liters must be stored in a flammable liquid storage cabinet. Large quantities of chemicals must be stored in specifically designed rooms that meet health, safety, and fire regulations. Refrigerators used for the storage of chemicals must be designed to safely store flammable materials.

Peroxides

Since peroxide-forming chemicals become more unstable with time, indicate the date of receipt on each container of peroxide-forming chemical that is in storage. Check storage areas routinely to determine if any of these chemicals must be tested or disposed. (The timeframes for testing common peroxide-forming chemicals are provided in Appendix B3.)

4. CONTAINER LABELING

Chemical container labeling standards are needed to meet the following goals:

- To formulate and implement standards that are consistent with the intent of federal, state and local regulations governing workplace health and safety and hazardous waste management.

- To minimize UNK's liability for accidents that could arise from a failure to implement commonly accepted safety standards.

- To minimize disposal problems and costs that result from incomplete labeling of chemicals.

a. Applicability

The chemical container labeling standards apply to all units at UNK. All non-exempt chemical containers must be labeled in accordance with these standards.

Although an attempt has been made to include all commonly encountered labeling scenarios, it is expected that some situations will not fit the defined categories. In these situations, it is recommended that the unit contact the EHS office to evaluate the labeling problem and approve a site-specific labeling scheme that meets the intent of the standards without creating an unnecessary burden on the unit.

Exemptions

The following chemical containers are exempt from these labeling standards:

- Consumer products to the extent that such chemicals are used in a manner consistent with normal consumer usage and are labeled as follows:

    - Permanent containers are identified by the original manufacturer's label; and

    - Durable containers are labeled with the name of the product and the name of the manufacturer.

See the definitions of *permanent* and *durable* containers later in this section.

- Food, food additives, and color additives when intended for incorporation into food products, and drugs and cosmetics when labeled in accordance with the Food, Drug, and Cosmetic Act.

- Samples and specimens that are received in the lab for normal testing when the exact composition of the materials is unknown, the likely hazards have been identified, and personnel have been trained to protect themselves against such hazards.

- Pesticides when labeled in accordance with the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). Pesticides must be kept in original containers. Pesticides may not be repackaged, except for immediate use, unless all applicable FIFRA requirements are met.

- Practically non-toxic and relatively harmless chemicals to the extent that such chemicals are labeled with the name(s) of the chemical constituent(s) or a properly cross-referenced acronym. See the definition for *practically non-toxic and relatively harmless chemicals* later in this section.

b. Labeling Terms

Durable Container means a chemical container that meets any of the following conditions:

- Holds chemicals that will not be used or disposed by the end of a single work session (generally considered to be the end of the day), or

- Will be used by more than one person, or

- Is not under the immediate physical control of the person placing the chemical in the container.

Transient Container means a chemical container that holds chemicals that will be consumed or disposed within the course of one work session, and remains under the physical control of the person placing the chemical in the container.

Permanent Container means a chemical container as received from the manufacturer, and a chemical container that is transported to another work area for use by someone other than the person placing the chemical in the container.

Chemical Name(s) means the description of a chemical(s) in a container according to one of the conventions listed below. All mixtures must be identified by listing all chemical constituents as part of the chemical name. All chemical constituents within a given solution must be identified, regardless of concentration.

- Fully written proper name (IUPAC name, CAS name, or the name as it appears on the MSDS) for each chemical(s) in the container, or

- Commonly recognized shorthand name or acronym, if the shorthand name is cross-referenced to a readily accessible chemical inventory. The inventory must be located in the work area and must identify all chemicals by fully written proper chemical names (described above).

Chemical Concentration(s) means the relative concentration of each chemical(s) in a container. The chemical concentration must be recorded on the label, using any conventional method (e.g., weight/weight, weight/volume, percent, molarity, or normality). The concentration of all chemicals within a solution or mixture must be identified.

Hazard Warning(s) means information conveying both the physical and health hazards (as defined more fully below) associated with a chemical. There are three acceptable mechanisms for communicating hazard warning information:

- Use of the National Fire Protection Agency (NFPA) four diamond hazard warning system

- Use of appropriate hazard warning words

- Use of standard warning symbols

Health Hazard means that there is valid evidence that the chemical may cause acute or chronic health effects which may occur in exposed employees. Acceptable warnings to indicate health hazards include BIOHAZARD OR INFECTIOUS, CORROSIVE, POISON OR TOXIC, RADIOACTIVE, CARCINOGEN, IRRITANT, and SENSITIZER.

Physical Hazards means that the chemical is potentially flammable, reactive or explosive. Acceptable warnings to indicate physical hazards include the words: FLAMMABLE, ORGANIC PEROXIDE, PYROPHORIC, OXIDIZER, COMPRESSED GAS, EXPLOSIVE, and WATER REACTIVE.

Practically Non-toxic and Relatively Harmless Chemicals means chemicals that meet all of the following criteria:

- Have an oral LD50 of greater than 5.0 g/Kg,
- Have an inhalation LC50 of greater than 20 mg/m3,
- Produce only slight skin irritation after 72 hours of exposure, or slight eye irritation, and
- Do not present a physical hazard or a health hazard other than being classified as an irritant.

c. Requirements by Container Type

Permanent Containers

Incoming chemical containers that are received from a manufacturer must be checked to ensure that the labels on those containers are not removed or defaced. If a chemical label is missing or otherwise unreadable, the shipment must be rejected, or a new label obtained from the chemical manufacturer. Additionally, as chemicals are accepted into

the workplace, the container must be marked with the date of receipt.

Chemicals transferred from one work area to another for use by someone other than the individual placing the chemical in the container, or chemicals that are synthesized and transported off campus, must also be marked. All permanent containers must be labeled with the following information:

- Chemical name(s) and concentration(s)
- Physical and health hazard warnings
- Target organ information
- Name and address of the chemical manufacturer, importer, or other responsible party

Durable Containers
Mandatory information that must occur on all non-exempt durable containers includes:

- Chemical name(s), or properly referenced shorthand name or acronym
- Chemical concentration(s)
- Date of preparation
- Initials or name of the person preparing the mixture
- Hazard information, including physical and health hazards

Additional recommended information that may be included on durable containers includes:

- Method or procedure reference
- Storage location
- Recordkeeping reference
- Target organ information

Transient Containers
Transient containers need not be labeled with any particular information as long as the container remains transient in nature. However, once the container becomes durable in nature (i.e., it remains in the work area for longer than one work shift, or leaves the physical control of the individual placing the chemical in the container), the labeling must conform to the requirements for durable containers.

d. Special Requirements for Small Containers

Of special consideration are small chemical containers that are not easily labeled due to size. These containers can be labeled in one of the following manners:

- If such containers are stored as a group in a common apparatus (i.e., a box or rack), then the group as a whole may be labeled with a single label on the storage apparatus. In this case, it is assumed that the label is applicable to all containers within the same storage apparatus.

- If the small containers are stored in one common area with other containers of the same chemical type, and the same physical and/or health hazards, then the entire area may be labeled by means of one placard. The placard is assumed to be applicable to all containers within the storage area; therefore, the boundaries of the storage area must be clearly marked. If a chemical is removed from this area and handled in a non-transient manner, then the labeling must conform to the labeling requirements for durable containers.

e. Labeling System Placard

Each work area must contain at least one wall chart or similar sign, which serves as a "key" to the labeling system used in that particular area. The wall chart or sign must give all the information necessary to understand the information conveyed by the symbols or warning words used in the labeling scheme. For example, in a work area that uses the NFPA system, the wall chart must describe the meaning of each color-coded section of the diamond and the meaning of each numerical rating.

f. Acceptable Labels

Each laboratory or work area is at liberty to use any type of labels, provided these labeling standards are met. Regardless of the type of label chosen, the label must be legible and resistant to smearing and fading. Extraneous markings and labeling must be obliterated before a chemical container is reused. Acceptable labels include:

- Blank labeling tape with hand written wording in permanent ink

- Pre-printed labels and placards prepared by each individual work area or laboratory

- Pre-printed standard labels available from any number of vendors

ALL CHEMICAL CONTAINERS MUST BE LABELED INCLUDING CONTAINERS OF USED CHEMICALS.

Ensure that all containers are in good condition, properly capped, and properly labeled. **There should be no unlabeled containers. Unlabeled containers are considered wastes. Departments may be held responsible for laboratory analysis of unknowns.** Each laboratory or work area is at liberty to use any type of labels, provided the labeling standards in this Manual are met. Regardless of the type of label chosen, the label must be legible and resistant to smearing and fading. Extraneous markings and old labeling must be obliterated before a chemical container is reused.

A one-page summary suitable for posting in the work area is provided in Appendix B11 of this Manual.

C. USED AND EXCESS CHEMICALS

Nearly all individuals within the campus community will, at one time or another, possess an unwanted product for which the fate of the material must be determined. Since the number and complexity of regulations governing the use, storage, and disposal of hazardous materials are vast, UNK has created various programs to assist and guide the campus community with regard to these laws. The disposal of even the most common products may be regulated as hazardous waste, and failure to abide by the regulations can subject UNK and its employees to civil and/or criminal prosecution.

The generation of hazardous waste necessitates the cooperation of the entire UNK community in providing for safe and appropriate disposal. These standards are intended to provide the framework to ensure that UNK fully complies with regulations governing the transportation, storage, treatment and disposal of hazardous wastes to protect human health and the environment.

1. HAZARDOUS WASTE REGULATIONS

a. Introduction to RCRA

What is the Resource Conservation and Recovery Act (RCRA)?

RCRA is a federal law enacted in 1976 to establish the first comprehensive system for "cradle-to-grave" management of hazardous waste. Since that time, several amendments to RCRA have occurred to increase penalties for non-compliance and to regulate the storage, treatment and disposal of hazardous waste. EPA and the Nebraska Department of Environmental Quality (NDEQ) have the authority to enforce regulations adopted pursuant to RCRA.

Who Is Affected by RCRA?

Most businesses and industries are regulated to some degree under RCRA. The quantity of hazardous waste generated by the facility determines the extent to which the business is regulated. Hence, businesses that generate large quantities of hazardous waste are regulated more stringently than businesses which produce small quantities of hazardous waste, and households are totally exempt from regulation under RCRA. Therefore, what may be legal at home may not be legal in the workplace, and what may be legal for one business may be an illegal activity at another workplace.

What Is a Hazardous Waste?

A waste is any material that is disposed, either to a landfill, sanitary sewer, air, land or water, because it is no longer useful. A waste is also any material that has no future use, but has not yet been disposed. Regulations apply to wastes during all storage prior to disposal as well.

A hazardous waste is any material that meets the definition of a solid waste and that exhibits any of the defined characteristics established in the regulations or that is

specifically listed as hazardous in the regulations. (*Solid waste* is a definition that includes solids, liquids and gases.) These hazardous characteristics and lists of hazardous wastes are provided in a following subsection within this part of the Hazardous Materials Manual.

How Does UNK Achieve Compliance with the RCRA Regulations?

The compliance status of the UNK campus depends on the cooperation of all individuals engaged in any activity on campus. EHS has been charged with the responsibility of ensuring that UNK complies with the regulations pertaining to the management of its hazardous waste.

In order to achieve this goal, EHS relies on the professionalism and responsible actions of all individuals on campus. **It is the responsibility of EHS to determine if a used or excess chemical or product is actually a waste, and if that product can be reused or recycled elsewhere on campus.** If a product is determined to be a waste then it is the sole responsibility of EHS to determine if that waste is hazardous and hence subject to regulation.

What Responsibilities Do UNK Employees and Students Have Regarding Waste Management?

The compliance status of UNK is very dependent upon the habits of the laboratory workers and others who produce used or excess chemical products. It is the responsibility of all faculty, staff and students to ensure that the UNK's waste-handling policies are strictly adhered to at all times. Specific procedures are listed in a following subsection.

How Does the Federal Government Enforce These Regulations?

EPA and NDEQ perform periodic unannounced inspections of waste generating facilities to assess the compliance status of the facility with regard to waste generating processes, records management, and waste storage and disposal. Inspections are very thorough and include monitoring laboratory areas, inspecting records and reviewing the qualifications and training of personnel. EPA has the authority to impose criminal and civil penalties for non-compliance. Therefore, employees who disregard the regulations pertaining to waste management may be personally liable if not acting within the scope of their employment.

Usually an inspector arrives on campus without forewarning and requests access to numerous buildings and laboratories. The inspector generally interviews someone in the laboratory in an attempt to ascertain if proper waste handling procedures are in place. The inspector will also closely scrutinize the laboratory for signs of waste mismanagement. When an inspector arrives, immediately notify the EHS.

Based upon the results of the campus inspection, the inspector may issue a *Notice of Violation*, and give UNK 10 days to respond to allegations. At the agency's discretion, monetary fines of up to $25,000 per violation per day of non-compliance may be assessed.

How Can I Avoid a Notice of Violation and Potential Civil And/or Criminal Liability for UNK and Myself?

If the standards identified in the Hazardous Materials Manual for the management of chemical waste are followed, the laboratory or work area will be in compliance with the regulations. Remember that the only entity on campus with the authority and responsibility to make a "hazardous waste determination" is EHS, which was created to help the campus community comply with these regulations. Please contact the EHS Hazardous Waste Technician with any waste management questions you have.

b. Identification of Hazardous Waste

Hazardous waste is any material or solid waste that is recycled, inherently waste-like, disposed, accumulated, stored, treated, or used in a manner constituting disposal, and that meets the definition of "hazardous" as stated in Title 128 or 40 CFR Part 261. Hazardous wastes from UNK are either used materials (i.e., have been through some process and, as a result, are no longer usable) or excess materials (i.e., products with no future use in the work area).

In general, a solid waste is considered "hazardous" if it exhibits a hazardous characteristic or if it is specifically listed in the regulations.

Characteristic Waste

- *Ignitable waste* includes the following: liquids with a flash point of less than 140° F; solids capable of igniting through friction or absorption of moisture; oxidizers; and ignitable compressed gases.

- *Corrosive waste* includes aqueous liquids with a pH of less than or equal to 2 or greater than or equal to 12.5, or liquid wastes capable of corroding steel at a specific rate.

- *Reactive waste* includes the following: wastes that react violently with water; wastes that generate toxic gases, fumes, or vapors when mixed with water; wastes with cyanide or sulfide bearing complexes; wastes that are unstable and will readily undergo violent change; and wastes that are explosive when subjected to a strong initiating force.

- *Toxicity Characteristic Leaching Procedure (TCLP)* waste includes wastes that contain any of the following constituents above the RCRA regulatory threshold: arsenic, barium, cadmium, benzene, carbon tetrachloride, chlordane, chlorobenzene, chloroform, chromium, cresol, 2,4-D, p-dichlorobenzene, 1,2-dichloroethane, 1,1-dichloroethene, 2,4-dinitrotoluene, endrin, heptachlor, heptachlor epoxide, hexachlorobenzene, hexachlorobutadiene, hexachloroethane, lead, lindane, mercury, methoxychlor, methyl ethyl ketone, nitrobenzene, pentachlorophenol, pyridine, selenium, silver, tetrachloroethylene, toxaphene, trichloroethylene, 2,4,5-trichlorophenol, 2,4,6-trichlorophenol, 2,4,5-TP(Silvex).

A summary of characteristic wastes is provided in Appendix C1. The TCLP list, including regulatory thresholds, is provided in Appendix C2.

Listed Waste

- *Wastes from non-specific sources* as identified by the F list, including used solvents. F-Listed wastes are listed in Appendix C3.

- *Wastes generated by specific manufacturing processes* as identified by the K list (none of which are generated on the UNK campus).

- *Virgin discarded commercial chemical products* identified as acutely toxic by the P list or as toxic by the U list. The P-List is provided in Appendix C4 of this Manual. The U-List is provided in Appendix C5. It is important to recognize that a container which held a P-listed chemical is regulated as a "hazardous waste" until it has been triple rinsed with a solvent capable of removing the residual chemical. In this case, the rinse water is a hazardous waste because it is contaminated with the acutely toxic chemical. Contact the Hazardous Materials Technician if you use P-listed chemicals.

- *Spill residues* from the release of a U-listed (toxic) or P-listed (acutely toxic) waste onto the land or into the water.

Universal Waste

In 1995, officials at the Environmental Protection Agency made it easier to manage certain types of hazardous waste that pose a relatively lower risk to human health and/or the environment. They called them universal waste instead of hazardous waste. The State of Nebraska adopted these new rules (40 CFR 273) and charged the Department of Environmental Quality with enforcing them. The rules can be found at Chapter 25 of Title 128. EHS personnel are responsible for making sure that UNK is in compliance with these rules.

Because of the lower risks associated with universal wastes, the rules for their management is much less stringent. For example, instead of six months, universal wastes can be accumulated for up to one year before being shipped to a licensed recycling or disposal facility. UNK is considered a small quantity handler of universal waste since we accumulate less than 5000 kilograms (11,000 pounds) at any time.

The purpose of this plan is to provide information to employees who generate and/or handle universal waste generated in their workplace. This plan contains the official policy of the University regarding management of universal waste. The plan applies to all UNK employees. The Director of Environmental Health and Safety is responsible for administering the plan.

mercury-containing instruments such as:
-barometers
-thermometers
-thermostats
-certain gauges
-electrical relays and switches

These types of instruments may contain mercury or lead which is toxic in even small amounts. Personnel who handle these items should protect themselves by wearing gloves, goggles and clothing appropriate to prevent exposure in case an instrument leaks while being handled. Instruments should be placed in a heavy duty plastic bag and then a box that is in good condition and in a manner that minimizes the chances of breakage. Broken instruments must be collected in a separate container.

A mercury-containing item becomes a waste on the day that it is removed from service either because it no longer works properly or it is no longer wanted or needed. Accumulation areas must be marked with the date that the first item is removed from service or the date that the first item was placed in the accumulation area AND one of the following:
UNIVERSAL WASTE MERCURY-CONTAINING ITEMS, WASTE MERCURY-CONTAINING ITEMS or USED MERCURY-CONTAINING ITEMS.

mercury-containing lamps such as:
-fluorescent lamps
-high intensity discharge lamps
-neon lamps
-high pressure sodium lamps
-mercury vapor lamps
-metal halide lamps

These types of lamps contain mercury, cadmium or lead which is toxic in even small amounts. Personnel who handle waste lamps should protect themselves by wearing gloves, goggles and clothing appropriate to prevent cuts in case a lamp breaks while being handled. Lamps should be placed in boxes that are in good condition and in a manner that minimizes the chances of breakage. Broken lamps must be collected in a separate container.

A lamp becomes a waste on the day that it is removed from service either because it no longer works properly or it is no longer wanted or needed. Lamps must not be intentionally broken. Broken lamps must be collected and disposed of as universal waste. Lamps or lamp accumulation areas must be marked with the date that the lamp is removed from service or the date that the lamp was placed in the accumulation area AND one of the following: UNIVERSAL WASTE LAMPS, WASTE LAMPS or USED LAMPS.

One notable exception is the Alto fluorescent lamps manufactured by Phillips. These are the ones with the green ends. They contain such a small amount of mercury that they pose little hazard and their disposal is not regulated. For safety reasons, however, Alto lamps should be placed in a box or heavy plastic bag before disposal into the regular trash. This will help prevent injury to garbage handlers from broken glass.

electronic items such as:
-cathode ray tubes (CRT)
-computers
-keyboards
-telephones
-FAX machines
-radios
-stereos
-other electronic equipment that contain at least one circuit board

Cathode ray tubes (CRT) are the video display portion of a computer monitor or television set.

The Nebraska Department of Environmental Quality (NDEQ) regulates computer parts and other electronic equipment as hazardous waste when it is disposed. These items often contain regulated toxic metals on their circuit boards or other parts. For example, computer monitors contain lead. These items have been banned from landfills. In addition, the Board of Regents has written policies that require all university property, including unwanted and broken computers to be properly disposed.
Computer parts and other electronic equipment that are not taken by other departments are handled through established recycling and refurbishing programs. Contact the Information Technology Help Desk at 8363 or the Facilities Management and Planning Service Desk at 1800.

Any mercury-containing device becomes a waste on the date that it is no longer operable or on the date that the decision is made to discard the item. Waste mercury-containing devices must be managed in a manner that minimizes the risk of leaking or spilling its hazardous contents. Mercury-containing devices or their storage areas must be labeled with the date that the first device was removed from service or the date that the first device was placed in the designated storage area AND one of the following: UNIVERSAL WASTE MERCURY-CONTAINING DEVICES, WASTE MERCURY-CONTAINING DEVICES or USED MERCURY-CONTAINING DEVICES. (Taken from Univ. Nebr. Omaha, EHS Fact Sheet)

pesticides:

Pesticides that have been recalled, suspended, canceled or banned are considered universal waste. Also pesticides that could still be used but are unwanted are universal waste. A pesticide becomes a universal waste on the date that it is declared unwanted. It is important to maintain the original label so that the proper method of disposal can be determined. Universal waste pesticides need to be stored in a manner that reduces the risk of spills. This may require placing containers into a plastic bucket or basin or heavy duty plastic bag.

Battery disposal

Many different kinds of batteries are used on our campus. Below are listed the most common types of batteries used and the proper disposal method for each. If you have unwanted batteries that are not listed here, contact Environmental Health and Safety (EHS) Technician at 308/627-5355.

Alkaline batteries, also called disposable or non-rechargeable, are the most commonly used type of battery. They are used in flashlights, portable radios and many other portable electronic devices. The word "alkaline" is always printed somewhere on the battery. Ordinary alkaline batteries are neither hazardous nor universal waste. They may be discarded in a regular trash can.

Rechargeable batteries typically contain nickel and cadmium (NiCad) or lead and acid. All of these batteries contain toxic metals and/or corrosive acid. They must be exchanged when new batteries are purchased or collected by EHS for recycling or proper disposal. Sometimes rechargeable batteries are built into a machine, tool or appliance such as rechargeable flashlights. When these items no longer work, the whole item must be collected by EHS. It is not safe to try to disassemble the device.

Automobile/Motorcycle batteries are usually the lead/acid type. Most stores will take back old battery when a new one is purchased. This type of battery can also be taken to salvage yards and recycling centers. UNK EHS will also take unwanted batteries of this type.

Button batteries are used in watches, calculators, hearing aids and other small electronic devices. They often contain mercury, silver or lithium. They should be returned to the manufacturer when new ones are purchased or collected by EHS.

A battery becomes a universal waste on the date that it is removed from service, either because it is no longer operable or because it is no longer wanted or needed. Each battery, container of batteries or battery accumulation area must be labeled with the date that the battery was taken out of service, the date that the container was first used for accumulation or the date that the first battery was placed in the accumulation area AND one of the following: UNIVERSAL WASTE BATTERIES, WASTE BATTERIES or USED BATTERIES. (Taken from Univ. Nebr. Omaha EHS Fact Sheet)

General Requirements for Universal Waste

UNK employees must not dispose of, dilute or treat universal wastes. Only EHS personnel are permitted to make arrangements for shipments to recycling or disposal facilities. Records of each shipment must be kept in EHS files and must include the name and address of the universal waste handler, the destination facility, the quantity of each type of universal waste and the date of each shipment. Universal wastes must be managed in a way that prevents spills or other types of releases of waste constituents. When universal waste is accumulated in a container, such as a box, the container must be closed except when adding waste. The container used must be compatible with the waste and free of defects or damage that could lead to a leak or spill.

Employees who handle universal wastes must be trained to be thoroughly familiar with the safest waste handling methods and emergency procedures. This training is available from the EHS office.

Emergency Procedures for Universal Waste

If hazardous constituents are accidentally released from a universal waste item, then the following procedures are recommended. Contact someone at the EHS Department. Wear disposable personal protective apparel. Place large pieces in a heavy duty plastic bag or jar or other container that can disposed of. Pick-up small pieces with adhesive tape. If a broom and a dust pan are used, be prepared to dispose of the contaminated items. If the spill occurred on carpet or other permeable surface, professional cleaning or removal of the flooring will be conducted. Do not use a vacuum to clean up the debris.

If elemental mercury metal is spilled, contact someone at the EHS Department. Open windows and doors in the area to maximize ventilation. Place barricades and/or signs around the spill to keep people from coming into contact with the mercury. Only trained persons should clean-up a mercury metal spill.

2. WASTE MINIMIZATION

a. Introduction

The basic idea of promoting waste minimization is simply that it makes sense to not produce hazardous waste rather than to develop extensive and expensive treatment schemes to ensure the safe management of the waste once it has been produced. Hazardous waste treatment and disposal costs are very high and continue to rise, but waste minimization can significantly reduce these costs.

Waste minimization is not only a good idea, but it is a regulatory requirement of EPA. In 1984, Congress declared waste minimization "to be the national policy of the United States that, wherever feasible, the generation of hazardous waste is to be reduced or eliminated as expeditiously as possible. Waste nevertheless generated should be treated, stored, or disposed of so as to minimize the present and future threat to human health and the environment."

The waste minimization policy places the following requirements on UNK:

- The efforts undertaken during the year to reduce the volume and toxicity of hazardous waste generated, and the progress made based on previous years, must be reported biennially to EPA.

- A certification stating that a program is in place to reduce the volume or quantity and toxicity of such waste to the extent economically practical, must be included with each shipment of hazardous waste off-site.

The scope of waste minimization and preferred waste-management methods were clarified and expanded by Congress in 1990 through the Pollution Prevention (P2) Act. The following hierarchy of waste management alternatives was established with the P2 Act (in order of descending preference):

1. Prevention (source reduction)

2. Environmentally-sound Recycling

3. Environmentally-sound Treatment

4. Environmentally-sound Disposal

Waste minimization was defined to include the two most-preferred alternatives, source reduction and recycling.

b. Source Reduction

Source reduction (preventing the generation of hazardous waste) is the most desirable waste minimization method. The following sections describe common source reduction practices.

Product Substitution

Substitute non-hazardous or less toxic materials for hazardous materials in your chemical processes and experiments. Examples include the following practices:

- Use water-based inks and paints instead of solvent-based products.
- Use non-halogenated solvents for cleaning instead of the more toxic halogenated compounds. The benefit gained from using non-halogenated solvents must be balanced with the increased flammability factor.
- Use high-flashpoint mineral spirits instead of highly flammable solvents.
- Use detergents and enzymatic cleaners instead of caustic solutions (e.g., sulfuric acid/potassium dichromate (Chromerge) cleaning solutions and ethanol/potassium hydroxide cleaning solutions).

Process Modification

To the extent that it does not affect vital research, teaching or service missions, laboratories and service areas can devise ways to modify experimental or standard processes to decrease the quantity of hazardous materials used and, therefore, hazardous wastes generated. An example of process modification is the Grounds-keeping Department's purchase of a no-waste discharge pesticide sprayer. Laboratory experiments performed on a micro-scale basis are also process modification efforts.

Segregation and Characterization

Segregation of waste types (i.e., minimal commingling of wastes) allows for more efficient off-site waste treatment and disposal and, incidentally, reduces disposal costs. The proper characterization of used and excess chemicals allows some of these materials to be redistributed for use elsewhere on campus.

- Do not mix hazardous waste with non-hazardous waste because the whole amount must then be handled as a hazardous waste, which unnecessarily increases disposal costs.
- Do not mix hazardous waste with radioactive isotopes. This "mixed" waste is extremely difficult and costly to manage.
- Accurately label all chemicals and waste containers so that redistribution can be considered if necessary or possible.

Inventory Management and Micro-scale Purchasing

Diligent inventory control can also aid UNK's chemical redistribution efforts by identifying excess chemicals on campus before additional purchases are made. Purchasing on a micro-scale basis reduces the amount of chemicals that may need to be disposed should no future use or redistribution options exist.

- Survey all chemicals in your lab, shop or storeroom and consider sending for redistribution those chemicals that have not been used within the past year or two.

- If you have chemicals stored in a common-use stockroom, take responsibility for sending for redistribution those chemicals left by personnel and students no longer with the University.

- Purchase only the quantity of chemicals required for specific projects. Excess chemical purchases are a significant portion of the hazardous wastes generated by UNK.

- When purchasing equipment, ask the supplier for models that do not require the use of hazardous materials for operation or cleaning (or require only the minimal amounts of these materials).

- Using videotapes to demonstrate lab experiments so that no waste is generated.

Training

Employees should be instructed on waste minimization concepts and the value of these efforts to UNK. Employees should be encouraged to suggest new and better methods to reduce waste in their areas, which can then be implemented in other areas.

c. Recycling Program

Environmentally sound recycling is the second preferred alternative of waste minimization. Recycling options should be implemented as often as possible for the volume of hazardous waste that cannot be reduced by source reduction.

A recycled material is one that is used, reused, or reclaimed. Recycling promotes waste minimization by reusing or reclaiming a material that would have otherwise become a waste. Many materials that are treated as chemical waste are actually excess chemicals, which can be reused. To further waste reduction efforts, the EHS accepts both opened and unopened containers of excess chemicals for redistribution to other UNK locations. Recycled chemicals are provided free of charge to any UNK department.

An effective recycling program is dependent on receiving recyclable materials from within UNK. Inform EHS of any usable, unwanted chemicals that may have accumulated in your area. If you are leaving UNK, inform EHS of your lab clean-out date. UNK policy states that Departments will be charged for all costs associated with chemical analysis and EHS time if chemicals are not properly tagged before separation with UNK.

EHS maintains a list of all unused chemicals that are available for redistribution.

Commonly recycled chemicals include the following items:

- *Solvents:* acetone, chloroform, dichloromethane, ethyl acetate, formaldehyde, glycerol, hexanes, isopropyl alcohol, methanol, petroleum ether, toluene and xylenes.

- *Acids:* acetic acid, hydrochloric acid and sulfuric acid.

- *Poisons and Oxidizers:* bromine, potassium chlorate, potassium dichromate, and silver nitrate.

Reclamation

EHS reclaims some precious metals and valuable chemicals to reduce waste volumes. Some examples are used photographic fixer (to reclaim silver), mercury (sold to a vendor for recovery), and fuel-grade solvents and oils (sold to a vendor for use as an energy source).

d. Treatment and Disposal

Since UNK does not have a Treatment, Storage or Disposal Facility (TSDF) permit, hazardous waste may not be treated or disposed on-site. Some laboratories are allowed to neutralize acids and bases; others may be allowed to precipitate metals from solutions if this activity is part of the experimental protocol. **In these cases, first contact the EHS Hazardous Waste Technician to determine if these options are available.**

Dilution of a hazardous waste to reduce its toxicity is specifically prohibited by EPA, as is evaporation or dewatering to reduce its volume. Please contact the EHS Hazardous Waste Technician for more information on specifically prohibited practices.

EHS is charged with the responsibility of ensuring that the most-preferred waste management method is used by off-site TSDFs when handling UNK hazardous wastes.

3. GENERAL REQUIREMENTS FOR USED AND EXCESS CHEMICALS

The following procedures provide a standardized method for the handling and storage of used and excess chemicals in the work area.

a. Handling and Storage Requirements

- Containers holding used and excess chemicals must be in good condition, compatible with the contents, and suitable for ensuring safe handling of the chemical. For example, a metal container would not be an appropriate choice for the collection of an acidic material.

    - It is preferable that the container have a tight, threaded lid. The lid must also be in good condition and impervious to any fumes or vapors that the chemical(s) may generate. As an exception, chemicals such as pesticides which are purchased in heavy paper bags may remain in such container with an original label.

    - If possible, keep all excess chemicals in the original containers with original labels.

- All chemical collection containers must be appropriately labeled with an accurate description of the contents. The chemical description must be fully written, utilizing proper chemical names. Empirical formulas, chemical structures, and trade names are not acceptable.

    - Chemical containers with missing labels, or truly "unknown" chemicals are considered "hazardous waste" and hence subject to regulation. Therefore, it is not acceptable for any laboratory to have such chemicals at any time. Contact EHS as soon as possible for assistance.

    - If there is a mixture of similar chemicals in the same container, the label must indicate the approximate percentage of each chemical in the container. Every chemical in the container must be accounted for on the label including water if it is an aqueous solution.

    - The chemical must be labeled *used* or *excess* as applicable. The chemical must not be labeled *spent* or *waste*.

    - Any extraneous markings on the container must be obliterated, including original labels if the container now holds a different chemical.

- Chemical collection containers MUST REMAIN CLOSED AT ALL TIMES, except when immediately adding or removing material from the container.

- Incompatible chemicals must not be placed in the same collection container.

- The laboratory supervisor must maintain records that are accessible for a period of five (5) years which describe the process generating the unwanted hazardous

material. If new chemicals are generated as a result of research, it is important to keep records of the following: procedures used to develop the new chemical; chemical content; and characteristics of the new chemical (i.e., ignitability, corrosiveness, toxicity, reactivity).

- Laboratory supervisors must know the chemicals that are present in their lab and the process in which these chemicals are used. Chemicals that are not intended for any future use are subject to regulation as waste. Therefore, it is important to perform a chemical inventory, no less than once a year, and request collection for all chemicals for which there is no use.

- Appropriate chemical disposal practices for non-hazardous wastes must be observed by all laboratory workers. These practices must comply with all federal, state and local regulations. These disposal practices should be well defined, documented, and known to all persons utilizing the laboratory.

    - EHS should be contacted for assistance in developing disposal policies for potentially non-hazardous wastes.

    - Disposal of chemicals through the sanitary sewer, city/county landfill, or evaporation may subject UNK to enforcement action and should NEVER be done without the prior written approval of EHS.

b. Chemical Collection Procedures

EHS is responsible for the collection of used and excess chemicals from all areas on campus. In order to notify the EHS that a collection is needed, and to meet other recordkeeping requirements, a collection-tag system is used.

An overview of the collection process follows. Specific procedures for collection, including instructions for completing the Chemical Collection Tag, are provided in Appendix C6 of the Hazardous Materials Manual. A copy of Appendix C6 should be kept with the unit's supply of collection tags.

- Collection containers for used chemicals must be kept at or near the area of the process producing the used chemical.

- Collection must be requested when a container holding used or excess chemicals is full, or when no additional material will be added to the container. The total amount of used or excess chemicals in an area by law cannot exceed 55 gallons (or 1 quart for excess chemicals on the P list). Contact the EHS immediately if the limit is exceeded. It is the policy of UNK that no more than 10 gallons of used and excess chemicals (or 1 pint of P-listed excess chemicals) will be stored in a single area without the express permission of the EHS. Exceptions will be allowed for collection into 30-gallon drums provided by the EHS.

- After the used or excess chemical(s) have been properly containerized and labeled, a "chemical collection tag" (available from the EHS office) must be completed and attached to the container. This tag is a two-part tag, with a

perforation in the middle. The top half of the tag remains with the container, while the bottom half of the tag is mailed to the EHS office. If there is not enough room to write all of the information on the chemical collection tag, make two (2) extra copies of the container label and attach one copy to the upper part and one copy to the lower part of the chemical collection tag.

- Pack tagged containers in sturdy boxes for pickup by the EHS. Incompatible chemicals should be physically separated in individual boxes. Sufficient packing material must be used to prevent breakage of the containers.

- Within five working days after receipt of the lower half of the tag at the EHS office, the materials will be collected by the EHS Hazardous Materials Technician. These chemicals will be transported to the campus collection site, reviewed for conformance of the chemical description with the physical appearance and characteristics of the material, and evaluated for redistribution. The following situations are in exception to this standard.

    - Any chemical that does not conform to the information provided on the tag will not be collected and the tag will be returned to the unit that requested collection. After proper identification, the chemical will be collected within five days by EHS.

    - Chemicals for which the identity is unknown will remain in the unit area until a sample is taken and the chemical is fully identified. After proper identification, the chemical will be collected within five days by EHS.

Employees who leave the University (i.e. retire, quit, etc.) must complete a chemical collection tag for all unwanted chemicals. Generally, employees know in advance when they will be leaving, so he/she will have time to tag all unwanted chemicals. Problems have arisen when employees left the University without tagging his/her chemicals. There have been instances when an office or laboratory has been left with hundreds of untagged and many unknown chemicals. These "unknowns" included chemicals labeled with coding known only to the user. When chemicals are left untagged, then the EHS personnel must tag each chemical. If unknown chemicals are present, then a sample must be sent to an outside laboratory for analysis. This is a very expensive process but it must be done if the identity of chemicals is unknown. Additionally, employees have left without turning in keys to chemical storage areas, requiring a locksmith to open doors. Therefore, is it the University's policy to charge the department responsible for the chemicals if the chemical collection procedure is not followed.

c. Training

Training on hazardous waste regulations and collection procedures is provided. Every person who handles used or excess chemicals is required to attend a short training class. Contact the EHS Hazardous Material Technician. A copy of the training outline is provided in Appendix C7 of this Manual.

4. REQUIREMENTS FOR SPECIFIC WASTES

a. Common Wastes

Used Oil and Used Oil Filters

Used Oil

Create a segregated storage area or container. Label the container "Used Oil Only". Maintain a written log to document all amounts and types of oil added to the container. No solvents, or oil contaminated with solvents, PCB's or any other material should be added to the container.

Analytical costs will be charged back to the department if a problem is encountered. Limit access to the container so that there is no chance that anything but used oil is added to the container. For example, the container may be locked with access allowed only by the immediate manager. When the container is full, complete a chemical collection tag and EHS will collect the oil.

Used Oil Filters

Used oil filters can contain up to 12-16 ounces of oil when they are removed. Therefore all oil filters must be punctured on the dome end and hot drained for 24 hours. "Hot drained" means that the filters are drained immediately after being taken off of a hot engine. Crushing or dismantling the filters will remove even more of the oil. Filters that are drained and/or crushed, and are non-terne-plated may be disposed in the regular garbage. Terne is a lead-containing alloy. Contact the oil filter manufacturer to ensure that the filters are non-terne-plated, and make a record of the conversation. It is strongly recommended that the used filters be recycled. Contact EHS if you would like more information on recycling oil filters.

Used Fuel Filters

Used fuel filters may exhibit the characteristic of ignitability or toxicity. All used fuel filters should be collected and tagged for collection by the EHS Hazardous Materials Technician.

Paint and Paint-related Materials

General

Most paints are either a water-based formula or an oil-based formula. Water-based formulas are sometimes referred to as latex, vinyl or acrylic. Oil-based formulas are sometimes referred to as alkyd, polyurethane or varnish. Paints may be regulated as a "hazardous waste" when disposed depending on the formulation. Oil-based paints are regulated due to their flammability and the presence of regulated solvents such as xylene and toluene. Water-based paints are generally not regulated since they are nonflammable. However, paints (both water-based and oil-based) that contain certain metallic pigments are regulated as a hazardous waste when disposed. These regulated

metals include the following: cadmium, chromium, lead, silver, barium, mercury, arsenic and selenium. Information concerning the presence of regulated materials and the type of formulation can be obtained from the label and/or MSDS.

Water-based Paint

Disposal of water-based paints that do not contain any regulated metals can be accomplished by spreading the paint on a piece of plastic or cardboard and allowing it to air dry. For drying purposes, the paint should be dried in a well-ventilated area that is protected from rain and the paint should not be spread thicker than one inch. When the paint has completely dried, it can be disposed in the normal trash. Never place wet paint in the trash. When washing paint brushes, pans and related materials that have been used with water-based paint always use a drain that is connected to the sanitary sewer. Never wash paints to the storm sewer.

Oil-based Paint

Substitute water-based paint for oil-based paint when possible. If oil-based paint must be used follow the instructions in this fact sheet. Excess oil-based paints must be collected by the EHS; this material cannot be dried and placed in the normal garbage.

Paint Thinners

Used paint thinners must be collected and disposed by the EHS. Collect used thinners in a metal can with a tight fitting lid labeled as "Used Paint Thinners." Thinners can be recycled by placing the used thinners in a can and allowing the paint solids to settle for several weeks. After the paint solids have settled, the clear supernatant can be poured off and reused. The remaining solids must be collected by EHS.

Paint Filters

Paint filters from spraying operations that use solvent- or oil-based paint, or that use paint containing regulated metallic pigments, must be collected by EHS.

Aerosol Cans

During ordinary use, aerosol cans cannot be emptied entirely. Some of the contents always remain. Because the contents are under pressure, aerosol cans could explode when heated. For these reasons the Nebraska Department of Environmental Quality (NDEQ) considers waste aerosol cans to be hazardous. Therefore, the NDEQ regulates waste aerosol cans as hazardous waste. Consequently, aerosol cans used at UNK must be collected by the Hazardous Materials Program personnel for proper disposal. This includes **ALL** aerosol cans; for example spray paint, other spray coatings, cleaners, degreasers, disinfectants, deodorizers, food products, bug spray and any other product that is dispensed in an aerosol can.

One or more containers for the collection of unwanted aerosol cans will be placed in each building at UNK. EHS personnel will work with faculty, staff and Facilities personnel to determine the best location for each container. UNK employees are being informed to

place all unwanted aerosol cans in the collection containers or to make arrangements with a custodian to do the same. When the containers are full, a previously designated person will call the Hazardous Materials Technician at 308/627-5355 or the Facilities Service Desk at 1800 to make arrangements for moving the aerosol cans to the waste accumulation area in Bruner Hall.

UNK employees are encouraged to substitute non-aerosols when possible since most products can be dispensed in a pump spray or by some other means. This will help UNK meet its waste minimization goals. Only aerosol cans that are the property of UNK will be disposed of at UNK. When UNK employees bring aerosol cans that are their personal property onto the campus, those cans must be taken back to the employee's home for disposal. UNK's aerosol can waste analysis plan is given in Appendix C8 of this manual.

Used Photographic Fixer Solutions
Used photographic fixer solutions contain trace amounts of silver and must be tagged for collection by EHS.

Unexposed Black and White Film
Unexposed black and white film contains trace amounts of silver and must be tagged for collection by EHS if no longer usable.

Smoke Detectors
These devices are considered universal waste because they contain a small amount of radioactive material. Smoke detectors must be given to EHS personnel for proper disposal.

b. Non-hazardous Wastes

Some wastes can be safely and legally disposed to a landfill or sanitary sewer. Since waste regulations are complex, departments must request and be granted permission in writing from EHS before disposing any wastes, even nonhazardous wastes. **When in doubt, contact EHS for more information.**

D. PROTECTION OF PERSONNEL, PROPERTY AND THE ENVIRONMENT

1. LABORATORY STANDARD

Control measures are actions taken by a campus unit/department to provide a safe working area to use, store, and conduct required activities that involve hazardous materials. It is important that each work area be designed and utilized by taking into consideration the collective properties of the kinds of chemicals to be used so that exposure can be prevented. Similarly, the equipment designed for the safe use of chemicals must be overseen and/or monitored by all individuals in the work area and obvious deficiencies corrected or reported.

Should you be exposed to a hazardous substance, there are three major routes of entry to the body. These include inhalation, skin and eye contact, and ingestion. Three types of control for prevention of these various routes of entry include: administrative controls, engineering controls, and personal protective equipment. Each exposure route of a chemical can be controlled by a varying number of methods.

Although the components of the hazard communication program aid in promoting a safe and healthy work environment, these alone are not adequate to fulfill the objectives of this Manual. Identifying and communicating the physical, biological and chemical hazards must be supplemented with a program that focuses on hazard minimization through administrative and engineering controls, unit and lab safety plans, inventory control, and deficiency identification and remediation.

a. Administrative Controls

UNK units should carry out administrative controls to reduce or eliminate risks associated with the use of chemicals. These include the following:

- Follow standard laboratory procedures and laboratory practices for chemical safety, personal safety, and housekeeping.
- Provide adequate training for working safely with chemicals.
- Place placards and warning signs to identify hazardous areas.
- If necessary, restrict access to areas where hazardous materials are used.
- Provide adequate labels on all chemical containers and maintain the required chemical inventory.
- Allow processes that emanate nuisance odors to be done only after typical office hours, when most of the people have left the building.

- Label chemical containers in accordance with EHS standards.

Standard Operating Procedures

The development and use of written Standard Operating Procedures (SOPs) is an effective administrative control, the importance and utility of which should not be overlooked by supervisors.

Unit and Laboratory Safety Plans

The importance of unit and lab safety plans cannot be over-emphasized. Safety plans not only encourage safe practices to prevent accidents, but also provide a course of action to minimize the threat to human health, the environment, and property in the event that an accident does occur. The unit safety plan should focus on general safety aspects, while lab safety plans should detail specific issues for a given lab or project. Unit Safety Plans should be inserted at the back of this Manual.

This Manual is expected to assist campus units in carrying out their Unit Safety Plans, Recommended topics to be included in the unit and lab safety plans are as follows:

Unit Safety Plans

- Brief overview of federal, state and local regulations.
- Content and location of unit safety plan.
- Good laboratory practices.
- Hazard awareness and recognition.
- Reading and understanding Material Safety Data Sheets.
- Personal protective equipment (use, limitations, availability).
- Engineering controls (i.e., fume hoods, safety cabinets).
- Emergency equipment use and limitations (i.e., fire extinguishers, safety showers, eye wash stations, spill kits).
- Emergency response procedures (i.e., emergency telephone numbers, emergency response agencies, evacuation routes).
- Chemical storage guidelines (i.e., compatibility classes, physical separation, special storage areas).
- Proper chemical labeling.
- Chemical inventories (content, maintenance, retrieval, availability).
- Housekeeping.
- Medical surveillance.
- Waste storage, handling, and removal policies and procedures.
- Recordkeeping.

Lab Safety Plans

- Location and content of "lab specific" safety plan.

- Location, maintenance, and retrieval of Material Safety Data Sheets.
- Lab or project specific safety precautions, including precautions for handling chemicals that present unusual hazards.
- PEL's and signs and symptoms of overexposure for hazardous materials used in the workplace.
- Emergency equipment and PPE location, use and limitations.
- Emergency contact person for work area.
- Chemical storage locations.
- Location, maintenance, and retrieval of records.

Unit Safety Committees

In general, larger units likely to have ongoing programs involving the use of hazardous materials on a continuous basis may wish to have a Unit Safety Committee to oversee the implementation of the unit safety program.
Although local unit safety committees must meet the responsibilities outlined herein, such committees may have broader responsibilities as deemed necessary by the unit administrator. The organization of the local unit safety committee and the procedures employed by that committee will be determined by the local unit. Staff members so appointed must possess the appropriate credentials. The unit safety committee shall be appointed by and report to the unit administrator.

Functions of the Unit Safety Committee

- Assisting in the implementation of the unit safety program.

- Conducting periodic safety inspections of laboratories and work places and report the results thereof to the unit administrator.

- Cooperating with the EHS Dept. in the collection and disposal of hazardous wastes.

- Consulting and cooperating with the EHS Dept. in developing procedures to be used in personnel matters, such as training and medical surveillance.

- Advising the unit administrator on matters relative to compliance with this Manual and the unit safety program, including the budgeting of funds required for compliance.

- Periodic monitoring of the safety performance of all employees, students, and visitors within the local unit.

- Preparing, reviewing, and updating all general safety plans intended for use by all members of the unit.

- Reviewing specific hazardous materials safety plans prepared by individual members of the unit prior to submission to the unit administrator.

- Monitoring compliance with the requirements for maintaining up-to-date inventories of all chemicals being used or stored in all unit work areas.

Housekeeping

Laboratory units are required to keep their work and storage areas as tidy and clean as possible (i.e., non-crowded, non-cluttered, clean areas). Disposal of unused equipment or chemicals should be accomplished promptly. The objective is to ensure proper storage of all items in the laboratory and workplace where chemicals are used.

Inventory Control

All laboratories and other areas where chemicals are used and stored must maintain a current chemical inventory to acquaint staff, students, and emergency personnel of the chemical hazards in the area. At a minimum, the inventory must identify the proper chemical name and typical quantity of the material on hand. Other items that the inventory may address include: storage location, supplier, catalog number or CAS number, and physical hazards.

The chemical inventory must be readily accessible, and updated regularly to reflect the activities in the area. All chemicals stored or used in a work area must appear on the chemical inventory. The chemical inventory shall also include the name(s) and phone number(s) of the individual(s) responsible for maintaining the chemical inventory, and who may be contacted in the event of an emergency.

Other related items that should be addressed during the chemical inventory process include the presence or absence of adequate labels, appropriate storage conditions with regard to compatibility and special circumstances (i.e., refrigeration), and signs of chemical or container degradation.

Deficiency Investigation and Remediation

This Hazardous Materials Manual establishes two mechanisms by which compliance with these guidelines is investigated: (1) EHS Safety and Compliance Surveys; and (2) Unit Safety Team Surveys.

EHS Safety and Compliance Surveys

EHS conducts periodic surveys of various UNK units to find and correct potential safety or regulatory concerns. The findings of the EHS survey are communicated to the laboratory supervisor and the department chair. If a deficiency is noted by EHS, the unit must correct the situation immediately, or as soon as is reasonably possible. If the situation is not corrected immediately, the EHS will conduct follow-up surveys to check on the unit's progress in correcting the problem.

In addition to EHS surveys, other members of the professional staff also conduct periodic inspections throughout UNK. If other staff find a potential problem in a work area that is contrary to these guidelines, they will contact the EHS Hazardous Mataerial Technician and request a review of the area.

Laboratory and Working Area Inspections

Chemical work areas, equipment operation, and safety procedures should be periodically reviewed. The following types and frequencies of inspections are suggested:

- Routine laboratory inspections, which should include chemical and general safety procedures and housekeeping. (quarterly)
- Eyewash functioning properly. (performed by EHS Dept.)
- Respirator fit testing and maintenance (qualitative/quantitative). (annually)
- Respirator fit check (positive and negative) before each use.
- Laboratory fire extinguisher function. (annually) (performed by EHS)

Other equipment inspections should be conducted annually by UNK service units as follows:

- Chemical fume hood tests and certification. (perfomed by EHS Dept.)
- Safety shower function. (perfomed by EHS Dept.)
- Utility maintenance. (Facilities Management)

b. Engineering Controls

Engineering controls relate to the physical design and operation of laboratory equipment to eliminate hazards associated with the use of chemicals. Laboratories at UNK are designed to meet applicable fire, electrical, plumbing, HVAC, lighting, structural and safety codes. It is the responsibility of UNK to provide a safe working laboratory environment by providing the appropriate design for the storage, use and handling of chemicals. Engineering control provisions include:

- Local and general exhaust ventilation (chemical fume hood, bio-safety cabinet, wash down hood, etc.).
- Physical isolation of operator or the process (laboratory storage rooms, research room isolation, equipment isolation).
- Equipment and process design.
- Services (water, gas, electricity, etc.) design and operation.
- Call Facilities Management Services at 865-1800 to report service or maintenance needs related to utilities or chemical fume hood operation.

Facility

The work facility shall have available adequate engineering controls, equipment and space to safely accommodate the work to be performed. Ventilation shall be adequate to prevent chemical exposures above the PEL. Engineering controls (i.e., fume hoods, glove boxes, cold rooms, ventilated storage cabinets, restricted areas) shall be selected in accordance with accepted and prudent practices, and the recommendations provided in the MSDS.

The work facility shall also minimize chemical hazards by physically separating chemical storage areas to accommodate the safe storage of incompatible chemicals. If necessary, EHS will provide guidance with regard to acceptable chemical storage classes.

Fume Hoods and Cabinets

<u>Laboratory Fume Hoods</u>

The laboratory chemical fume hood is designed to remove harmful vapors from chemicals and prevent their escape into the general laboratory atmosphere. The chemical fume hood also provides containment of chemicals and their reactions. Procedures for the operation of a chemical fume hood are as follows:

- The hood sash should be as low as practical during use. The hood shield is a limited safety shield, and 18 inches is the maximum opening recommended.

- Exhaust rates over 150 feet per minute will cause air turbulence in the fume hood and possible release of vapors into the laboratory.

- The minimum exhaust rate should be at least 100 feet per minute at full open sash to capture and effectively remove harmful vapors in a chemical fume hood, or at least 100 feet per minute for radioactive fume hoods. When using a carcinogen, the fume hood exhaust rate should be at least 125 feet per minute. Other special use exhaust hoods will be considered separately.

- All apparatus and chemicals should be kept at least 6 inches from the face of the hood to permit adequate capture of vapors.

- In general, fume hoods should not be used with the sash fully open.

- If there is a chance of explosion, always use an effective protective barrier. The sash is not an effective barrier.

- Unless absolutely necessary, do not use the hood as a storage site for chemicals or apparatus. Keep these items in their proper storage areas.

- Take steps to keep airflow unrestricted and effective. Overcrowding and poor apparatus design can reduce the effectiveness of the hood.

- Keep laboratory airflow (fans, air conditioners, etc.) from interfering with the containment of fume hood exhaust. Prevent excessive foot traffic near the fume hood opening.

- Verify, if necessary, with Facilities Management that baffle openings are proper. Do not block airflow through the fume hood's rear, lower baffle.

- If there are indications that a fume hood is not performing properly, call Facilities Management to have the hood tested.

Perchloric Acid Fume Hoods

Perchloric acid should only be used in a specially designed wash down hood. Perchloric acid crystals can accumulate and become an explosion hazard. Therefore, it is necessary that only a wash down hood with a wash down exhaust system be used for this chemical. The following procedures are required for the use of perchloric acid:

- Identify perchloric acid fume hoods with proper warning and use signs. Similarly, all exhaust duct work should have appropriate caution and procedural signs.

- Do not use the perchloric acid fume hood as a general chemical fume hood.

- All apparatus and lubricants should be inorganic. No organic material should be used in the hood.

- A wash-down after each use of perchloric acid is required. It may be necessary to remove the lower hood baffle and wash away the residual deposits.

- Perchloric acid containers should not be stored in the hood. Once perchloric acid is opened, the container should be placed into a glass container so that none of the chemical content drips onto the open shelf.

- Contact EHS prior to any use of concentrated solutions of perchloric acid.

Radiological Hoods and Biological Safety Cabinets

These types of laboratory equipment are important for protection of laboratory personnel from specific hazards. Their safe use, operation and maintenance will be addressed in a separate UNK manual governing radiological.

Laboratory Utility Services

Laboratory utility services are essential to the proper use, storage and handling of chemicals. Electricity, water, sewer, ventilation, temperature control and other utilities are necessary for conducting activities in the laboratory. Design, construction materials and maintenance are the responsibility of Facilities Management. However, it is important that laboratory personnel follow all procedures for the use of utilities and recognize and report deficiencies.

Environmental Monitoring

In some cases, it may be necessary to evaluate the atmospheric conditions of the work environment to determine what administrative/engineering controls are necessary to ensure that employees are not exposed to contaminants above the PEL.

Environmental monitoring must be initiated under the following circumstances: if there is reason to believe that exposure levels are above the action level or PEL; or when an employee exhibits signs and symptoms of overexposure. Symptoms that indicate a possible exposure can be found on the MSDS. The lab supervisor must determine if the potential for exposure exists. EHS is available to provide information and guidance upon request.

Furthermore, environmental monitoring may be in order under the following circumstances: during testing or redesigning of hoods and other local ventilation devices; when a specific substance that is highly toxic is regularly and continuously used; or when a large quantity of a specific substance is stored or used in the work area.

It is understood that environmental monitoring, under most routine circumstances, is neither necessary nor practical. Environmental monitoring is not generally necessary if the following conditions are met: the ventilation system, including fume hoods, are functioning properly and routinely inspected; employees are using proper protective clothing to avoid chemical exposures; and employees are observing safe practices and procedures.

All environmental monitoring events shall be documented and records maintained indefinitely. These monitoring results shall be made available to employees within fifteen (15) days after the results are received. If monitoring demonstrates that the PEL has been exceeded, corrective action must be taken immediately. Work shall not resume until the situation has been corrected, and repeat monitoring demonstrates that the engineering and administrative controls implemented are effective and adequate.

c. Safety and Emergency Equipment

Adequate emergency equipment shall be available and in working order in each work area. This equipment may consist of emergency showers, eye wash stations, spill kits, first aid kits, telephones or alarms, or other equipment as deemed necessary. Emergency equipment shall be inspected on a routine basis to ensure that the equipment is accessible, operable, and fit for use.

Facilities Management is responsible for maintenance of fire extinguishers, fire alarms, smoke detectors, heat sensors, eye wash stations, safety showers and fume hoods. Business Services is responsible for telephone services. Each department is responsible for the purchase and routine inspection of first aid kits and spill clean-up kits.

Safety Shields

Chemicals that vaporize at room temperatures or lower should be used under a fume hood. If spattering or other release is expected, the fume hood sashes should be drawn and the operator should use a face shield, glove box, or other device for protection. Explosive chemicals require specific safety shields and/or containment.

Eye-wash/Safety Shower

An accessible, working eyewash and safety shower are requirements for every chemical laboratory. A safety shower must be located within 50 feet of the laboratory.

Fire Extinguishers

Every laboratory must have a working, annually-inspected fire extinguisher (either carbon dioxide or dry chemical or both). Pressurized water extinguishers should not be located in a chemical laboratory.

First Aid Kits

A properly stocked first aid kit must be available in each work area. This is especially important in areas with a higher than average risk of injury. It is recommended that all laboratory teaching assistants and at least one person in each department/unit be trained in first aid and CPR.

Spill Kits

In laboratory settings, it is mandatory that appropriate equipment be available for responding to and containing spills as well as for attending to injuries. A first aid kit, emergency eye wash, safety shower, and a specific type of fire extinguisher are required.

Chemical spill kits should be available in each laboratory to contain and clean up spilled chemicals. Commercial spill control kits or specially designed kits are acceptable. Recommended materials for containing spills include a smothering and damming material (sand), neutralizing agents (sodium carbonate and sodium bisulfate), and an absorbent (diatomaceous earth). Each laboratory must secure and maintain these laboratory spill control items.

Listed below is the equipment recommended for use in a general spill kit for chemical spills of up to 4 liters.

Spill Kit Equipment

- One plastic five-gallon bucket with lid. The bucket should be labeled "Chemical Spill Kit."
- Twenty pounds (about three gallons) of absorbent (diatomaceous earth or bentonite) in a sealed plastic bag. The same amount of sodium bicarbonate should also be included in the kit if concentrated acids are present in the work area.
- A plastic brush about five inches wide. (inert, non-sparking)
- A plastic scoop about five inches wide. (inert, non-sparking)
- One or two pair of Silver Shield gloves.
- One or two sets of goggles.
- One heavy poly bag.

Place the absorbent, scoop, brush, gloves, and goggles in the bucket that is labeled "Chemical Spill Kit."

d. Personal Protective Apparel and Equipment

In accordance with accepted and prudent practices, and the recommendations provided in the MSDS, each employee must be provided with PPE that is adequate for the assigned task. This equipment will vary from task to task, and may consist of items such as lab coats, safety goggles, safety shields, face shields, protective gloves, chemical resistant clothing, etc. This equipment must be supplied at no cost to the employee.

Personal protective equipment (PPE) is made available to all individuals at UNK in order to provide optimum protection when working with hazardous materials. UNK requires departments to provide PPE at their expense. Academic laboratories are required by Nebraska law to provide protective eye wear (safety goggles) to students. Descriptions of typical PPE items follow:

Respirators

Where engineering controls are not sufficient to remove air contaminants in a designated work area, employees may be required to wear a respirator. Students are not allowed in such areas. Employees designated to wear a respirator must have the approval of their supervisor, have a medical exam, be trained and fit tested prior to its use.

Eye Protection

Safety glasses are required where there is a risk of flying projectiles. (Grinding, construction and agricultural activities are common examples.) If necessary, permanent side shields must be provided.

Face Shields

Where there is risk from projectiles, chemicals, or radiant energy, a face shield is recommended.

Safety Goggles

To protect the eyes from chemical vapors, mists, sprays, splashes, or dusts, it is required to wear eye goggles in the laboratory.

It should be noted that it may be necessary to combine various eye protection items to give complete eye protection to the individual working in an environment with multiple risks.

Hand Protection

There are numerous kinds of physical and chemical environments necessitating a specific kind of hand protection. Many chemicals can be readily absorbed through the skin, so

appropriate protection is necessary. Choose the type of glove with the specific chemical in mind. Wash gloves after each use and inspect frequently for wear. Many individuals prefer disposable gloves.

Body Protection

To protect employees from accidental spills, splashes, or other dispersions, body-protection apparel is required. There are specific textured laboratory coats and coveralls designed to provide adequate protection from the risk of working under these conditions. Laboratory coats should be laundered frequently. Most coveralls are disposable and need to be discarded when protection is no longer assured. Rubber suits and some heavier coveralls can be washed after each use.

Foot Protection

Rubber boots may be necessary when there is a risk of splashes or during spraying activities. It is mandatory that a shoe which covers the entire foot be worn by personnel in laboratories. Bare feet, sandals, and open-toed shoes are not permitted when working with chemicals.

2. HAZARD COMMUNICATION PROGRAM

In order to promote a safe and healthy work environment, the hazards of a work area or task must be adequately identified and communicated to UNK faculty, staff, students, and visitors. These guidelines establish four key components of the UNK Hazard Communication Program: (1) Material Safety Data Sheet (MSDS) maintenance and retrieval; (2) placing placards in potentially hazardous work areas; (3) labeling of chemical containers; and (4) training. These four components will ensure necessary information is available to employees to inform them of the risk and potential dangers of an area or task.

a. Material Safety Data Sheets (MSDS)

All chemical manufacturers are required, by law, to determine the physical, health and other hazards of all chemical products that they market. Manufacturers must communicate this information to all purchasers in the form of an MSDS. The MSDS provides the major means of communicating the potential hazards of a chemical, and as such, forms an integral part of these guidelines.

Manufacturers and vendors are required to send MSDSs with each initial purchase of chemical products. MSDSs can also be found on the web. Following are a few examples of web sites that have MSDSs, however, since web sites change frequently, it is recommended that persons search the web periodically for appropriate sites and update bookmarks.

http://hazard.com/#msds
Vermont Safety Information Resources, Inc. This site contains a wide variety of occupational and environmental safety and health information, including material safety data sheets.

http://www.phys.ksu.edu/area/jrm/Safety/msds.html
This site is provided by the Physics Department of Kansas State University. It contains many links to databases of material safety data sheets (MSDS).

http://www.pp.okstate.edu/ehs/links/msds.htm
This site is provided by Oklahoma State University.

http://www.esd.uga.edu/ESS/RightToKnow.html
This site is provided by the University of Georgia.

MSDSs are often addressed to the Safety Officer rather than the department that ordered the item. When MSDSs are received at Environmental Health and Safety, they will be forwarded to the appropriate department.

All persons engaged in University activities involving hazardous materials must have access to all applicable MSDS. The MSDS must be available for employees and students to review before beginning each chemical use activity. The MSDS must be the most recent version and easily accessible. Immediate access to hard copies of the MSDS must be made available in each work area in case of emergency situations.

OSHA specifies the information to be included on an MSDS but does not describe the precise format. A generic MSDS form is provided in Appendix D2 of the Hazardous Materials Manual. The main headings on a typical MSDS with appropriate information are as follows:

Chemical Identity:
The chemical and common name(s) must be provided for each chemical.

Manufacturer's Identity:
The name of the manufacturer and their location is important.

Hazardous Ingredients:
Chemical and common names of all ingredients determined to be health hazards. Those comprising less than 1% (0.1% for carcinogens) of the mixture must be listed if they can still exceed an established Permissible Exposure Limit (PEL) or Threshold Limit Value (TLV) or present a physical hazard.

Physical and Chemical Characteristics:
Examples are vapor density, vapor pressure, flash point, flammable limits, odor, boiling point, heat of combustion, and molecular or formula weight.

Fire and Explosion Hazard Data:
The fire hazards of the chemical and the conditions under which it could ignite or explode must be identified. Fire fighting methods and the extinguishing agent of choice should be listed.

Reactivity Data:
Information should be provided on possible interaction with other chemicals.

Health Hazards:
This section describes the nature of the hazardous affect resulting from exposure if no proper first aid is given. The primary routes of exposure such as inhalation, ingestion, skin, or eyes should be listed along with the affects, signs, and symptoms that could occur from acute and chronic exposure.

Precautions for Safe Handling and Use:
This information is important in case the chemical is accidentally released or spilled. Precautions for safe handling and storage must be included, and the EPA waste disposal method is sometimes included in this section.

Control Measures:

Control measures are those taken to protect individuals from exposure. These include engineering controls, personal protective equipment, safe handling procedures, and special information necessary to prevent exposure.

Disposal Procedures:

Often the disposal procedures provided on MSDSs do not consider the regulatory requirements in place at a facility and should not be followed. The EHS should be contacted regarding disposal procedures.

If a University researcher formulates a chemical for use by others outside of the initial investigator's control, it is the researcher's responsibility to determine the health and physical hazards of the chemical and prepare an informative fact sheet similar in form to a MSDS.

If a proprietary or research chemical is brought into the work area, and the actual chemical composition is unknown or unavailable, the supervisor of the area must, at a minimum, obtain a fact sheet describing the physical hazards, health hazards, and disposal information pertaining to the product.

b. Placards and Warning Signs in Potentially Hazardous Areas

Placards and/or signs must be installed in areas where chemical hazards are posed, including on each entry door for rooms where chemicals are kept. Placards and signs serve to communicate necessary information to firefighters and other emergency response personnel, as well as to persons visiting the area.

NFPA Placard Standard

The University has adopted the National Fire Protection Association (NFPA) placard procedure (Standard 704) for identification and to provide awareness of hazards in areas where chemicals are used or stored. The system is based on a color-coded warning with blue indicating health hazard, red indicating flammability, and yellow indicating instability. A copy of the NFPA Standard 704 can be obtained through the Office of Environmental Health and Safety.

A numerical signal must be assigned to each color coded area with a range from 0 to 4. Zero indicates materials which on exposure under conditions of fire would offer no hazard beyond ordinary combustible materials, and are stable. In the blue area of health hazard rating, a numerical 4 indicates materials that are quite toxic and could cause death under conditions of fire; a 4 in the flammability (red) area indicates materials which will vaporize and burn readily; and a 4 in the yellow (instability hazard) area indicates that materials are readily capable of detonation or explosive decomposition at normal pressures and temperatures.

As is evident, the higher the number, the more hazardous the area. The highest number within each warning category for the chemicals present is posted on the placard. (It may be helpful to develop a table with the chemicals present listed on the left-hand side, and the warning categories listed across the top. Fill in the ratings for each chemical. Determine the rating number for the placard by going down each warning category's column and finding the highest number.) NFPA ratings for can be found on Material Safety Data Sheets (MSDS).

NFPA placards can be obtained through the Environmental Health and Safety office. A summary of how to assign ratings for each chemical is provided in Appendix D3 and D4 of this Manual. Additional information is available at the EHS office.

Laboratory Entrance Placard

It is required that each laboratory or work area where chemicals are used or stored be posted with the standard NFPA placard which should include the following information:

- Appropriate reference number(s) to note flammability, health risk, and instability of chemicals.
- Specific instructions on the NFPA placard to assist emergency response personnel (e.g., do not use water).
- Emergency information, including names and phone numbers of the laboratory supervisor or other responsible person to contact in the event of a fire, accident, or spill.
- Other appropriate placards or warning signs to note the presence of specific types of hazards (e.g., radiological, biological, carcinogen, laser, etc.).
- Inventory of chemicals present in the room.

Other Placards

Other placards that should be posted where necessary include the location of emergency exits, fire extinguishers (including the type of fire that the extinguisher is suitable for) and spill kits, and a listing of emergency telephone numbers.

c. Labeling of Chemical Containers

A precautionary label includes concise information that must be affixed to each container of hazardous material. The Hazard Communication Standard mandates the use of warning labels where hazardous substances are used. A warning label meeting the Hazard Communication Standard consists of three required parts:

- The identity of the chemical contents which must be the same as those shown on the identity section on the MSDS.

- Appropriate hazard warning: These are specific words, pictures, or symbols that convey the hazard of the chemical(s) and involves some assessment of the information for each hazard listed on the MSDS. Examples are irritant, causes eye burns, flammable, etc. Target organs also need to be listed on the label.

- Lists the name and address of the manufacturer.

Specific requirements for container labeling are provided in Section B of the Hazardous Materials Manual.

d. Employee Information and Training

Employee Information

All UNK employees must receive appropriate training at the time of initial assignment. The level of training required for UNK employees varies with assigned duties and tasks. For the purpose of simplicity, the training requirements are divided into three major groupings:

- All UNK employees

- Laboratory workers

- Employees exposed to special hazards

UNK requires that individuals working with hazardous materials be informed of the types and levels of hazards of these materials. In addition, they must receive practical training in all aspects of the safe use of these substances, including the response to emergencies. The information and training must be provided when individuals are initially assigned to an area where chemicals are present and prior to assignments involving new hazardous chemicals and/or new work procedures. Departments, and, ultimately, the supervisor(s) are responsible for providing required information and training to their employees/students.

Training Topics

Following is a list of training topics that must be included in the training agenda for all UNK employees:

All employees

- Hazard recognition: methods and observations used to detect the release of hazardous materials in the work area (i.e., environmental monitoring, visual detection, odor, etc.); physical and health hazards of the chemicals in the work area; and location of the chemical inventory for the work area.

- MSDS (Material Safety Data Sheet): location and content of these sheets; personal protective equipment; and administrative or engineering controls used to minimize chemical exposures.

- Chemical labeling: explanation of the chemical labeling and placard systems, including a discussion on hazard symbols, warning words, and NFPA ratings.

- Emergency procedures: emergency response protocols and evacuation routes.

- Written Program(s): location and content of the hazard communication program and unit safety plan.

- Employee rights and responsibilities.

Laboratory Workers

In addition to the training topics listed above, the following subjects must be addressed in the training agenda for laboratory personnel:

- Use, limitations, and application of personal protective equipment (i.e., protective clothing and gloves, respirators, eye wear, etc.).

- The permissible exposure limits (PELs) of OSHA-regulated chemicals and recommended exposure limits of non-regulated materials. (Available through EHS.)

- Use, limitations, and application of administrative and engineering controls used to prevent or minimize chemical exposures (i.e., fume hoods, standard operating procedures, emergency equipment, etc.).

- Location and content of unit safety plan and laboratory safety plan.

- Location and content of UNK Hazardous Materials Manual.

At a minimum, training must occur both at the time of initial assignment, and prior to new assignments involving new exposure situations or new chemicals. The frequency of additional on-going training shall be determined at the discretion of the unit administrator, however, it is recommended that training be provided on an annual basis. The unit must determine how training will be extended to all individuals working in

potentially hazardous environments, and ensure that the training received is adequate to allow the individual to perform their job in a safe and healthy manner.

Training Resources

The unit is not expected to duplicate training efforts that are provided by Facilities Management. Rather, the unit training program should focus on those training topics that are specific to the particular job or assignment within the unit. Facilities Management will arrange for lectures, videos, or workshops to accommodate the training requirements for all UNK employees.

Training services offered by Facilities Management are elective at this time. However, it is the responsibility of the unit to provide the necessary training whether via the services of Facilities Management or through a program developed by the unit.

Training can be arranged through the Facilities Management office for the areas listed below. (Facilities Management does not provide all of this training, but can assist with finding a source of training for departments.)

- Employee/Student Safety
- Laboratory/Chemical Safety
- Respiratory Protection Training
- Hearing Protection Training
- Bloodborne Pathogens
- Special Topics (e.g., asbestos, lead, carcinogens, fume hoods, exposure prevention, personal protection equipment)
- Biosafety
- Hazard Communication Standards
- Waste Disposal Guidelines
- Labeling Requirements
- Radiation safety, including components of the radiation safety program and regulated training requirements.
- Back Injury
- Hearing Conservation
- Cardiopulmonary Resuscitation (CPR)

Training Documentation

Training activities must be documented within the unit including a description of the training agenda, person(s) providing the training, attendees, date of training, and length of training. Training documentation shall be maintained indefinitely.

3. EMERGENCY RESPONSE PROCEDURES

Emergency situations in the workplace can most often be avoided by following guidelines for the safe handling, usage and storage of chemicals. When spills or accidents do occur, emergency response procedures must be implemented to prevent or minimize injury, loss of property, and/or contamination of the environment. In order to be effective, emergency response procedures must be developed before an accident occurs.

This section provides information about planning for an emergency response and for handling specific emergencies, including those involving personal injury. These basic procedures must be incorporated into each Unit Safety Plan, in addition to any unit-specific emergency response procedures. A copy of the general campus emergency response plan is available from the Safety/Hazardous Materials Program. The general plan must be considered when developing the unit-specific response plan.

a. Planning

Planning for an emergency requires a thorough review of all work practices to determine where and how accidents could occur. Any unsafe work practices should be eliminated. Planning also involves determining how those accidents would be handled to minimize injury, damage to property and contamination of the environment. The following tasks should be included in the planning process:

- Identify areas where spills, fires or explosions could occur based on the chemicals, equipment and work practices in each area. (Consider handling and transportation practices, chemical storage areas and equipment failure in this assessment.)

- Determine the potential consequences of these spills, fires or explosions, with respect to injury, damage to property and contamination of the environment. Consider the following factors:

    - The quantities of chemicals that could be spilled.

    - The physical and chemical properties (e.g., physical state, vapor pressure, and air or water reactivity) of the chemicals involved and of those chemicals stored nearby.

    - The hazardous characteristics (e.g., flammability, corrosiveness, reactivity and/or toxicity) of the chemicals involved and of those chemicals stored nearby.

- Document specific response measures for spills, fires and explosions. The following elements must be included:

- Emergency communication systems, supplies and equipment that is readily available.

- Room and building evacuation plans, including signals for notifying occupants to evacuate.

- Procedures for notifying campus service units, the fire department and the EHS Dept.

- General procedures for spills, fires and personal injury that are listed in the remainder of this section.

Implement emergency drills on response measures. It is recommended that drills be performed whenever there is a significant turnover of staff working in the area (including graduate students), or at least once each year. For the best results, drills should occasionally be implemented with no prior notice to staff, and at non-routine times of the day (e.g., first thing in the morning, after normal working hours, over the lunch period).

b. Procedures for Spills

General Spill Procedures

- Open windows and doors to increase ventilation in case the spilled material is toxic by inhalation.

- Place barricades around the spill to keep people from coming into contact with the spilled material.

- Consult the Material Safety Data Sheet (MSDS) for the chemical spilled if the hazards of the chemical are not immediately known.

- Determine if the spill can be contained using the spill kit in the area without causing exposure or injury.

    - If the spill cannot be contained or poses immediate threat to human health or the environment, implement the procedures for large spills (following this subsection).

    - If the spill can be contained using the spill kit, implement the procedures for small spills (following this subsection).

- Notify Police Services on Campus when any of the following situations occur. The Manager of Environmental Health and Safety has the responsibility of reporting certain chemical spills to federal, state and local regulatory agencies, including the following circumstances:

- The quantity spilled was greater than 1 pound.
- The spilled material poses an immediate threat to human health or the environment.

Small Spill Response

If it is determined that the spill can easily be cleaned up with the supplies from the spill kit, implement the following procedures.

- Place barricades around the area of the spill, if necessary, to prevent persons from tracking through the spilled material.
- Ask someone to standby in case a problem occurs during cleanup.
- Wear gloves and goggles. (If gloves and goggles are not sufficient for the hazards involved, the procedures for a large response should be implemented instead.)
- Pour the absorbent from the bag around the perimeter of the spill to prevent the spill from spreading.
- Use the plastic scoop and brush to work the absorbent into the spilled material.
- Add more absorbent as needed to contain and clean up the spill. (Twenty pounds of diatomaceous earth should be adequate to absorb most 4-liter spills.)
- Use the scoop and brush to collect the contaminated absorbent and place it into the five gallon bucket along with any other contaminated items (e.g., broken bottles, gloves).
- Seal the bucket.
- Notify the Environmental Health and Safety Hazardous Material Technician .

<u>Limitations to the Spill Kit</u>

The equipment and procedures noted above are acceptable for many chemical spills. However, the following limitations apply:

- The nitrile gloves in the spill kit provide good general protection against chemicals, but are not resistant to all chemicals. Silver Shield gloves will provide the best protection. However, it is important to avoid contact with the chemical. The scoop and brush should be the only items that contact the spilled material.

- No respiratory protection is included in the spill kit. Personnel should not attempt to contain a spill where chemical vapors or fumes may pose a health hazard. The MSDS should provide the necessary information to determine whether respiratory protection is needed. If respiratory protection is required, implement the procedures for large spills.

- Bentonite, also known as "floor dry" and "high dri," is a good absorbent for most spills. Bentonite is noncombustible and is compatible with most chemicals. However, bentonite must not be used with strong, concentrated acids. Bentonite is only an absorbent; it does not render chemicals nonhazardous nor does it absorb flammable or otherwise dangerous vapors. A flammable liquid absorbed into bentonite may still emit vapors, which could ignite.

Large Spill Response

If it is determined that the amount and/or hazardous nature of a spill is beyond the ability to respond safely, implement the following procedures:

- Vacate the area immediately.

- Implement proper evacuation procedures (e.g., for room, floor, or building). If the suitable level of evacuation is not known, activate the nearest fire alarm to evacuate the building.

- Contact the Police Services Office or 911 Emergency Services from the nearest telephone that is in a safe area and provide the following information:

    - Exact location of spill (e.g., building, room number).

    - Type and amount of chemical(s) involved.

    - Brief description of incident, and any other potential hazards in the area.

    - Your name, and telephone number where you can be reached.

Mercury Spill Response

Mercury is present in several instruments and in chemical compounds used throughout the campus. Preventative measures should be taken such as storing mercury metal in unbreakable plastic containers and placing instruments containing mercury in a tray or tub large enough to hold the contents. The physical properties of elemental mercury, and the health risks posed by mercury vapors require special cleanup methods. Elemental mercury spreads easily and is difficult to contain. Spilled mercury will continue to give off vapors that can be absorbed through the skin until cleanup is complete. The following procedures should be implemented when a mercury spill occurs:

- Place barricades, such as chairs, around the area of the spill to prevent persons from tracking mercury out of the area. (Tape or string can also be used for barricades if available.)

- Post make-shift signs stating *Mercury spill - Do not enter* on all doors leading into the area.

- Call the EHS Hazardous Materials Technician immediately and continue to monitor the area of the spill until cleanup activities begin. (EHS has special equipment for cleaning up mercury spills. If mercury spills are common in your area, consider purchasing mercury spills kits and training workers on mercury cleanup methods.)

- Place all broken containers or instruments that contain mercury in a sealed plastic bag or container for collection by the EHS Hazardous Mateirals Technician.

c. Procedures for Fires and Explosions

In general, the fire alarm should be pulled before attempting to extinguish any fire. The fire department can always be called back to notify them that the fire is out. The general classes of fires and types of fire extinguishers are listed in Appendix D5.

Small fires in the laboratory can usually be successfully extinguished with a suitable portable fire extinguisher. Ensure that all staff are trained in the use of fire extinguishers.

In the case of a large, possibly rapid-spreading fire, or an explosion, implement the following procedures:

- Activate the fire alarm.

- Evacuate the building, shutting doors and providing assistance to other building occupants on the way out.

- Call 911 from a safe area.

- Provide fire and police officials with information about the incident upon their arrival.

- Contact EHS if not already on the scene.

d. Accidents Involving Personal Injury

When a personal injury is sustained during or as the result of any spill, fire or explosion, incorporate the following procedures into the emergency response action:

- For minor cuts, burns, etc; keep a standard first aid kit available and follow first-aid procedures. If necessary, follow up with care at the UNK-designated health care facility.
- For major injury or medical emergencies, call 911 Emergency Services.
- Assist victims and administer immediate aide which may include:
    - washing under a safety shower.
    - removing contaminated clothing.
    - irrigating the eyes at an eyewash station.
- Notify emergency response personnel of the injury, including specific information on any chemicals involved, if known.
- Notify personnel in adjacent areas of any potential exposure hazard.

See the Student Health Emergency Policy in Appendix D6 for instructions on treating students who become ill or are injured while on campus. See also the Exposure Assessment section in this part of the Hazardous Materials Manual for actions to be taken after the emergency response is completed.

4. EXPOSURE ASSESSMENT

Medical surveillance serves as a compliment to administrative/ engineering controls in minimizing chemical exposures and ensuring the present and future health of UNK faculty and staff. The composition of an appropriate medical monitoring program is dependent upon a number of subjective and objective parameters.

Objective considerations include assigned work activities; work environment (i.e., noise levels, potential for heat stress, biological hazards, physical hazards); type, duration, and amount of exposure; the potential severity of an adverse event; and regulatory requirements.

It must also be recognized that subjective parameters will also play a role in whether medical monitoring is applicable to a given employee. Individual factors such as age, sex, medical history, pre-existing physical conditions, weight, diet, medication, and hobbies can influence the severity of a chemical exposure.

A qualified occupational health physician shall determine the frequency and type of medical monitoring that is necessary.

The intent of the Hazardous Materials Manual is to provide individuals with information about their laboratory work environment, to assist in assessment of possible exposure(s), and to prevent themselves from becoming overexposed to chemicals. Laboratory personnel are expected to initially assess chemical processes or activities being conducted to determine if exposures may occur. If necessary, EHS will arrange for determining exposure levels by conducting personal sampling or environmental monitoring of the work area when the following conditions exist:

- If there is reason to believe that exposure levels for a chemical exceed the OSHA "action level" or Permissible Exposure Level (PEL).

- Whenever an employee exhibits signs or symptoms of an exposure to a chemical.

If monitoring indicates that a chemical exposure above the action level is occurring, EHS will make recommendations for corrective actions or alternative procedures. Each campus unit supervisor is responsible for carrying out the recommended corrective action(s). Additional monitoring will be conducted in order to establish the effectiveness of the corrective action(s), and periodically thereafter as specified by the particular standard involved. The campus unit will be notified in writing by EHS of the outcome of any laboratory monitoring. Supervisors are required to notify employees within 15 days of the receipt of those results.

a. Required Monitoring

An Occupational Health program is available to all individuals at the UNK who work with hazardous materials. Before an individual is permitted to work with a hazardous substance, the campus unit's supervisor must determine the nature and risk of the work assignment, and for individuals working in situations listed below, a pre-employment physical, and subsequent periodic medical examinations shall be conducted. The frequency of follow-up medical examinations may be determined by the regulations governing the particular chemical, length of use, employee age, or combination of factors, including consultation with the supervisor or EHS.

- Anyone whose work involves regular and frequent handling of toxicologically significant quantities of a chemical should consult a qualified physician to determine on an individual basis whether a regular schedule of medical surveillance is desirable.

- Persons assigned to tasks requiring the use of a respirator.

- Employees who are or may reasonably be expected to be exposed to airborne concentrations at or above the action level for the contaminants listed in the OSHA Subpart Z List of Toxic and Hazardous Substances with Specific Standards, as provided in Appendix B1.

- Persons who are or may reasonably be expected to have frequent exposure to secretions and body fluids of diseased animals or sick individuals.

- Persons involved in hazardous waste operations.

- Employees who develop signs/symptoms of over-exposure.

- Employees who have been exposed at or above the PEL or TLV as determined via environmental monitoring.

- Employees regularly exposed to ionizing and non-ionizing radiation.

- Employees exposed to specific hazardous materials in accordance with specific standards.

- Employees who may be exposed to asbestos in accordance with applicable regulations.

- Baseline eye exams for working with Class III or VI lasers.

b. Consultations and Examinations

Periodic Medical Examinations

Where a department chairperson determines that a risk to the health of a working employee exists because of employee activities and/or exposures, a periodic medical examination must be initiated. The assessments will include an updating of the employee's work and medical histories, including occurrences of any accidental exposures previously unreported. The periodic health assessment may also include a medical examination, laboratory assessments, and agent-specific studies as needed.

Non-routine Consultations and Examinations

A follow-up of suspected occupational illness resulting from known or probable accidental exposures is required. The University will follow-up and provide for medical services related to known and suspected accidental exposures to a toxic substance when an illness has been diagnosed as resulting from exposure to the hazardous material involved.

Employees who suspect or who indicate signs or symptoms from possible exposure will be referred to the UNK-designated occupational health clinic for medical surveillance. If there is an acute exposure/accidental injury, employees should go directly to the UNK-designated health center facility for treatment. In all cases where employees who may have been exposed have sought medical care, the Workers' Compensation "First Report of Alleged Occupational Injury or Illness" must be completed.

If an employee reports to the UNK-designated occupational health facility for medical surveillance other than in an emergency situation, the following information must be provided as a supplement to the Workers' Compensation Report and given to the occupational health nurse for review:

- Chemicals being used by the individual and those chemicals suspected to be involved in the exposure incident.
- Measurements from EHS monitoring or other information to indicate how the exposure may have occurred.
- A description of the signs and symptoms as relating to the exposure. The duration of time, onset of symptoms, and other supporting information about the incident is helpful.
- A copy of the MSDS for each chemical suspected to be involved in the exposure incident as available.

Exit Medical Examinations

When an employee participating in the medical surveillance program leaves the University, a separation medical exam shall be performed within the month prior to separation. This exam will consist of the same procedures followed in the baseline examination.

An employee transferring from an area to another involving the use of different chemical(s) may need an examination which includes a review of the new area's hazards and related tests as determined by relevant standards and the occupational health physician.

c. Records

The UNK medical officer or his/her designee will maintain health assessment records during the tenure of the employee's service with UNK. Upon termination of an employee, including retirement or death, the medical records will be kept indefinitely in a readily accessible manner.

These records will be handled with standard medical confidentiality and will be available to the employee and/or their physician, with the appropriate consent. Only workplace implications will be communicated to the employee's supervisor.

REFERENCES AND RESOURCES

American Conference of Governmental Industrial Hygienists: Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment with Intended Changes (latest edition); P.O. Box 1937, Cincinnati, OH 45201.

American National Standards Institute (ANSI), (selected standards); 1430 Broadway, New York, NY 10018.

Annual Report on Carcinogens (latest edition); National Toxicology Program, U.S. Department of Health and Human Services, Public Health Service, U.S. Government Printing Office, Washington, DC.

Bretherick, L.: Handbook of Reactive Chemical Hazards, 2nd edition, Butterworths, London, 1979.

Code of Federal Regulations, 29 CFR, Part 1910, Subpart Z (latest edition); U.S. Government Printing Office, Washington, DC 20402.

IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man (latest edition); World Health Organization Publications Center, 49 Sheridan Avenue, Albany, NY 12210.

National Fire Protection Association (NFPA), Batterymarch Park, Quincy, MA 02269:
Fire Protection for Laboratories Using Chemicals, NFPA 45, 1982.
Safety Standard for Laboratories in Health Related Institutions, NFPA 56c, 1980.
Fire Protection Guide on Hazardous Materials, 7th Edition, 1978.
Standard System for the Identification of the Hazards of Materials for Emergency Response, NFPA 704, 2001.

National Research Council: Prudent Practices for Handling Hazardous Chemicals in Laboratories, 1981; National Academy Press, Washington, DC.

National Research Council: Prudent Practices for Disposal of Chemicals from Laboratories, 1983; National Academy Press, Washington, DC.

NIOSH/OSHA Pocket Guide to Chemical Hazards, NIOSH Pub. No. 85-114, 1985 (or latest edition); U.S. Government Printing Office, Washington, DC.

Patty, F.A.: Industrial Hygiene and Toxicology (five volumes); John Wiley & Sons, Inc., New York, NY.

Proctor, N.; Hughes, J.; Fischman, M.: Chemical Hazards of the Workplace, 1988; J. B. Lippincott Co., Philadelphia, PA.

The Merck Index: An Encyclopedia of Chemicals and Drugs, 1976 (or latest edition); March and Company, Inc., Rahway, NJ.

Sax, N.I.: Dangerous Properties of Industrial Materials, (latest edition); Van Nostrand Reinhold, NY.

Young, J.: Improving Safety in the Chemical Laboratory, 1991; John Wiley and Sons, Inc., New York.

In addition, various University of Nebraska documents were used to develop the UNK Haz Mat Manual. These include: UNMC Chemical Safety Manual (draft); UNL Chemical Hygiene Plan; UNL Guidelines for the Safe Use of Hazardous Materials and the Disposal of Hazardous Waste; UNL Chemical Labeling Guidelines; and other UNL, UNMC, UNO and UNK policies and procedures.

ILLNESS AND INJURY PREVENTION PROGRAM

The University of Nebraska at Kearney's position and its commitment to safety and health are as follows:

The University of Nebraska at Kearney (UNK) is committed to providing the best possible working conditions for its employees and the students on campus. We are committed to providing the methods for discovering, correcting, and preventing safety and health hazards that could affect our employees. Further, we are committed to providing the safest possible atmosphere for students and visitors to the campus.

To fulfill the policy the University will:

1. Designate a safety director to develop and administer the UNK workplace safety program in conjunction with the safety committee.

2. Maintain ongoing programs at all levels to identify employee safety and health risks. All department supervisors shall ensure that all employees under their supervision understand all facets of the UNK safety and health program. This includes but is not limited to specific tasks of the employee's assigned duties.

3. Make control and elimination of such risks a top priority in all UNK business plans and budgets. The University shall provide the necessary support to implement safety and health programs.

4. Control and reduce employee exposure to all known or clearly suspected occupational safety and health risks and attempt to lower exposure levels as quickly as technology and economic feasibility allow.

5. Designate a Hazardous Materials Technician to take appropriate measures to ensure compliance with applicable regulations and policies. Further.

6. Provide adequate training and guidance to all employees to ensure that they are aware of safety procedures and policies. Insist that all employees follow safe work practices and take corrective action if an employee fails to do so.

7. Encourage all employees to identify, control, and eliminate occupational safety and health risks.

8. Plan all new facilities to provide the safest and most healthful work environment possible.

EFFECTIVE INJURY PREVENTION PROGRAM

OSHA compliance: UNK will comply with OSHA regulatory requirements to the greatest extent possible. OSHA guidelines will be the standard by which all activities are measured.

The UNK Safety Director may conduct periodic safety inspections of work sites and specific workstations. The primary responsibility however, rests with supervisory personnel within the specific department. Supervisors are also responsible for monitoring the workplace to insure that appropriate safety practices are followed.

The results of any inspection and any noted safety deficiencies will be immediately forwarded to the responsible supervisor, building supervisor, director, or person in a similar capacity. The responsible person will initiate action to correct the deficiency as quickly as possible.

HAZMAT: To insure the safety of employees, students, and faculty the University will insist upon compliance with all applicable Federal, State, and local regulations as well as University Policies pertaining to hazardous materials and hazardous waste. This includes proper handling, storage, and disposal. Departments whose employees use hazardous materials will develop safety procedures specific to department activities to ensure compliance. A copy of these procedures will be forwarded to the Hazardous Materials Technician. The UNK Hazardous Materials Manual will be adhered to in all circumstances.

Workers' Compensation: The University will strive to reduce workers' compensation claims by eliminating safety and health risks. The status of an employee shall not be affected by the filing of a workers' compensation claim.

Safety Programs

a. Each newly hired employee shall receive a safety orientation, which will include at minimum, reviewing the Chancellor's safety statement and this safety plan. New employees should be encouraged to be alert to safety risks and knowledgeable of how to report them.

b. Each department shall have an appropriate safety orientation for employees. The content and depth of the orientation will depend upon the tasks to be performed and work environment for each employee. For example, secretaries need not know how to utilize protective equipment required by facilities workers. All workers should however be aware of evacuation procedures. The safety Director and Safety Committee members will assist in the development of the orientations.

c. the Safety Director shall present programs designed to heighten safety awareness and provide guidance to departments concerning safety matters.

Employee Responsibilities: All employees are responsible for performing their assigned duties in the safest manner possible. The are expected to comply with safety directives and operate machinery, vehicles, or similar equipment safely. Further, they are expected to utilize appropriate protective equipment provided by the employer. Employees are not expected to and should not operate defective equipment nor engage in any practice that they believe constitutes a safety risk. They should report any unsafe condition as quickly as possible. No person may be dismissed for employment at UNK as a result of making a complaint or expressing concern about unsafe conditions or practices at the University. All persons are, however, expected to attempt to resolve safety problems by utilizing the resources within the University rather the contacting outside agencies.

Protective Equipment and Measures: Departments within the University are responsible for determining the appropriate protective equipment for the task assigned to an employee and appropriate safety measures to be followed by employees. The University will make all of its resources available to assist the department in this effort.

Safety Regulations and Requirements: In designating safety measures UNK shall use all federal and state regulations as guidelines and meet the substantive requirements of each.

Safety Education: The University believes strongly that the key to success in a safety and health program is the individual employee. Employees must be informed of required safety and health procedures on a timely basis and need information to view the safety program in a positive manner. They should be advised of trends, recurrent problems, and new potential hazards as they arise.

Communication: This plan as well as relevant safety information should be available to administrators and employees throughout the University. Supervisors should schedule regular safety briefings on items relevant to the tasks being performed by their department. All new employees will be given the opportunity to review this plan and will read the Chancellor's policy statement concerning safety.

Administrators will:

1. Communicate the University's injury prevention programs to all employees.

2. Encourage employees to bring safety and health problems to their supervisor's attention.

3. Demonstrate their commitment to safety by actively participating in the program, i.e. Conducting safety inspections, acting quickly to resolve problems and presenting safety briefings as appropriate.

4. Ensure that supervisors understand their responsibilities regarding safety and health.

5. Ensure that copies of any accident report or investigation are provided to the Safety Director.

Supervisors will:

1. Share safety educational material with employees.

2. Analyze the work performed under their supervision to identify potential hazards.

3. Inspect their workplace regularly to discover and correct any safety hazards.

4. Motivate employees to follow the safe work practices.

5. Investigate minor workplace accidents and provide information to the safety committee. Also, ensure that the Safety Director is contacted in the event of a serious accident.

Employees will:

1. Be aware of any safety hazards in their workplace and correct them if possible. Report any safety hazards that cannot be immediately corrected to their supervisor as soon as possible.

2. Follow safe work practices and use protective equipment provided for the performance of their assigned duties.

3. Actively participate in the safety program and support the safety goals of the University.

Responsibilities of the Safety Director:

1. Plan, organize, and conduct quarterly meeting of the Safety Committee.

2. Investigate serious accidents to determine methods to prevent recurrence.

3. Maintain records of investigations, inspections, and committee meetings.

4. Provide guidance and assistance to departments for the development of safety programs and procedures.

5. Initiate immediate action to correct and safety deficiency that may result in a serious accident.

UNIVERSITY OF NEBRASKA AT KEARNEY
HAZARDOUS MATERIALS MANUAL

APPENDIX A2

GUIDELINES FOR CONTRACTS INVOLVING WASTE AND KNOWN HAZARDS 2009

1. Project Planning

A. This document has been written to assist Facilities Management and Planning in their understanding of potential waste streams and hazards associated with building construction, renovation or demolition. Contract language is also included for the proper management of waste and steps to be taken when a contractor encounters asbestos or other hazard. Recognition of these wastes and hazards is useful in preparing estimated costs for a project during its early planning stages for inclusion in the overall project cost and to ensure that the proper precautions are taken so the waste is properly managed.

Contact UNK's Manager of Environmental Health and Safety (EHS) for assistance.

B. Where UNK EHS disposes of wastes generated from a project, the disposal costs, including testing, are charged back to the overall project cost.

2. Orientation Conference with Contractor

Discuss known hazards and solid and hazardous waste management. UNK's Manager of EHS should attend this meeting.

3. Hazardous Waste

A. Regulated pursuant to Subtitle C of the federal Resource Conservation and Recovery Act of 1976, as amended, cradle to grave management of hazardous waste.

B. Hazardous waste determination is made by Robin Harding, UNK Hazardous Materials Technician, 308/627-5355. UNK's hazardous waste identification number must be used. Waste examples include but are not limited to: oil-based paint, solvents, aerosol cans, caustic or corrosive cleaners, certain chemicals and materials containing lead or mercury.

C. Hazardous waste must be dated when generated and shipped for proper disposal within 180 days of generation.

D. Disposal can occur only at a permitted hazardous waste facility.

E. Contractor and UNK are co-generators of waste and share liability for proper management but can contractually agree as to who takes lead responsibility. Unused product is either retained by the contractor or is included in UNK's recycling program.

F. Contract (Agreement) language:

Article 1; ENVIRONMENTAL ISSUES

1.1 Environmental Licenses, Certifications, & Permits. Contractor covenants and agrees that during the term of the Agreement and any extensions or renewals thereof, all of its employees, agents, representatives, and Subcontractors, if any, performing Work will have the requisite skills, licenses, certifications, training, permits and the like mandated by all applicable federal, state and local governing authorities with jurisdiction over environmental matters, including recognition of damage, deterioration, and delamination of asbestos containing materials. Prior to the start of construction, Contractor shall compile Material Safety Data Sheets for the use of chemicals or other hazardous materials. Contractor agrees to provide to Owner's Representative evidence of compliance with the requirements of this Section 1.1 upon demand.

1.2 Environmental Laws. Contractor, its Subcontractors, representatives, employees, and/or agents shall comply with all federal, state, and local laws, rules, and ordinances relating to environmental protection governing the Work.

1.3 Termination. Contractor agrees that a material breach of any of the terms, conditions, and obligations of this Article 1 would be detrimental to Owner, a material breach of this Agreement and grounds for Owner's immediate termination of the Agreement.

1.4 Application With Other Provisions. The provisions of this Article 1 shall operate in addition to, and not in limitation of, any other obligations contained in the Contract Documents.

1.5 Encountering Hazardous Substances. In the event the Contractor or its Subcontractors encounter on the site material reasonably believed to be asbestos, polychlorinated biphenyl (PCB) or other Hazardous Substances as defined in Section 1.6, which has not been rendered harmless, the Contractor shall immediately stop Work in the area affected and report the condition to the Owner in writing. The Work in the affected area shall be resumed (1) in the absence of any Hazardous Substances, (2) when any Hazardous Substances have been rendered harmless, or (3) by written agreement of the Owner and Contractor.

1.6 Definition of Hazardous Substances. For the purposes of the Agreement, the term Hazardous Substances@ means any substance, including solid, liquid or gaseous material which is listed or defined as Hazardous@ in the Comprehensive Environmental Response, Compensation and Liability Act (ACERCLA@), 41 U.S. ' 9601, et seq., or regulations promulgated pursuant thereto; oil and oil waste as those terms are defined in the Clean Water Act, 33 U.S.C. ' 1251, et seq., or regulations promulgated pursuant thereto; and source, special nuclear, or by-product material as defined by the Atomic Energy act of 1954, 42 U.S.C. ' 3011, et seq., or regulations promulgated pursuant thereto; and includes any other substance defined by federal, state or local statute, regulation, or ordinance relating to any hazardous, toxic or dangerous waste or substance.

1.7 Clean-up Including Hazardous Waste, Spills and Conditions of Premises. Hazardous waste, if any generated from the Project shall be properly disposed of at the end of the Project by the Contractor and its Subcontractors pursuant to applicable hazardous waste laws and regulations. The Contractor shall coordinate the disposal with the Owner's representative. Hazardous waste left on-site at the end of the Project shall be properly disposed of by the University with all costs

associated for the disposal deducted from outstanding pay invoices and/or billed to the Contractor.

1.7.1 The Contractor shall provide copies of shipping manifests to the Owner's representative from licensed disposal facilities for the disposal of hazardous waste, asbestos, and other hazardous substances as required by the Project.

1.7.2 Any spill of hazardous substance or extremely hazardous substance by the Contractor or its Subcontractors shall be the responsibility of the Contractor to report the spill to the regulatory agency, if applicable, to notify both the Owner's representative and the University's Manager of EHS, and to clean up the spill in accordance with regulatory requirements and to the satisfaction of the Owner's representative.

1.7.3 The Contractor shall stockpile waste concrete generated from the Project in an area designated by the Owner's representative and shall remove and legally dispose of the waste concrete off-site at the end of the Project.

1.7.4 Upon completion of the Work and at the end of each day, the Contractor shall remove from the work site all materials and rubbish resulting from its work. At the completion of the Project and as applicable, the Contractor shall repair and re-touch the building, sidewalk, landscape amenities, etc. to cover any damage, marking or marring of these items by the Contractor or Subcontractor.

G. Contact UNK's Manager of EHS to insure proper management.

4. Friable Asbestos - Building Demolition or Renovation

A. Regulated pursuant to the federal Clean Air Act, as amended, specifically the National Emission Standards for Hazardous Air Pollutants (NESHAPs), where friable asbestos may be released to the outdoors.

B. NESHAPs apply to demolition or renovation activities that affect certain threshold quantities of friable asbestos containing material that is actually removed. Friable asbestos containing material must be removed before a building is demolished or renovated.

C. OSHA standards set limitations on the amount of asbestos in indoor air to protect workers and employees. The Nebraska Department of Health and Human Services System Regulation and Licensure regulates the licensing of asbestos consultants and contractors including work practices.

D. Friable asbestos containing material is classified as a special waste which must be disposed of at the Buffalo County landfill with prior approval from Steve Hart, City of Kearney Sanitation Department, 233-3206.

E. **Asbestos abatement contracts** are specific to asbestos containing material removal. The asbestos abatement contractor includes the cost for asbestos disposal as part of the

project cost.

5. Non-friable Asbestos

A. Counter-tops, floor tiles, fume hood liners (transite paneling) that are not broken and have not been sanded, ground, pulverized or abraded.

B. If non-friable and will not be used, it is still managed as friable and as a special waste at the Buffalo County landfill.

C. If non-friable, it can be reused if it will not be cut or managed in such a manner that it may become friable.

D. Determination as to friability and reuse is made by UNK's Director of Facilities.

E. Generally, when glued carpet is removed and tiles stick to the carpet during removal, the tiles can be re-glued if the square feet of removed tiles is less than or equal to 1/2% of the total square feet of tile. Contact UNK's EHS Manager

6. Lead Paint Disposal - buildings built prior to 1978

A. Pre-renovation. A new regulation effective 6/01/99 requires compensated renovators to distribute an information pamphlet (Protect Your Family from Lead in Your Home) to owners and occupants of target housing built prior to 1978 before beginning any renovation activity. Target housing does not include dormitories but does include married student housing.

B. Target Housing and Child Care Facilities. Effective 3/01/99, a lead hazard screen or risk assessment can only be conducted by a person certified by EPA as a risk assessor, and inspections must be conducted only by individuals certified by the EPA as an inspector or risk assessor.

C. Lead Paint Abatement (paint chips) may be a hazardous waste depending upon TCLP test results. If it is hazardous waste or unknown, tag for collection by UNK's Hazardous Materials Technician, Robin Harding.

D. Construction Debris with Lead Paint.

1) Buffalo County landfill requires TCLP testing if lead is suspected. If TCLP test results show lead at or above the regulatory level, then the waste must be managed as a hazardous waste. If lead is present but below regulated level, then the waste must be managed as a special waste. Contact Steve Hart at the City of Kearney Sanitation Department for assistance, 233-3206.

2) It is a case-by-case determination. Call UNK's Manager of EHS for assistance.

3) OSHA standards set limitations on the amount of lead in indoor air to protect workers and employees when lead paint is abated or the structure is renovated or demolished and lead paint is disturbed. Testing of painted surfaces is conducted.

The test results are included in the bid specifications so contractors have knowledge of the lead paint and comply with OSHA and because lead paint may affect the cost of the project.

7. Construction and Demolition Debris

A. Solid waste regulated pursuant to the Nebraska Environmental Protection Act and the Integrated Solid Waste Management Act.

B. Disposed of at the Buffalo County landfill.

C. Waste concrete from trucks should be stock-piled in an area designated by the University and removed by the contractor at the end of the project and disposed at the Buffalo County landfill (see contract language in paragraph 3.F.5. above).

8. PCB Ballasts, PCB Oils (capacitors), and PCB Paint

A. Regulated pursuant to the federal Toxic Substances Control Act.

B. UNK ships PCB ballasts and capacitors for disposal as necessary, but at least once a year.

C. Disposal can occur only at a licensed out-of-state facility which must destroy the PCBs within one year after the date of removal from UNK.

D. Tag all of the above for collection by UNK's Hazardous Materials Technician, Robin Harding. 308/627-5355.

E. PCBs in paint are not likely present unless the building was constructed by the military. Testing is not required unless UNK has reason to believe that PCBs were used. Contact Robin Harding at 308/627-5355 for assistance.

9. All batteries, including lead, cadmium, mercury, silver, lithium, except alkaline, generated by UNK (not spent batteries from a contractor)

A. Regulated as hazardous waste or Universal Waste unless recycled.

B. Tag for collection by Robin Harding, Hazardous Materials Technician at 308/627-5355.

10. Used Oil - equipment maintenance, engines, vacuum pumps, etc. generated by UNK (not used oil from a contractor)

A. Recycled locally if no volatile organic compounds (VOCs in solvents) are present.

B. If solvent contaminated or suspected solvent contaminated, tag for collection by Robin Harding, Hazardous Materials Technician at 308/627-5355.

11. Scrap Metal

A. Solid waste regulated pursuant to the Nebraska Environmental Protection Act and the Integrated Solid Waste Management Act.

B. Recycled locally, contact Robin Harding, Hazardous Materials Technician at 308/627-6355.

12. Fluorescent and High Intensity Discharge (HID) Bulbs also known as Mercury-Containing Lamps

A. HID, metal halide and mercury vapor lamps are hazardous waste unless recycled.

B. Re-box and give to Robin Harding, Hazardous Materials Technician, 308/627-5355.

C. Can be stored for up to one year before recycling.

D. All Phillips brand bulbs with green end caps contain a very low amount of mercury. They are considered a "Special Waste" and as such can be disposed of at the Buffalo County landfill with permission from the City of Kearney. Contact Steve Hart, 233-3206, for written approval.

13. White Goods (large appliances, e.g. refrigerators) destined for disposal

A. May be recycled or disposed of locally, contact Facilities, 865-1800.

B. Freon and oil will be removed by certified personnel and certification of removal will be taped to the appliance.

14. Other Materials destined for disposal

A. Liquids, known or unknown, may be hazardous waste, contact Robin Harding, Hazardous Materials Technician, 308/627-5355.

B. Latex paint is not a hazardous waste and is either recycled or dried and land-filled.

C. Empty chemical containers may be hazardous waste if it contained a P-listed hazardous waste or a pesticide.

D. Photographic chemicals including old film may be hazardous waste.

E. Gas cylinders may be hazardous waste. Return to vendor or contact Robin Harding.

Tag for collection all of the above and materials suspected of being hazardous waste and contact Robin Harding, Hazardous Materials Technician at 308/627-5355.

F. Radioactive materials. Contact Paul Twigg, Radiation Safety Officer, 865-8315, for assistance.

G. Biosafety filters. Contact Paul Twigg for assistance.

H. Fume hoods. Call Robin Harding, 865-8647, for assistance with decontamination.

15. Fugitive Dust

A. Nebraska air quality regulations prohibit a person from conducting activities, including construction and demolition that would cause dust (also referred to as fugitive dust or particulate matter) to leave the premises.

B. The regulation is enforced against the property owner when large quantities of dust leave the premises and either creates a visibility problem on a street or other roadway or a nuisance situation evidenced by a neighbor complaint.

C. A **contractor** should be required to take reasonable measures, e.g. using dust suppressants such as water or not doing dirt work on a very windy day, to prevent the dust from leaving the premises.

16. Storm Water Permits

A. Construction site activities involving clearing, grading and excavating land equal to or greater than 5 acres may require a storm water permit from the NE Department of Environmental Quality if there is potential for storm water to discharge to surface waters. Surface waters include storm drains. Note that in March 2003, the acreage affected becomes more stringent by applying to construction sites disturbing greater than **one acre**.

B. A storm water permit application includes a Storm Water Pollution Prevention Plan and is regulated under the National Pollutant Discharge Elimination System permit program. When contractors do the work, the bid specifications can require the contractor to get the permit. The City of Kearney may also require a grading application to grade and provide erosion control at the site.

THE INFORMATION CONTAINED HEREIN IS INTENDED TO PROVIDE A GENERAL OVERVIEW. FOR MORE SPECIFIC INFORMATION OR IF YOU HAVE ANY QUESTIONS, PLEASE CALL THE UNIVERSITY'S ASSOCIATE GENERAL COUNSEL AT (402)472-1201.

LIST OF ACRONYMS AND ABBREVIATIONS

ACGIH	American Conference of Governmental Industrial Hygienists
ASTM	American Society for Testing and Materials
CAA	Clean Air Act (federal)
CAS	Chemical Abstracts Service
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (Superfund)
CFC	Chlorofluorocarbon
CFR	Code of Federal Regulations
CCT	Chemical Collection Tag
CHO	Chemical Hygiene Officer
CPR	Cardiopulmonary Resucitation
CRT	Cathode Ray Tube
CWA	Clean Water Act (federal)
DOT	U.S. Department of Transportation
EC	Emergency Coordinator
EHS	Environmental Health and Safety
EPA	U.S. Environmental Protection Agency
FDA	U.S. Food and Drug Administration
FFDCA	Federal Food, Drug and Cosmetic Act
FIFRA	Federal Insecticide, Fungicide and Rodenticide Act
g	grams
Haz Mat	Hazardous Materials

HMT	Hazardous Materials Technician
HMTA	Hazardous Materials Transportations Act
HMTUSA	Hazardous Materials Transportation Uniform Safety Act
HVAC	Heating, Ventilating and Air Conditioning
IARC	International Agency for Research on Cancer
IDLH	Immediately Dangerous to Life and Health
IUPAC	International Union of Pure and Applied Chemistry
kg	kilograms
LC50	Lethal Concentration in 50% of a test population
LD50	Lethal Dose in 50% of a test population
LEL	Lower Explosive Limit
LEPC	Local Emergency Planning Committee
m^3	cubic meter
mg	milligrams
MSDS	Material Safety Data Sheet
NDEQ	Nebraska Department of Environmental Quality
NFPA	National Fire Protection Association
NiCad	Nickel/Cadmium rechargeable battery
NIOSH	National Institute for Occupational Safety and Health
NTP	National Toxicology Program
OSHA	Occupational Safety and Health Administration
PCB	Polychlorinated Biphenyl compounds

PEL	Permissible Exposure Limit
pH	A measure of the acidity of a solution (Potential of Hydrogen)
ppm	Parts per million
ppb	Parts per billion
PPE	Personal Protection Equipment
RCRA	Resource Conservation and Recovery Act and applicable regulations, 40 CFR Parts 260-271 and Title 128 - Rules and Regulations Governing Hazardous Waste Management in Nebraska
RQ	Reportable Quantity
RTECS	Registry of Toxic Effects of Chemical Substances
S/HMP	Safety/Hazardous Materials Program
SOP	Standard Operating Procedure
STEL	Short Term Exposure Limit
TCLP	Toxicity Characteristic Leaching Procedure
TSCA	Toxic Substances Control Act
TSDF	Treatment, Storage or Disposal Facility
TLV	Threshold Limit Value
TWA	Time Weighted Average
VOC	Volatile Organic Compound

OCCUPATIONAL SAFETY AND HEALTH STANDARDS FOR TOXIC AND HAZARDOUS SUBSTANCES (29 CFR PART 1910 SUBPART Z)

CFR SECTION NUMBER	SUBSTANCE NAME	CAS NUMBER
1910.1014	2-Acetylaminofluorene	53-96-3
1910.1045	Acrylonitrile	107-13-1
1910.1011	4-Aminobiphenyl	92-67-1
1910.1018	Arsenic, Inorganic	7440-38-2
1910.1001	Asbestos	none
1910.1028	Benzene	71-43-2
1910.1010	Benzidine	92-87-5
1910.1030	Bloodborne pathogens	none
1910.1051	1,3-Butadiene	106-99-0
1910.1027	Cadmium	7440-43-9
1910.1008	bis-Chloromethyl ether	542-88-1
1910.1044	1,2-Dibromo-3-chloropropane	96-12-8
1910.1007	3,3'-Dichlorobenzidine (and its salts)	91-94-1
1910.1015	4-Dimethylaminoazobenzene	60-11-7
1910.1047	Ethylene oxide	75-21-8
1910.1012	Ethyleneimine	151-56-4
1910.1048	Formaldehyde	50-00-0
1910.1096	Ionizing radiation	none
1910.1025	Lead	7439-92-1
1910.1006	Methyl chloromethyl ether	107-30-2
1910.1052	Methylene chloride	75-09-2
1910.1050	Methylenedianiline	101-77-9
1910.1004	alpha-Naphthylamine	134-32-7
1910.1009	beta-Naphthylamine	91-59-8
1910.1003	4-Nitrobiphenyl	92-93-3
1910.1016	N-Nitrosodimethylamine	62-75-9
1910.1013	beta-Propiolactone	57-57-8
1910.1017	Vinyl chloride	75-01-4

TOXIC AND CARCINOGENIC CHEMICALS

"What is it that is not poison? All things are poison and nothing is without poison. It is the dose only that makes a thing not a poison."
Paracelsus (1493-1541)

Toxicity Defined

The toxicity of a substance is due to its ability to damage or disrupt the metabolism of living tissue. An acutely toxic substance can cause damage as the result of a single or short-duration exposure. A chronically toxic substance causes damage after repeated or long-duration exposure or that becomes evident only after a long latency period. Carcinogens are considered a special class of chronic poisons.

It is understood that essentially all chemicals, at some concentration, are toxic. This section will focus on those chemicals which can be classified as extreme toxics or severe poisons, and those which have been shown to be toxic if exposure is long-term, i.e., chronic exposures, with special attention for those that possess carcinogenic characteristics. There are special problems associated with working with these compounds, and for regulated carcinogens in particular, additional precautions are prescribed by legislation. Topics considered here include identification of the hazardous materials, proper storage and handling techniques, and legal requirements.

Toxicology is the science that investigates the adverse reaction of chemicals on the biological system. The toxicity of a chemical, as defined in *The Dose Makes the Poison*, is related to its ability to damage an organ system, or to disrupt a biochemical process (such as the blood forming mechanism), or to disturb an enzyme system at some site in the body removed from the site of contact (as opposed to the affecting the site of contact as when a corrosive comes in contact with the skin). The systemic damage that a chemical does is not random - it affects the same set of body functions in all people. The sensitivity of individuals will vary and the effect may appear worse in some persons than others, but the target function or organ does not vary.

Poison Defined: Acute versus Chronic

Poisons are chemicals which cause illness, injury or death when taken in very small quantities. The legal definition of a poison is a chemical that takes less than 50mg per kilogram of body weight to kill 50% of the victims exposed. This is really a very small amount of material - about 3/4 of a teaspoon for the average adult and about 1/8 a teaspoon for a 2 year old child. There are very few chemicals that are lethal at these doses, but those that are must be classified as poisons. These materials will be classified as "acute poisons" because their effect is *immediate*.

Chronic toxicity, on the other hand, refers to the systemic damage that is done after repeated exposure of low concentrations over long periods of time. Materials most often associated with chronic toxicity are those that have been labeled as carcinogens, though there are other classes of chronic toxins which must be used with equal care. All chronically toxic materials are problematic because we do not know when or if the effect of the exposure will be felt. Workers in research laboratories and in other chemical settings should not discount any chemical exposure - materials not thought to be hazardous in the recent past are often found to be carcinogenic at a later time.

Most chemicals exhibit some degree of both acute toxicity and chronic toxicity. The symptoms displayed and the systemic effect will, however, differ. In addition, some materials may act as acute toxins, but show no chronic ill effects. The same is true for materials labeled as chronically toxic, which have no adverse single dose effect. Despite this lack of correlation, the effects of both forms of toxicity are definitely dose related, that is, the greater the dose, the greater the effect.

Examples of acute and chronic (carcinogenic and toxics) follows:

- Acute Poisons
  - hydrogen cyanide
  - hydrogen sulfide
  - nitrogen dioxide
- Chronic Poisons
  - mercury
  - lead
  - vinyl chloride
- Carcinogens
  - benzene
  - carbon tetrachloride
  - cadmium compounds

Factors that Affect Toxicity

1. Routes of exposure

Toxicity varies with the route of exposure and the effectiveness at which the material is absorbed. A chemical that enters the body in large quantities but is not easily absorbed is a much lower risk than one that is easily absorbed into the bloodstream.

*Skin contact

Perhaps the most common route of exposure is through skin contact. Fortunately the skin acts as an effective barrier against entry by most chemicals and thus greatly reduces the possibility of a toxic exposure. This is not true, however, if the skin is not intact, i.e., if there is an open cut. **General rule**: most inorganic chemicals are not easily absorbed through the skin, organic chemicals may or may not be absorbed, depending on numerous conditions. Some chemicals, such as DMSO (dimethyl sulfoxide) greatly enhance absorption of other chemicals through the skin, so particular care should be used with these materials. Once a chemical passes through the skin it enters the bloodstream and is carried to all parts of the body.

*Inhalation

This is the most dangerous route of entry into body because the lungs are not an effective barrier to entry. The lung membrane allows ready passage of gases necessary to sustain life (a good thing!), but sadly they just as readily allow passage of chemicals that can be fatal (not a good thing!) Chemicals that pass the lung membrane are absorbed into the bloodstream and carried to all parts of the body. Absorption can be extremely rapid. The rate of absorption depends on the concentration of the toxic substance, its solubility in water, the depth of respiration and the rate of blood circulation.

*Ingestion

Ingestion of toxic materials is an unlikely event in the chemical laboratory as long as good hygiene practices are followed. Materials that are ingested may be absorbed into the bloodstream anywhere along the gastrointestinal tract. If the material cannot be absorbed it will be eliminated from the body.

2. Species

Toxicity is species specific, with the level of sensitivity dependent upon each species. The difference in observed reaction is related to the method that each species handles the substance. The rate that the chemical is absorbed, metabolized or excreted in a greater or lesser amount, or the metabolic pathway that is utilized to handle the material will determine the end effect. Occasionally a physiological difference will determine the fate of the toxicant. For instance, some animals are not capable of vomiting so when they ingest a poison they have no means of removing the offending substance from the body.

3. Gender

Though the data for humans is almost nonexistent, there are definitive results that show there are gender differences in the sensitivity to certain chemicals. These differences are often not evident in the immature animals, indicating that the sensitivity is perhaps related to sex hormone production. On the other hand, there is ample evidence to show that the gender specific reproductive progress can be severely compromised by exposure to toxic substances.

4. Health

Individuals that are predisposed to certain health problems, such as diseases of the liver or lungs, are more likely to be affected by exposure to toxic materials, and once exposed, more likely to experience a more severe reaction.

5. Presence of other substances

Certain substances are dangerous when a person is exposed to 2 or more substances at the same time. The resulting effect is more hazardous than would be predicted from the exposure to either of the individual substances. This is known as a synergistic effect.

Identifying Toxic Materials

1. Using Chemical Structure as a Guide to Toxicity and Carcinogenicity

Unfortunately, it is not often easy to predict which classes of chemicals are going to be toxic or carcinogenic, and which are not. There are some generalizations, however, that are possible. The following classes of chemicals have been found to be acute and chronic toxins, and extra care should be taken when working with them.

Acute toxins

- All halogens are toxic (bromine, chlorine, fluorine, iodine).
- Cyanides and nitriles (CN groups) are rapid acting toxins.
- Heavy metals (arsenic, cadmium, mercury, etc.) are well known toxins, some acute, others chronic.

Chronic toxins

- Heavy metals (arsenic, cadmium, mercury, etc.) are well known toxins, some acute, others chronic.

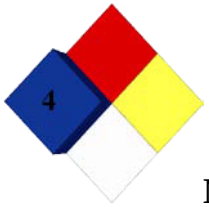
Carcinogens

- alkylating agents (alpha-halo ethers; sulfonates; epoxides; electrophilic alkenes and alkynes)
- acylating agents
- organohalogen compounds
- hydrazines
- N-nitroso compounds
- aromatic amines
- aromatic hydrocarbons
- many "natural products"

Specific examples of these agents (acute toxins, chronic toxins and carcinogens) are also available.

2. Using Chemical Labels as an Aid

As an aid in identifying the chemicals which pose a reactivity hazard in the laboratory, all chemical manufacturers are required to include relevant information on the chemical label. One of the most common grading systems is that developed by the National Fire Protection Association (NFPA). In this system, chemicals are rated from 0 (non-toxic) to 4 (extremely toxic). It is important for all laboratory personnel to recognize and become familiar with the NFPA diamond and understand the grading levels established by the NFPA for toxic materials. The blue portion of the diamond gives an indication of the toxicity of the material.



NFPA System for Rating the Toxicity of Chemicals

Rating	Type of Possible Injury
0	Materials that on exposure under fire conditions offer no hazard beyond that of ordinary combustible materials.
1	Materials that on exposure would cause irritation but only minor residual injury.
2	Materials that on intense or continued but not chronic exposure could cause temporary incapacitation or possible residual injury.
3	Materials that on short exposure could cause serious temporary or residual injury.

4 Materials that on very short exposure **could cause death** or major residual injury.

One difficulty with the NFPA labeling system is that it offers no indication as to whether the material is a carcinogen or potential carcinogen. You must consult the chemical label or material data safety sheet to obtain this information.

An even more obvious warning that a material is a poison is the presence of the familiar skull and crossbones on the chemical label. This is a standard symbol required by the Department of Transportation (DOT) to be used on all packages offered for transport over public highways, airways or by sea, which carry materials classified as an inhalation hazard, a poison or poison gas.

More recently, in an effort to warn small children of the dangers of toxic materials, a new picture has been introduced and widely used by the media and schools. Many substances, especially those that may be found in the home or school where children may be present, now carry the fluorescent green "Mr. Yuck" symbol prominently on their label.

And finally, the symbol which is now used to indicate that a material is a carcinogen or potential carcinogen is the cropped repeating "C".

It is important that all lab personnel are familiar with these symbols that are associated with toxic materials. **Always look for these warnings!** Never handle a potentially poisonous chemical until you are aware of the hazards, the level of protection required to work safely with the material, and the appropriate response should you be exposed to the substance. Some toxic materials will list an antidote on the label in case of accidental exposure. Always be aware of this antidote and be certain that it is within easy access of the area where the toxic material will be used.

3. Materials Recognized by Reporting Authorities to be Hazardous to Health

Three agencies are responsible for evaluating data on carcinogenicity or otherwise regulating the use of these materials. They are the International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP), and the Occupational Safety and Health Administration (OSHA). These agencies each perform very different functions with regards to determining carcinogenicity, analyzing the results on this research, and making recommendations.

A. International Agency for Research on Cancer

The International Agency for Research on Cancer (IARC) was established in 1965 by the World Health Organization. IARC's mission is to coordinate and conduct research on the causes of human cancer, and to develop scientific strategies for cancer control. The Agency is involved in both epidemiological and laboratory research, and disseminates scientific information through meetings, publications, courses and fellowships.

Since 1969, the IARC has published 44 monographs considering the risk of cancer of various chemicals, mixtures and exposure circumstances, i.e. occupations. The IARC does not make recommendations regarding regulatory standards, but rather evaluates scientific studies. Materials that are studied are classified into one of 3 categories:

- Group 1: The material is carcinogenic to humans.
- Group 2A: The material is probably carcinogenic to humans.

This category is used if there is limited evidence of carcinogenicity in humans **and** sufficient evidence in experimental animals. Or it can be placed in this category if there is sufficient evidence of carcinogenicity in humans or experimental animals, strengthened by other supporting evidence.

- Group 2B: The material is possibly carcinogenic to humans.

This category is used when there is limited evidence of carcinogenicity in humans but no or inadequate supporting evidence in experimental animals. A material may also be placed in this group if there is no or inadequate evidence in humans, but limited evidence in experimental animals coupled with other supporting evidence.

B. National Toxicology Program

The NTP (National Toxicology Program) prepares the annual report on carcinogens which is issued by the Secretary of the Department of Health and Human Services. Carcinogenic substances are grouped as "known carcinogens" or "reasonably anticipated to be carcinogens". The NTP prepares annual reports on materials that have been shown or are suspected to cause cancer in humans.

List of chemicals known to be carcinogens

Many materials have been shown to cause cancer in humans; these materials are known to be carcinogens if there is sufficient evidence of carcinogenicity from studies in humans which indicates a causal relationship between the agent and human cancer.

List of chemicals reasonably anticipated to be carcinogens

The NTP designates a material as an anticipated carcinogen if:

A. There is limited evidence of carcinogenicity from studies in humans, which indicates that causal interpretation is credible, but that alternative explanations, such as chance, bias or confounding, could not adequately be excluded, or
B. There is sufficient evidence of carcinogenicity from studies in experimental animals which indicates that there is an increased incidence of malignant tumors: (a) in multiple species or strains, or (b) in multiple experiments (preferably with different routes of administration or using different dose levels), or (c) to an unusual degree with regard to incidence, site or type of tumor, or age at onset. Additional evidence may be provided by data concerning dose-response effects, as well as information on mutagenicity or chemical structure.

C. Occupational Safety and Health Administration

The Occupational Safety and Health Administration (OSHA) does not maintain a list of known carcinogens but does regulate a number of specific carcinogenic materials through standards. The standards provide very strict guidelines on handling, use and storage of these materials, including information regarding sampling, medical monitoring, training, labeling and hazard communications. A list of these OSHA regulated materials is available.

Exposure Limits

The greatest danger of overexposure to hazardous materials occurs through inhalation. Because of this, three agencies provide information regarding exposure limits, specifying levels of air borne contaminants which are considered safe. OSHA has established a list of 425 substances which are considered air contaminants, many of which are commonly found in the research lab. Each of these materials has associated with it a PEL or permissible exposure limit. In addition, there are two other authorities interested in measuring air contaminants - the National Institute of Occupational Safety (NIOSH) and the American Conference of Governmental Industrial Hygienists (ACGIH). These 3 agencies have established guidelines and specific exposure levels of various contaminants. The levels recommended by these agencies should be used as guidelines, and in addition, the PELs established by OSHA are considered **legal limits** with the power of the legal system behind them.

1. Terminology Related to Exposure Limits

The terminology used by each of these authorities (OSHA, NIOSH, ACGIH) is critical in assessing the risk of a hazardous materials. All lab personnel should take time to become acquainted with these terms and acronyms, which are commonly encountered in the Toxicological Information section of the material safety data sheet (MSDS), prior to handling a potentially hazardous material.

A. Occupational Safety and Health Administration (OSHA)

The first legislative action that responded to worker health issues was the Occupational Safety and Health Act of 1970, with enforcement authority granted to the newly created Occupational Safety and Health Administration (OSHA). With the chemical release disaster in Bhopal in 1984 which killed 2,000 people and injured 30,000, and heightened awareness of the public of the effects of contaminants in the environment, Congress began studying other plant disasters, leading to passage of the Right to Know Laws of 1986. This required that safe levels of specific chemicals be determined and exposure guidelines be set. The following terms are those used by OSHA with regards to exposure limits.

PEL (Permissible Exposure Limit)
The maximum allowable limit for an air contaminant for which a worker may be exposed on a daily basis without suffering adverse affects.

C (Ceiling)
The concentration of a substance that should not be exceeded.

TWA (Time Weighted Average)
The airborne concentration of a material to which workers may not exceed for an eight hour day of a 40 hour week. This level may not be appropriate for the old, young, ill or those predisposed to problems from chemical exposures.

AL (Action Level)
The exposure level at which OSHA regulations for protective programs must be put into effect. This would include such things as air-monitoring, medical surveillance and training.

B. American Conference of Governmental Industrial Hygienists (ACGIH)

The American Conference of Governmental Industrial Hygienists is a not-for-profit organization which addresses the administrative and technical aspects of worker health and safety. ACGIH serves as a medium for the exchange of ideas and experiences to facilitate the promotion of standards, recommendations, and techniques in occupational and environmental hygiene. It offers support to the industrial hygiene profession in the anticipation, recognition, evaluation, and control of job-site hazards that may result in injury, illness, or well-being of workers. This organization has determined exposure limits for over 600 substances.

TLV (Threshold Limit Value)
The airborne concentration of a substance which nearly all workers may be exposed day after day without adverse effects.

TLV-TWA (Threshold Limit Value - Time Weighted Average)
The allowable 8-hour a day concentration that a worker may be exposed to during a 40-hour week.

TLV-C (Threshold Limit Value - Ceiling)
The ceiling value that should not be exceeded even for an instant. Unlike the other TLVs which serve as guidelines, the TLV-C must be viewed as an absolute boundary.

TLV-STEL (Threshold Limit Value - Short-Term Exposure Limit)
The short term exposure or maximum concentration of a substance which a worker may be exposed to for a continuous 15 minute period, with a low probability of experiencing irritation, irreversible damage, or unconsciousness. Four of these 15 minute periods are allowed per workday, with at least a 60 minute break in between. However, at no time may the TLV-TWA be exceeded.

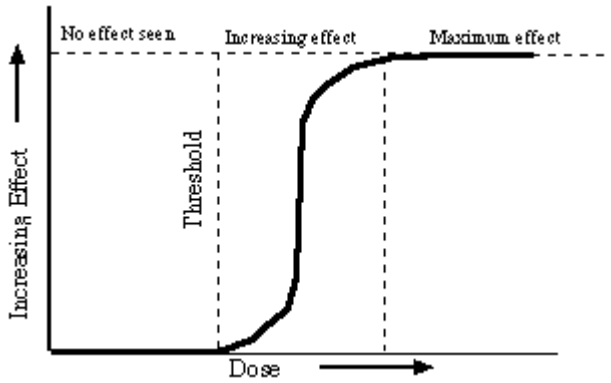
C. National Institute of Occupational Safety (NIOSH)

REL (Recommended Exposure Level)

The highest airborne contamination level that a person may be exposed to and expect not to be injured. It may be expressed as a ceiling level or as a TWA (time weighted average) for a 10 hour work day.

IDLH (Immediately Dangerous to Life and Health)
This is the concentration above which is immediately dangerous. It is the value that is used in selecting an appropriate respirator.

2. Dose-Response Principles



The relationship between the dose and response can be represented graphically as seen in the accompanying graph. With initial exposure, no effect is seen. This can be interpreted as the range at which the body successfully mounts its own defense mechanisms and fights off the effects of the material. This remains true until the threshold is reached and surpassed. At that time, small incremental increases in the material results in comparatively larger responses. At this point the victim begins to display symptoms of exposure. As the dose continues to be increased, the maximum effect is reached at which point further increases in the material yield no additional change or response to the material. The ultimate maximum effect, of course, would be death of the victim.

The dose-response relationship will be highly dependent from one species to another, from one individual to another within a species, and perhaps even for the same individual given different testing conditions. So how can you set explicit levels that will guarantee that a given exposure will not cross the threshold? The FDA has done this by arbitrarily setting a 100-fold margin of safety. That is, if a test animal has a threshold of 100 ppm, the FDA has set the safe level for humans at 1 ppm. Why, you might ask, is the level set at 100-fold? This is based on the assumptions that humans are 10-times as sensitive to the material as animals, and that the weak portion (the old, young, ill, predisposed) of the population is 10-times as sensitive as the healthy human population.

It becomes apparent that the crucial value in determining the toxicity of a material is the threshold value. To determine this value, laboratory animals are used to establish the onset of symptomatic reactions. From these studies, toxicity data is gathered, threshold values are determined, and the results are reported. These are the values that are commonly reported in the material safety data sheets (MSDS) provided by chemical manufacturers.

3. Terminology Related to Toxicity Data

The following terms are ones that you will encounter on the material safety data sheet (MSDS) for all chemicals provided by a chemical manufacturer. As mentioned above in the section relating the dose to the response, many experiments have been done to determine the dangerous concentration levels of hundreds of materials. These results are tabulated and available in many references, as well as the MSDS, and it is important that all lab personnel are familiar with the degree of toxicity of the materials in use.

LC_{50} (Lethal Concentration 50)
The concentration of a material in air that, on the basis of laboratory tests, is expected to kill 50% of a group of test animals when administered as a single respiratory exposure in a specific time period.

LC_{LO} (Lethal Concentration Low)
The lowest concentration of substance in air reported to have caused death in humans or animals. The reported concentrations may be entered for periods of exposure that are less than 24 hours (acute) or greater than 24 hours (subacute and chronic).

LD_{50} (Lethal Dose 50)
The single dose of substance that causes the death of 50% of an animal population from exposure to a substance by any route other than inhalation.

LD_{LO} (Lethal Dose Low)
The lowest dose of a substance introduced by any route, other than inhalation, reported to have caused death in humans or animals.

TC_{LO} (Toxic Concentration Low)
The lowest concentration of substance in air to which humans or animals have been exposed for any given period of time that has produced any toxic effect in humans or produced tumorigenic or reproductive effect in animals or humans.

TD_{LO} (Toxic Dose Low)
The lowest dose of a substance introduced by any route other than inhalation over any given period of time and reported to produce any toxic effect in humans or to produce any tumorigenic or reproductive effect in humans or animals.

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CHEMICAL COMPATIBILITY CLASSES

EXPLOSIVES/ SHOCK-SENSITIVES	**EX**	EXPLOSIVE
	SS	SHOCK-SENSITIVE
FLAMMABLE/ COMBUSTIBLE LIQUIDS	**FL**	ORGANIC GROUP-ONE 1
	FL-2	ORGANIC GROUP-TWO 2
	FL-HYZ	HYDRAZINE
	FL-A	FLAMMABLE ACID
	FL-B	FLAMMABLE BASE
FLAMMABLE SOLIDS	**FS**	FLAMMABLE SOLID
OXIDIZERS	**OX-A**	INORGANIC ACID
	OX-B	BASIC AND OTHER
	OX-O	ORGANIC OXIDIZER
ACIDS	**AC-I**	INORGANIC ACID
	AC-O	ORGANIC ACID
BASES	**BS-I**	INORGANIC BASE
	BS-O	ORGANIC BASE
CYANIDES AND SULFIDES	**CN**	CYANIDE
	SU	SULFIDE
POISONS	**PO**	ORGANIC GROUP-ONE 1
	PO-2	ORGANIC GROUP-TWO 2
	PO-I	INORGANIC POISON 3
OTHER	**SA**	**STORE ALONE!**

1 Group-One = Alcohols, glycols, aldehydes, amides, esters, ethers, aromatic hydrocarbons, halogenated organics, ketones and aliphatic saturated hydrocarbons.

2 Group-Two = Aliphatic and aromatic amines, dithio-carbamates, carbamates, mercaptans and other organic sulfides, nitriles, organic nitro compounds, and unsaturated aliphatic hydrocarbons.

3 Inorganic poisons generally can be placed with either Group One or Group Two poisons.

CHEMICAL CONTAINER LABELING SUMMARY

PERMANENT CONTAINERS (Purchased Products)

- **Chemical Name**
- **Physical Hazards** (Pyrophoric, Organic Peroxide, Flammable, Oxidizer, Reactive, Water Reactive, Explosive) See Attachment 1.
- **Health Hazards** (Biohazard, Corrosive, Poison, Toxic, Radioactive, Carcinogen, Irritant, Sensitizer) See Attachment 2.
- **Target Organs**
- **Manufacturer Name & Address**
- **Date of Receipt**

DURABLE CONTAINERS (in use > one work session)

- **Chemical Name/Concentration**
- **Date of Preparation, Initials of Preparer**
- **Physical Hazards**
- **Health Hazards**
- **Non-mandatory:**
    - Method or Procedure Reference
    - Storage Location
    - Recordkeeping Reference
    - Target Organ Information

TRANSIENT CONTAINERS (in use < one work session)

- **No Required Labeling**

CLASSES OF FLAMMABLE LIQUIDS

Examples of Class IA Flammable Liquids

(Liquids having flashpoints below 73°F and boiling points below 100°F)

Acetaldehyde
Acetone
Acetonitrile
Acetyl chloride
Acrolein
Acrylonitrile
Amylene
Benzene
2-Bromobutane
Bromoethane
1,3-Butadiene
Butane
2-Butanone
Butene
tert-Butyl alcohol
Butylamine
tert-Butyl ethyl ether
tert-Butyl methyl ether
Butyl vinyl ether
Carbon disulfide
1-Chlorobutane
Cyclohexane
Cyclohexene
3,4-Dihydro-2H-pyran
Diisopropylamine
Dimethylamine
2,2-Dimethylpropane
1,2-Epoxybutane
Ethyl acetate
Ethyl alcohol
Ethylamine solutions
Ethylene oxide
Ethyl ether
Ethyl nitrite
Ethyl vinyl ether
Furan
Heptane
Hexanes
Isopropyl alcohol
Isopropylamine
Methanethiol
Methanol
2-Methylbutane
Methyl ether
Methyl sulfide
Methyl vinyl ether
Methyl formate
Pentane
1-Propanol
Propylene
Propylene oxide
Tetrahydrofuran
Triethylamine
Trimethylamine
Vinyl chloride
Vinylidene chloride

Examples of Class IB Flammable Liquids

(Liquids having flashpoints below 73°F and boiling points at or above 100°F)

Acetal
Allyl acetate
tert-Amyl alcohol
Benzotriflouride
3-Bromopentane
Butyl acetate
Butyl formate
1 2-Dichloropropane
1,2-Dimethoxypropane
1,3-Dimethylbutylamine
3,3-Dimethylbutyraldehyde
1,1-Dimethylcyclohexane
2,5-Dimethyl-1,5-hexadiene
1,4-Dioxane
Ethyl acrylate
Ethylbenzene
N-Ethylbutylamine
Ethyl butyrate
Ethylcyclohexane
Fluorotoluene
Heptane
Hexylamine
Isobutyl acetate
Methyl butyrate
Methylcyclohexane
4-Methyl-1-cyclohexene
Methylheptane
Methyl methacrylate
2-Methyl-2-pentanol
1-Methylpyrrole
Octane
1-Octene
1-Pentanethiol
2-Pentanone
3-Pentanone
Pyridine
Toluene
Triethylaluminum
2,2,4-Trimethylpentane
Valeraldehyde

Examples of Class IC Flammable Liquids

(Liquids having flashpoints at or above 73°F and below 100°F)

Allyl chloroformate
Amyl acetate
1-Bromopentane
1-Bromopropane
2,3-Butanedione
1-Butanol
Butyl ether
Chlorobenzene
1-Chlorohexane
Cyclohexylamine
Cyclohexyl chloride
Cyclopentanone
1,2-Diaminopropane
1,1-Dichloroacetone
1,3-Dichlorobutane
1,3-Dichloro-2-butene
1,3-Dichloropropane
Dicyclopentadiene
Diisobutylamine
Dimethylaminoacetonitrile
Ethylenediamine
4-Ethylmorpholine
Isoamyl acetate
Isobutyl alcohol
Mesityl oxide
Methyl disulfide
Nitroethane
Nitromethane
2-Pentanol
Styrene monomer
Triethyl orthoformate
m-Xylene
o-Xylene
p-Xylene

COMMON PEROXIDE-FORMING CHEMICALS

Severe Peroxide Hazard on Storage with Exposure to Air

Use within 3 months

Diisopropyl ether (isopropyl ether)
Divinyl acetylene (DVA)
Potassium metal
Potassium amide
Sodium amide (sodamide)
Vinylidene chloride (1,1-dichloroethylene)

Peroxide Hazard on Concentration

Do Not Distill or Evaporate Without First Testing for the Presence of Peroxides

Use or test for peroxides within 6 months

Acetaldehyde diethyl acetal (acetal)
Cumene (isopropylbenzene)
Cyclohexene
Cyclopentene
Decalin (decahydronaphthalene)
Diacetylene (butadiene)
Dicyclopentadiene
Diethyl ether (ether)
Diethylene glycol dimethyl ether (diglyme)
Dioxane
Ethylene glycol dimethyl ether (glyme)
Ethylene glycol ether acetates
Ethylene glycol monoethers (cellosolves)
Furan
Methyl acetylene
Methylcyclopentane
Tetrahydrofuran (THF)
Tetralin (tetrahydronaphthalene)
Vinyl ethers

Hazard of Rapid Polymerization Initiated by Internally-Formed Peroxides*

Use or test for peroxides within 6 months

Chloroprene (2-chloro-1,3-butadiene)
Styrene
Vinyl acetate
Vinyl pyridine
Methyl methacrylate
Acrylic acid
Acrylonitrile
Butadiene
Tetrafluoroethylene
Chlorotrifluoroethylene
Vinyl acetylene
Vinyl chloride

*Under conditions of storage in the liquid state the peroxide-forming potential increases and certain of these monomers (especially butadiene, chloroprene, and tetrafluoroethylene) should then be considered as A list compounds.

SHOCK-SENSITIVE COMPOUNDS

Acetylenic compounds—especially polyacetylenes, haloacetylenes and heavy metal salts of acetylenes (copper, silver and mercury salts are particularly sensitive).

Acyl nitrates

Alkyl nitrates—particularly polyol nitrates (i.e. nitrocellulose and nitroglycerine).

Alkyl and acyl nitrites

Alkyl perchlorates

Amminemetal oxosalts—metal compounds with coordinated ammonia, hydrazine or similar nitrogenous donors and ionic perchlorate, nitrate, permanganate or other oxidizing groups.

Azides—including metal, nonmetal and organic azides.

Chlorite salts of metals (i.e., $AgClO_2$ and $Hg(ClO_2)_2$

Diazo compounds (i.e. CH_2N_2)

Diazonium salts (when dry)

Fulminates—silver fulminate (AgCNO) can form in the reaction mixture from the Tollens' test for aldehydes if it is allowed to stand for some time; this can be prevented by adding dilute nitric acid to the test mixture as soon as the test has been completed.

Hydrogen peroxide—becomes increasingly treacherous as the concentration rises above 30 percent, forming explosive mixtures with organic materials and decomposing violently in the presence of traces of transition metals.

N-Halogen compounds (i.e. difluoroamino compounds and halogen azides)

N-Nitro compounds (i.e. N-nitromethylamine, nitrourea, nitroguanidine and nitric amide).

Oxo salts of nitrogenous bases—perchlorates, dichromates, nitrates, iodates, chlorites, chlorates and permanganates of ammonia, amines, hydroxylamine, guanidine, etc.

Perchlorate salts—most metal, nonmetal and amine perchlorates can be detonated and may undergo violent reaction in contact with combustible materials.

Peroxides and hydroperoxides

Peroxides (solid)—crystallized from or are left from evaporation of peroxidizable solvents.

Peroxides—transition-metal salts

Picrates—especially salts of transition and heavy metals (i.e. Ni, Pb, Hg, Cu and Zn). Picric acid is explosive, but is less sensitive to shock or friction than its metal salts and is relatively safe as a water-wet paste.

Polynitroalkyl compounds (i.e. tetranitromethane and dinitroacetonitrile)

Polynitroaromatic compounds—especially polynitro hydrocarbons, phenols and amines

Source: Iowa State University, Chemical Hygiene Plan

EXAMPLES OF EXPLOSIVE & SHOCK-SENSITIVE MATERIALS

Acetylides of heavy metals
Aluminum ophorite explosive
Amatol
Ammonal
Ammonium nitrate
Ammonium perchlorate
Ammonium picrate
Ammonium salt lattice
Butyl tetryl
Calcium nitrate
Copper acetylide
Cyanuric triazide
Cyclotrimethylenetrinitramine
Cyclotetramethylenetetranitramine
Dinitroethyleneurea
Dinitroglycerine
Dinitrophenol
Dinitrophenolates
Dinitrophenyl hydrazine
Dinitoresorcinol
Dinitrotoluene
Dipicryl sulfone
Dipicrylamine
Erythritol tetranitrate
Fulminate of mercury

Fulminate of silver
Fulminating gold
Fulminating mercury
Fulminating platinum
Fulminating silver
Gelatinized nitrocellulose
Guanyl nitrosamino guanyl tetrazene
Guanyl nitrosamino guanylidene hydrazine
Heavy metal azides
Hexanite
Hexanitrodiphenylamine
Hexanitrostilbene
Hexogen
Hydrazinium nitrate
Hydrazoic acid
Lead azide
Lead mannite
Lead mononitroresorcinate
Lead picrate
Lead salts
Lead styphnate
Trimethylolethane
Magnesium ophorite
Mannitol hexanitrate
Mercury oxalate
Mercury tartrate
Mononitrotoluene
Nitrated carbohydrate
Nitrated glucoside
Nitrated polyhydric alcohol
Nitrogen trichloride
Nitrogen tri-iodide
Nitroglycerine
Nitroglycide
Nitroglycol
Nitroguanidine
Nitroparaffins
Nitronium perchlorate
Nitrourea
Organic amine nitrates
Organic nitramines
Organic peroxides
Picramic acid
Picramide
Picratol

Picric acid
Picryl chloride
Picryl fluoride
Polynitro aliphatic compounds
Potassium nitroaminotetrazole
Silver acetylide
Silver azide
Silver styphnate
Silver tetrazene
Sodatol
Sodium amatol
Sodium dinitro-ortho-cresolate
Sodium nitrate-potassium nitrate explosive mixture
Sodium picramate
Syphnic acid
Tetrazene
Tetranitrocarbazole
Tetrytol
Trimonite
Trinitroanisole
Trinitrobenzene
Trinitrobenzoic acid
Trinitrocresol
Trinitro-meta-cresol
Trinitronaphthalene
Trinitrophenetol
Trinitrophloroglucinol
Trinitroresorcinol
Tritonal
Urea nitrate

Source: Triangle Resource Industries, One Hundred Most Commonly Found Explosive and Shock-Sensitive Materials.

Known and Reasonably Anticipated Human Carcinogens

The following lists are from the U.S. Department of Health and Human Services' 11th report on carcinogens. The first list includes chemicals that are known human carcinogens. The second list includes chemicals that are reasonably anticipated to be human carcinogens. The report can be found at http://ehp.niehs.nih.gov/roc/. It includes detailed information about each item on the lists.

The absence of a chemical from one of the lists **does not** mean that it cannot have carcinogenic properties. The presence of a chemical on one of the lists **does not** indicate that it is a proven carcinogen. Users should treat the materials listed with the caution, and gather as much safety data as possible before starting work.

UNIVERSITY OF NEBRASKA AT KEARNEY
HAZARDOUS MATERIALS MANUAL
APPENDIX B6
REGISTRATION FORM FOR ACUTE HAZARDOUS CHEMICALS

Campus personnel who use or store any chemicals found on the EPA "P List" are required to provide the following information and to submit this form to the Hazardous Material Technician. The EPA "P List" is provided within Appendix C4 of the UNK Hazardous Materials Manual. Submit **one form for each room** where P-Listed chemicals are used and/or stored. Please provide updates whenever additional P-listed chemicals are purchased. The Hazardous Materials Technician will request quarterly updates of this information.

Faculty name and Department: _____

Building and Office Room Number: _____

Telephone Number: _____

Building and Room Number where chemical(s) is(are) used/stored: _____

Check the situation that applies:
_____This is the first time that this form has been submitted for this room.
_____This information is provided in addition to that provided on the original form.
_____This is a quarterly update. The information provided here supersedes the information provided on the original form.

Please provide the following information:

Chemical Name	C.A.S. Number	Amount in Storage

If this is a quarterly update, have there been any changes since the last report?
Do you expect to generate waste containing any of these chemicals within the next three months?
If yes, approximately how much?
If any of these chemicals have been used but no waste was generated, briefly describe why no waste was generated. (use the back of this sheet or attach additional sheets)

Signature: _____

Date: _____

(Latest revision: 2009)

SPECIFIC CHEMICAL INCOMPATIBILITIES

Chemical Name	Is Incompatible With:
Acetic Acid	Chromic acid, nitric acid, carbonates, hydroxides, oxides, ethylene glycol, perchloric acid, peroxides, permanganates, oxidizers, strong caustics, most metals (except aluminum).
Acetone	Concentrated nitric and sulfuric acid mixtures, oxidizing materials, chloroform, alkalis, chlorine compounds and acids.
Acetylene	Air (may form explosive mixtures with air), heat (may cause fire or explosion), oxidizers, chlorine, bromine, fluorine, copper, silver, mercury or salts of copper, silver and mercury.
Alkali and alkaline earth metals (carbides, hydrides, metals, oxides, peroxides, hydroxides)	Water, carbon dioxide, halogens, halogenated organic compounds, oxidizing agents, acids, halogenating agents.
Ammonia, anhydrous	Strong acids, oxidizers, acetaldehyde, acrolein, gold, silver, mercury, halogenating agents, fluorine, chlorine, iodine, bromine and hypochlorite bleaches.
Ammonium nitrate	Acids, metal powders, flammable liquids, chlorates, nitrates, sulfur, finely divided organic or combustible materials.
Aniline	Strong acids, strong oxidizers, albumin, solutions of iron, zinc, aluminum, toluene diisocyanate and alkalis. Ignites spontaneously in presence of red fuming nitric acid and with sodium.
Arsenical materials	Any reducing agent.
Azides, inorganic	Acids, heavy metals (copper, lead and zinc, etc.), oxidizing agents
Bromine	Water, steam and most metals, especially aluminum, titanium, mercury and potassium. Also reducing agents, combustibles and many organic chemicals.
Carbon, activated	Calcium hypochlorite, all oxidizing agents
Calcium Oxide	Water, acids
Carbon Tetrachloride	Sodium, potassium and lithium
Chlorates	Ammonium salts, acids, metal powders, sulfur, finely divided organic or combustible materials
Chromic acid and chromium trioxide	Acetic acid, naphthaline, camphor, glycerin, turpentine, alcohol, flammable liquids in general

Chlorine	Ammonia, acetylene, butadiene, butane, methane, propane (or other petroleum gases), hydrogen, sodium carbide, turpentine, benzene, finely divided metals
Chlorine dioxide	Ammonia, methane, phosphine, hydrogen sulfide
Copper	Acetylene, hydrogen peroxide, azides
Cumene hydroperoxide	Acids, organic or inorganic
Cyanides, inorganic	Acids, strong bases
Dimethylsulfoxide	Iodine pentaflouride, periodic acid, potassium permanganate, acid chlorides, silver fluoride, and other strong oxidlzing agents such as magnesium perchlorate and perchloric acid
Flammable liquids	Ammonium nitrate, chromic acid, hydrogen peroxide, nitric acid, sodium peroxide, the halogens
Fluorine	Ammonia, covalent halides, hydrocarbons, hydrofluoric acid, hydrogen, hydrogen sulfide, ice, nitric acid, non-metal oxides, non-metals, oxygen, sodium acetate, water, most organic matter
Hydrazine	Hydrogen peroxide, nitric acid, any other oxidant
Hydrocarbons (butane, propane, benzene, gasoline, turpentine, etc.)	Fluorine, chlorine, bromine, chromic acid, peroxides
Hydrocyanic Acid	Nitric acid, alkali
Hydrofluoric Acid, anhydrous	Ammonia, aqueous or anhydrous
Hydrogen peroxide	Copper, chromium, iron, most metals or their salts, alcohols, acetone, organic materials, aniline, nitromethane, flammable liquids, combustible materials
Hypochlorites	Acids, activated carbon
Hydrogen sulfide	Fuming nitric acid, oxidizing gases
Iodine	Acetylene, ammonia (aqueous or anhydrous), hydrogen, nitric acid, sodium azide
Mercury and its amalgams	Acetylene, fulminic acid (produced in nitric acid - ethanol mixtures), ammonia
Nitrates, inorganic	Acids, reducing agents
Nitric acid (concentrated)	Acetic acid, aniline, chromic acid, chromates, hydrocyanic acid, sulfides, flammable liquids, flammable gases, acetone, alcohol, nitratable substances, metals, bases, permanganates, reducing

	agents, sulfuric acid
Nitrites, inorganic	Acids, oxidizing agents
Nitroparaffins	Inorganic bases, amines
Organic compounds	Oxidizing agents
Organic acyl halides	Bases, organic hydroxy and amino compounds
Organic anhydrides	Bases, organic hydroxy and amino compounds
Organic halogen compounds	Group IA and IIA metals, aluminum
Organic nitro compounds	Strong bases
Oxalic acid	Silver, mercury and their salts
Oxygen	Oils, grease, hydrogen, flammable liquids, solids or gases
Perchloric acid	Acetic anhydride, bismuth and its alloys, alcohol, paper, wood, grease, oils
Peroxides, organic	Acids, (organic or mineral). Avoid friction; store cold.
Phosphorus	Air, oxygen, alkalis, oxidizing agents
Phosphorus pentoxide	Alcohols, strong bases, water
Potassium	Carbon tetrachloride, carbon dioxide, water and other halogenated hydrocarbons
Potassium chlorate	Sulfuric and other acids
Potassium perchlorate	Sulfuric and other acids
Potassium permanganate	Hydrogen peroxide, oxidizable substances, nitric acid, glycerin, ethylene glycol, benzaldehyde, sulfuric acid
Selenides	Reducing agents (e.g., active metals; zinc)
Sodium	Carbon tetrachloride, other halogenated hydrocarbons, carbon dioxide, water

Sodium peroxide	Ethyl or methyl alcohol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulfide, glycerin, ethylene glycol, ethyl acetate, methyl acetate, furfural, any oxidizable substance
Sodium nitrite	Ammonium nitrate and other ammonium salts
Silver	Acetylene, oxalic acid, tartaric acid, ammonium compounds, fulminic acid
Sulfides, inorganic	Acids
Sulfuric acid	Potassium chlorate, potassium perchlorate, potassium permanganate (or compounds with similar light metals, such as sodium, lithium), bases, perchlorates, water
Tellurides	Reducing agents (e.g., sodium, magnesium, hydrogen, zinc)

Source: National Research Council. Committee on Hazardous Substances in the Laboratory. 1981. Prudent Practices for Handling Chemicals in Laboratories. National Academy Press. Washington, D.C.
Iowa State University, Chemical Hygiene Plan.
Material Safety Data Sheets.

POTENTIALLY EXPLOSIVE COMBINATIONS OF COMMON REAGENTS

Acetone + chloroform in the presence of base

Acetylene + copper, silver, mercury, or their salts

Ammonia (including aqueous solutions) + $C1_2$, Br_2 or I_2

Carbon disulfide + sodium azide

Chlorine + an alcohol

Chloroform or carbon tetrachloride + powdered Al or Mg

Decolorizing carbon + an oxidizing agent

Diethyl ether + chlorine (including a chlorine atmosphere)

Dimethyl sulfoxide + an acyl halide, $SOCl_2$, or $POCI_3$

Dimethyl sulfoxide + CrO_3

Ethanol + calcium hypochlorite

Ethanol + silver nitrate

Nitric acid + acetic anhydride or acetic acid

Picric acid + a heavy-metal salt, such as of Pb, Hg, or Ag

Silver oxide + ammonia + ethanol

Sodium + a chlorinated hydrocarbon

Sodium hypochlorite + an amine

UNIVERSITY OF NEBRASKA AT KEARNEY

HAZARDOUS MATERIALS MANUAL

APPENDIX B9

(copied from http://www.labsafety.org/files/ChemicalCompatibility.htm)

Chemical Compatibility Chart

Below is a chart adapted from the CRC Laboratory Handbook which groups various chemicals into 23 groups with examples and incompatible chemical groups. This chart is by no means complete but it will aid in making decisions about storage. For more complete information please refer to the MSDS for the specific chemical.

Group	Name	Example	Incompatible Groups
Group 1	Inorganic Acids	Hydrochloric acid Hydrofluoric acid Hydrogen chloride Hydrogen fluoride Nitric acid Sulfuric acid Phosphoric acid	2,3,4,5,6,7,8,10,13,14,16,17,18, 19,21,22,23
Group 2	Organic acids	Acetic acid Butyric acid Formic acid Propionic acid	1,3,4,7,14,16,17,18,19,22
Group 3	Caustics	Sodium hydroxide Ammonium hydroxide solution	1,2,6,7,8,13,14,15,16,17,18,20,23
Group 4	Amines and Alkanolamines	Aminoethylethanolamine Aniline Diethanolamine Diethylamine Dimethylamine Ethylenediamine 2-Methyl-5-ethylpyridine Monoethanolamine Pyridine Triethanolamine Triethylamine Triethylenetetramine	1,2,5,7,8,13,14,15,16,17,18,23
Group 5	Halogenated Compounds	Allyl chloride Carbon tetrachloride Chlorobenzene	1,3,4,11,14,17

Group 5	Halogenated Compounds	Chloroform Methylene chloride Monochlorodifluoromethane 1,2,4-Trichlorobenzene 1,1,1-Trichloroethane Trichloroethylene Trichlorofluoromethane	1,3,4,11,14,17
Group 6	Alcohols Glycols Glycol Ether	1,4-Butanediol Butanol (iso, n, sec, tert) Diethylene glycol Ethyl alcohol Ethyl butanol Ethylene glycol Furfuryl alcohol Isoamyl alcohol Methyl alcohol Methylamyl alcohol Propylene glycol	1,7,14,16,20,23
Group 7	Aldehydes Acetaldehyde	Acrolein Butyraldehyde Crotonaldehyde Formaldehyde Furfural Paraformaldehyde Propionaldehyde	1,2,3,4,6,8,15,16,17,19,20,23
Group 8	Ketones	Acetone Acetophenone Diisobutyl ketone Methyl ethyl ketone	1,3,4,7,19,20
Group 9	Saturated Hydrocarbons	Butane Cyclohexane Ethane Heptane Paraffins Paraffin wax Pentane Petroleum ether	20
Group 10	Aromatic Hydrocarbons	Benzene Cumene Ethyl benzene Naphtha Naphthalene Toluene Xylene	1,20
Group 11	Olefins	Butylene 1-Decene	1,5,20

Group 11	Olefins	1-Dodecene Ethylene Turpentine	1,5,20
Group 12	Petroleum Oils	Gasoline Mineral Oil	20
Group 13	Esters	Amyl acetate Butyl acetates Castor oil Dimethyl sulfate Ethyl acetate	1,3,4,19,20
Group 14	Monomers Polymerizable Esters	Acrylic acid Acrylonitrile Butadiene Acrylates	1,2,3,4,5,6,15,16,19,20,21,23
Group 15	Phenols	Carbolic acid Cresote Cresols Phenol	3,4,7,14,16,19,20
Group 16	Alkylene Oxides	Ethylene oxide Propylene oxide	1,2,3,4,6,7,14,15,17,18,19,23
Group 17	Cyanohydrins	Acetone cyanohydrin Ethylene cyanohydrin	1,2,3,4,5,7,16,19,23
Group 18	Nitriles	Acetonitrile Adiponitrile	1,2,3,4,16,23
Group 19	Ammonia	Ammonium Hydroxide Ammonium Gas	1,2,7,8,13,14,15,16,17,20,23
Group 20	Halogens	Chlorine Fluorine	3,6,7,8,9,10,11,12,13,14,15,19,21,22
Group 21	Ethers	Diethyl Ether THF	1,14,20
Group 22	Phosphorus	Phosphorus, Elemental	1,2,3,20
Group 23	Acid Anhydrides	Acetic anhydride Propionic anhydride	1,3,4,6,7,14,16,17,18,19

CHARACTERISTIC HAZARDOUS WASTES

Ignitable Waste

- Liquids with a flashpoint of less than 60 C (140° F)
- Solids capable of causing fire through friction or absorption of moisture or spontaneous chemical changes
- Oxidizers
- Ignitable compressed gases

Corrosive Waste

- Liquids with a pH of less than or equal to 2 **OR** greater than or equal to 12.5
- Liquids capable of corroding steel at a specific rate defined in NDEQ Title 128

Reactive Waste

- Wastes that are unstable and will readily undergo violent change
- Wastes that react violently with water
- Wastes that form potentially explosive mixtures with water
- Wastes that generate toxic gases, fumes, or vapors when mixed with water
- Wastes with cyanide or sulfide bearing complexes
- Wastes that are explosive when subjected to a strong initiating force
- Wastes that are readily capable of detonation
- Wastes that are forbidden explosives or Class 1.1, 1.2, or 1.3 explosives as defined in 49 CFR Part 173

Toxic Waste

- Wastes that exceed the regulatory threshold for one or more of the constituents listed in Appendix C2 using the Toxicity Characteristic Leaching Procedure (TCLP)

MAXIMUM CONCENTRATION OF CONTAMINANTS FOR THE TOXICITY CHARACTERISTIC LEACHING PROCEDURE (TCLP)			
EPA Waste Number	Name of Contaminant	C.A.S. Number	Regulatory Level(mg/L)
D004	Arsenic	7440-38-2	5
D005	Barium	7440-39-3	100
D018	Benzene	71-43-2	0.5
D006	Cadmium	7440-43-9	1
D019	Carbon tetrachloride	56-23-5	0.5
D020	Chlordane	57-74-9	0.03
D021	Chlorobenzene	108-90-7	100
D022	Chloroform	67-66-3	6
D007	Chromium	7440-47-3	5
D023	o-Cresol	95-48-7	200.0**
D024	m-Cresol	108-39-4	200.0**
D025	p-Cresol	106-44-5	200.0**
D026	Cresol		200.0**
D016	2,4-D	94-75-7	10
D027	1,4-Dichlorobenzene	106-46-7	7.5
D028	1,2 Dichloroethane	107-06-2	0.5
D029	1,1-Dichloroethylene	75-35-4	0.7
D030	2,4-Dinitrotoluene	121-14-2	0.13*
D012	Endrin	72-20-8	0.02
D031	Heptachlor (and its epoxide)	76-44-8	0.008
D032	Hexachlorobenzene	118-74-1	0.13*
D033	Hexachlorobutadiene	87-68-3	0.5
D034	Hexachloroethane	67-62-1	3
D008	Lead	7439-92-1	5
D013	Lindane	58-89-9	0.4
D009	Mercury	7439-97-6	0.2
D014	Methoxychlor	72-43-5	10
D035	Methyl ethyl ketone	78-93-3	200
D036	Nitrobenzene	98-95-3	2
D037	Pentachlorophenol	87-86-5	100
D038	Pyridine	110-86-1	5.0*
D010	Selenium	7782-49-2	1
D011	Silver	7440-22-4	5
D039	Tetrachloroethylene	127-18-4	0.7
D015	Toxaphene	8001-35-2	0.5
D040	Trichloroethylene	79-01-6	0.5
D041	2,4,5-Trichlorophenol	95-95-4	400
D042	2,4,6-Trichlorophenol	88-06-2	2
D017	2,4,5-TP (Silvex)	93-72-1	1
D043	Vinyl Chloride	75-01-4	0.2

* Quantitation limit is greater than calculated regulatory level. The quantitation limit therefore becomes the regulatory limit.

** If o-, m-, and p-Cresol concentrations cannot be differentiated, the total Cresol (D026) concentration is used. The regulatory level of total Cresol is 200 mg/L.

From Nebraska Department of Environmental Quality, Title 128, Chapter 3, Table 3, effective date: April 13, 2002.

HAZARDOUS WASTE FROM NON-SPECIFIC SOURCES
("F"-LIST)

Hazardous
Waste No. Hazardous Waste Description

F001 ..... The following spent halogenated solvents used in degreasing: tetrachloroethylene, trichloro-ethylene, ethylene chloride, 1,1,1-trichloroethane, carbon tetrachloride, and chlorinated fluorocarbons; all spent solvent mixtures/blends used in degreasing containing, before use, a total of ten percent or more (by volume) of one or more of the above halogenated solvents or those solvents listed in F002, F004, and F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures. (Toxic waste)

F002 .....The following spent halogenated solvents: tetrachloroethylene, methylene chloride, trichloroethylene, 1,1,1-trichloroethane, chlorobenzene, 1,1,2-trichloro-1,2,2-trifluoroethane, ortho-dichlorobenzene, tri-chlorofluoromethane, and 1,1,2-trichloroethane; all spent solvent mixtures/ blends containing, before use, total of ten percent or more (by volume) of one or more of the above halogenated solvents or those listed in F001, F004, or F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures. (Toxic waste)

F003 ..... The following spent non-halogenated solvents: Xylene, acetone, ethyl acetate, ethyl benzene, ethyl ether, methyl isobutyl ketone, n-butyl alcohol, cyclohexanone, and methanol; all spent solvent mixtures/blends containing, before use, only the above spent non-halogenated solvents; and all spent solvent mixtures/blends containing, before use, one or more of the above non-halogenated solvents, and, a total of ten percent or more (by volume) of one or more of those solvents listed in F001, F002, F004, and F005; and still bottoms from the recovery of these spent solvents and spent solvent mixtures. (Ignitable waste)

F004 ..... The following spent non-halogenated solvents: Cresols and cresylic acid, and nitrobenzene; all spent solvent mixtures/blends containing, before use, a total of ten percent or more (by volume) of one or more of the above non-halogenated solvents or those solvents listed in F001, F002, and F005: and still bottoms from the recovery of these spent solvents and spent solvent mixtures. (Toxic waste)

F005 ..... The following spent non-halogenated solvents: Toluene, methyl ethyl ketone, carbon disulfide, isobutanol, pyridine, benzene, 2-ethoxyethanol, and 2-nitropropane; all spent solvent mixtures/blends containing, before use, a total of ten percent or more (by volume) of one or more of the above non-halogenated solvents or those solvents listed in F001, F002, or F004; and still bottoms from the recovery of these spent solvents and spent solvent mixtures. (Ignitable and toxic waste)

F006 .....Wastewater treatment sludges from electroplating operations except from the following processes: (1) sulfuric acid anodizing of aluminum; (2) tin plating on carbon steel; (3) zinc plating (segregated basis) on carbon steel; (4) aluminum or zinc-aluminum plating on carbon steel; (5) cleaning/stripping associated with tin, zinc and aluminum plating on carbon steel; and (6) chemical etching and milling of aluminum. (Toxic waste)

F007 .....Spent cyanide plating bath solutions from electroplating operations. (Reactive and toxic waste)

F008 .....Plating bath residues from the bottom of plating baths from electroplating operations where cyanides are used in the process. (Reactive and toxic waste)

F009 .....Spent stripping and cleaning bath solutions from electroplating operations where cyanides are used in the process. (Reactive and toxic waste)

F010 ..... Quenching bath residues from oil baths from metal heat-treating operations where cyanides are used in the process. (Reactive and toxic waste)

F011 .....Spent cyanide solutions from salt bath pot cleaning from metal heat-treating operations. (Reactive and toxic waste)

F012 .....Quenching wastewater treatment sludges from metal heat-treating operations where cyanides are used in the process. (Toxic waste)

F019 ..... Wastewater treatment sludges from the chemical conversion coating of aluminum except from zirconium phosphating in aluminum can washing when such phosphating is an exclusive conversion coating process. (Toxic waste)

F020 .....Wastes (except wastewater and spent carbon from hydrogen chloride purification) from the production or manufacturing use (as a reactant, chemical intermediate, or component in a formulating process) of tri- or tetrachlorophenol, or of intermediates used to produce their pesticide derivatives. (This listing does not include wastes from the production of hexachlorophene from highly purified 2,4,5-trichloro-phenol.). (Acute hazardous waste)

F021 .....Wastes (except wastewater and spent carbon from hydrogen chloride purification) from the production or manufacturing use (as a reactant, chemical intermediate, or component in a formulating process) of pentachlorophenol, or of intermediates used to produce its derivatives. (Acute hazardous waste)

F022 .....Wastes (except wastewater and spent carbon from hydrogen chloride purification) from the manufacturing use (as reactant, chemical intermediate, or component in a formulating process) of tetra-, penta-, or hexachlorobenzenes under alkaline conditions. (Acute hazardous waste)

F023 .....Wastes (except wastewater and spent carbon from hydrogen chloride purification) from the production of materials on equipment previously used for the production or manufacturing use (as a reactant, chemical intermediate, or component in a formulating process) of tri- and tetrachlorophenols. (This listing does not include wastes from equipment used only for the production or use of Hexachlorophene from highly purified 2,4,5-trichlorophenol.) (Acute hazardous waste)

F024 .....Process wastes, including but not limited to, distillation residues, heavy ends, tars, and reactor clean-out wastes, from the production of certain chlorinated aliphatic hydrocarbons by free radical catalyzed processes. These chlorinated aliphatic hydrocarbons are those having carbon chain lengths ranging from one to and including five, with varying amounts and positions of chlorine substitution. (This listing does not include wastewaters, wastewater treatment sludges, spent catalysts, and wastes listed in Title 128, Chapter 3, Sections 013 or 014). (Toxic waste)

F025 .....Condensed light ends, spent filters and filter aids, and spent desiccant wastes from the production of certain chlorinated aliphatic hydrocarbons, by free radical catalyzed processes. These chlorinated aliphatic hydrocarbons are those having carbon chain lengths ranging from one to and including five, with varying amounts and positions of chlorine substitution. (Toxic waste)

F026 .....Wastes (except wastewater and spent carbon from hydrogen chloride purification) from the production of materials on equipment previously used for the manufacturing use (as a reactant, chemical intermediate, or component in a formulating process) of tetra-, penta-, or hexachlorobenzene under alkaline conditions. (Acute hazardous waste)

F027 .....Discarded unused formulations containing tri-, tetra-, or pentachlorophenol or discarded unused formulations containing compounds derived from these chlorophenols. This listing does not include formulations containing Hexachlorophene synthesized from prepurified 2,4,5-trichlorophenol as the sole component.). (Acute hazardous waste)

F028 .....Residues resulting from the incineration or thermal treatment of soil contaminated with EPA Hazardous Waste Nos. F020, F021, F022, F023, F026, and F027. (Toxic waste)

F032 .....Wastewaters, process residuals, preservative drippage and spent formulations from wood preserving processes generated at plants that currently use or have previously used chlorophenolic formulations (except potentially cross-contaminated wastes that have had the F032 waste code deleted in accordance with Section 017 of this Chapter and where the generator does not resume or initiate use of chlorophenolic formulations). This listing does not include K001 bottom sediment sludge from the treatment of wastewater from wood preserving processes that use creosote and/or

pentachlorophenol. (Note: The listing of wastewaters that have not come into contact with process contaminants is stayed administratively by EPA. (Toxic waste)

F034.....Wastewaters, process residuals, preservative drippage, and spent formulations from wood preserving process generated at plants that use creosote formulations. This listing does not include K001 bottom sediment sludge from the treatment of wastewater from wood preserving processes that use creosote and/or pentachlorophenol. (Toxic waste)

F035 .....Wastewaters (except those which have not come into contact with process contaminants), process residuals, preservative drippage, and spent formulations from wood preserving process generated at plants that use inorganic preservatives containing arsenic chromium. This listing does not include K001 bottom sediment sludge from the treatment of wastewater from wood preserving processes that use creosote and/or pentachlorophenol. (Toxic waste)

F037 .....Petroleum refinery primary oil/water/solids separation sludge-Any sludge generated from the gravitational separation of oil/water/solids during the storage or treatment of process wastewaters and oily cooling wastewaters from petroleum refineries. Such sludges include, but are not limited to, those generated in: oil/water/solids separators; tanks and impoundments; ditches and other conveyances; sumps; and stormwater units receiving dry weather flow. Sludge generated in stormwater units that do not receive dry weather flow, sludges generated from non-contact once-through cooling waters segregated for treatment from other process or oily cooling waters, sludges generated in aggressive biological treatment units as defined at the end of this section (including sludges generated in one or more additional units after wastewaters have been treated in aggressive biological treatment units) and K051 wastes are not included in this listing. (Toxic waste)

F038 .....Petroleum refinery secondary (emulsified) oil/water/ solids separation sludge-Any sludge and/or float generated from the physical and/or chemical separation of oil/water/solids in process wastewaters and oily cooling wastewaters from petroleum refineries. Such wastes include, but are not limited to, all sludges and floats generated in: induced air flotation (IAF) units, tanks and impoundments, and all sludges generated in DAF units. Sludges generated in stormwater units that do not receive dry weather flow, sludges generated from non-contact once-through cooling waters segregated for treatment from other process or oily cooling waters, sludges and floats generated in aggressive biological treatment units as defined at the end of this section (including sludges and floats generated in one or more additional units after wastewaters have been treated in aggressive biological treatment units) and F037, K048, and K051 wastes are not included in this listing. (Toxic waste)

F039 .....Leachate (liquids that have percolated thorough land disposed wastes) resulting from the treatment, storage, or disposal of wastes classified by more than one waste code under Sections 011 through 016 of this Chapter, or from a mixture of wastes

classified under Sections 005 through 010 of this Chapter. (Leachate resulting from the management of one or more of the following EPA Hazardous Wastes and no other hazardous wastes retains its hazardous waste number(s): F020, F021, F022, F026, F027, and/or F028). (Toxic waste)

From the Nebraska Department of Environmental Quality, Title 128, Chapter 3, effective date: April 13, 2002.

ACUTELY TOXIC HAZARDOUS WASTES (P-LIST)

(in alphabetical order)

E.P.A. WASTE NO.	C.A.S. NO.	CHEMICAL NAME
P069	75-86-5	Acetone cyanohydrin or 2-methyllactonitrile
P002	591-08-2	1-Acetyl-2-thiourea or N-(aminothioxomethyl)-acetamide
P003	107-02-8	Acrolein or 2-Propenal
P070	116-06-3	Aldicarb
P203	1646-88-4	Aldicarb sulfone
P004	309-00-2	Aldrin or HHDN or compound 118 or Octalene
P005	107-18-6	Allyl alcohol or 2-Propen-l-ol or vinyl carbinol
P006	20859-73-8	Aluminum phosphide or Celphos or Detia or Phostoxin
P008	504-24-5	4-Aminopyridine or 4-Pyridinamine or Fampridine
P009	131-74-8	Ammonium picrate
P119	7803-55-6	Ammonium vanadate(V) or Ammonium metavanadate
P072	86-88-4	ANTU or 1-Naphthalenylthiourea or alpha-Naphthylthiourea
P010	7778-39-4	Arsenic acid or Orthoarsenic acid or H_3AsO_4
P012	1327-53-3	Arsenic (III) oxide or Arsenic trioxide or arsenous acid or As_2O_3
P011	1303-28-2	Arsenic pentoxide or Arsenic oxide or As_2O_5
P038	692-42-2	Arsine, diethyl-
P036	696-28-6	Arsonous dichloride, phenyl-
P054	151-56-4	Aziridine or ethylenimine or dimethylenimine
P013	542-62-1	Barium cyanide
P028	100-44-7	Benzyl chloride or alpha-chlorotoluene or (chloromethyl)-benzene
P015	7440-41-7	Beryllium powder
P017	598-31-2	Bromoacetone or 1-bromo-2-propanone
P018	357-57-3	Brucine or 2,3-dimethoxystrychnidin-10-one
P021	592-01-8	Calcium cyanide $Ca(CN)_2$ or cyanogas
P127	1563-66-2	Carbofuran or Furadan
P022	75-15-0	Carbon disulfide
P189	55285-14-8	Carbosulfan
P023	107-20-0	Chloroacetaldehyde
P024	106-47-8	p-Chloroaniline or 4-chloroaniline or 4-chlorobenzenamine
P026	5344-82-1	1-(2-Chlorophenyl)-2-thiourea
P027	542-76-7	3-Chloropropionitrile or 3-Chloropropanenitrile
P029	544-92-3	Copper cyanide Cu(CN) or cuprous cyanide
P202	64-00-6	m-Cumenyl methylcarbamate
P030	----------	Cyanides (soluble cyanide salts), not otherwise specified
P031	460-19-5	Cyanogen or ethanedinitrile

P033	506-77-4	Cyanogen chloride (CN)Cl
P034	131-89-5	2-Cyclohexyl-4, 6-dinitrophenol
P016	542-88-1	Dichloromethyl ether or sym-Dichloromethyl ether
--------	----------	or Oxybis[chloromethane]
P036	696-28-6	Dichlorophenylarsine
P037	60-57-1	Dieldrin or Compound 497
P038	692-42-2	Diethylarsine
P040	297-97-2	O, O-Diethyl-O-(2-pyrazinyl) phosphorothioate or
------	----------	Thionazin
P043	55-91-4	Diisopropyl fluorophosphate or DFP
P044	60-51-5	Dimethoate
P046	122-09-8	Dimethylphenethylamine; alpha, alpha-
P191	644-64-4	Dimetilan
P047	534-52-1	4,6-Dinitro-o-cresol or Dinitrocresol and salts
P048	51-28-5	2, 4-Dinitrophenol
P020	88-85-7	Dinoseb or 2-(1-Methylpropyl)-4,6-dinitrophenol
P039	298-04-4	Disulfoton or Phosphorodithioic acid O,O-diethyl S-[2-
------	----------	(ethylthio)ethyl] ester
P049	541-53-7	2,4-Dithiobiuret or Thioimidodicarbonic diamide
P050	115-29-7	Endosulfan
P088	145-73-3	Endothall
P051	72-20-8	Endrin and metabolites
P042	51-43-4	Epinephrine or (R)-4-[1-hydroxy-2-(methylamino)-
------	----------	ethyl]-1,2-benzenediol
P097	52-85-7	Famphur
P056	7782-41-4	Fluorine
P057	640-19-7	Fluoroacetamide
P058	62-74-8	Fluoroacetic acid, sodium salt or Compound 1080
P198	23422-53-9	Formetanate hydrochloride
P197	17702-57-7	Formparanate
P065	628-86-4	Fulminic acid, mercury(2+) salt or Mercury fulminate
P059	76-44-8	Heptachlor
P062	757-58-4	Hexaethyl tetraphosphate
P116	79-19-6	Hydrazinecarbothioamide or Thiosemicarbazide
P063	74-90-8	Hydrogen cyanide or hydrocyanic acid
P096	7803-51-2	Hydrogen Phosphide or Phosphine
P060	65-73-6	Isodrin
P192	119-38-0	Isolan
P202	64-00-6	3-Isopropylphenyl N-methylcarbamate
P196	15339-36-3	Manganese dimethyldithiocarbamate
P065	628-86-4	Mercury fulminate
P199	2032-65-7	Methiocarb
P066	16752-77-5	Methomyl
P067	75-55-8	2-Methylaziridine or propyleneimine
P068	60-34-4	Methylhydrazine

P064	624-83-9	Methyl isocyanate or Isocyanatomethane
P071	298-00-0	Methyl parathion
P190	1129-41-5	Metolcarb
P128	315-18-4	Mexacarbate
P007	2763-96-4	Muscimol or 5-(aminomethyl)-3-isoxazolol
P072	86-88-4	alpha-Naphthylthiourea or ANTU or 1-
------	----------	naphthalenylthiourea
P073	13463-39-3	Nickel carbonyl
P074	557-19-7	Nickel cyanide or $Ni(CN)_2$
P075	54-11-5	Nicotine or (S)-(-)-Nicotine
P076	10102-43-9	Nitric oxide or Nitrogen oxide or NO
P077	100-01-6	p-Nitroaniline or 4-nitrobenzenamine
P078	10102-44-0	Nitrogen dioxide or Nitrogen oxide or NO_2
P081	55-63-0	Nitroglycerine
P082	62-75-9	N-Nitrosodimethylamine or N-methyl-N-
------	----------	nitrosomethanamine
P084	4549-40-0	N-Nitrosomethylvinylamine
P085	152-16-9	Octamethylpyrophosphoramide or Schradan
P087	20816-12-0	Osmium tetroxide or Osmium oxide or OsO_4
P194	23135-22-0	Oxamyl
P041	311-45-5	Paraoxon or Phosphoric acid diethyl 4-nitrophenyl ester
P089	56-38-2	Parathion
P046	122-09-8	Phentermine or alpha, alpha-dimethyl-benzeneethanamine
P092	62-38-4	Phenylmercuric acetate or Phenylmercury acetate
P093	103-85-5	Phenylthiourea or Phenylthiocarbamide
P094	298-02-2	Phorate
P095	75-44-5	Phosgene or Carbonic dichloride
P096	7803-51-2	Phosphine or Hydrogen phosphide
P204	57-47-6	Physostigmine
P188	57-64-7	Physostigmine salicylate
P098	151-50-8	Potassium cyanide or K(CN)
P099	506-61-6	Potassium silver(I) cyanide or silver(I) potassium cyanide
P201	2631-37-0	Promecarb
P102	107-19-7	Propargyl alcohol or 2-Propyn-1-ol
P101	107-12-0	Propionitrile or propanenitrile or ethyl cyanide
P103	630-10-4	Selenourea
P104	506-64-9	Silver cyanide or Ag(CN)
P105	26628-22-8	Sodium azide
P106	143-33-9	Sodium cyanide or Na(CN)
P108	57-24-9	Strychnine and salts or Strychnidin-10-one and salts
P109	3689-24-5	Sulfotep or Thiodiphosphoric acid tetraethyl ester
------	----------	or Tetraethyldithiopyrophosphate
P110	78-00-2	Tetraethyllead or Tetraethylplumbane or TEL
P111	107-49-3	Tetraethyl pyrophosphate or Diphosphoric acid tetraethyl
------	----------	ester

P112	509-14-8	Tetranitromethane
P062	757-58-4	Tetraphosphoric acid, hexaethyl ester
P113	1314-32-5	Thallium sesquioxide or Thallic oxide or Thallium peroxide
P114	12039-52-0	Thallium(I) selenite or Selenious acid dithallium salt
P115	7446-18-6	Thallium(I) sulfate or Thallous sulfate or Eccothal
P045	39196-18-4	Thiofanox
P040	297-97-2	Thionazin or Phosphorothioic acid O, O-diethyl O-pyrazinyl ester
P014	108-98-5	Thiophenol or Benzenethiol
P116	79-19-6	Thiosemicarbazide or Hydrazinecarbothioamide
P185	26419-73-8	Tirpate
P123	8001-35-2	Toxaphene
P118	75-70-7	Trichloromethanethiol
P120	1314-62-1	Vanadium pentoxide or Vanadium oxide or V_2O_5
P084	4549-40-0	Vinylamine, N-methyl-N-nitroso-
P001	81-81-2	Warfarin and salts, when present at concentrations greater than 0.3%
P121	557-21-1	Zinc cyanide or $Zn(CN)_2$
P122	1314-84-7	Zinc phosphide or Zn_3P_2, when present at concentrations greater than 10%
P205	137-30-4	Ziram or Zinc dimethyldithiocarbamate

Adapted from Nebraska Department of Environmental Quality; Title 128 – Rules and Regulations Governing Hazardous Waste Management in Nebraska; May 27, 2000

LIST OF TOXIC HAZARDOUS WASTE (U-LIST)

EPA WASTE NO.	CAS NO.	CHEMICAL NAME
U394	30558-43-1	A2213 or 2-(dimethylamino)-N-hydroxy-2-oxo-ethanimidothioic acid, methyl ester
U001	75-07-0	Acetaldehyde or ethanal
U002	67-64-1	Acetone or 2-propanone
U003	75-05-8	Acetonitrile or methyl cyanide
U004	98-86-2	Acetophenone or 1-phenylethanone
U006	75-36-5	Acetyl chloride
U007	79-06-1	Acrylamide or 2-propenamide
U008	79-10-7	Acrylic acid or 2-propenoic acid
U009	107-13-1	Acrylonitrile or 2-propenenitrile
U011	61-82-5	Amitrole or 1H-1,2,4-triazol-3-amine
U012	62-53-3	Aniline or benzenamine
U014	492-80-8	Auramine or benzenamine, 4, 4'-carbonimidoylbis N, N-dimethyl-
U015	115-02-6	Azaserine or L-Serine diazoacetate (ester)
U280	101-27-9	Barban or carbamic acid, (3-chlorophenyl)-, 4-chloro-2-butynyl ester
U278	22781-23-3	Bendiocarb or 1,3-Benzodioxol-4-ol, 2,2-dimethyl-, methyl carbamate
U364	22961-82-6	Bendiocarb phenol or 1,3-Benzodioxol-4-ol, 2,2-dimethyl-
U271	17804-35-2	Benomyl or Carbamic acid, [1-[(butylamino)carbonyl]-1H-benzimidazol-2-yl], methyl ester
U016	225-51-4	Benz[c]acridine
U017	98-87-3	Benzal chloride or benzene, (dichloromethyl)-
U018	56-55-3	1,2-Benzanthracene or benz[a]anthracene
U049	3165-93-3	Benzenamine, 4-chloro-2-methyl-, hydrochloride or 4-chloro-o-toluidine, hydrochloride
U019	71-43-2	Benzene or benzol
U107	117-84-0	1,2-Benzenedicarboxylic acid, dioctyl ester or Di-n-octyl phthalate
U020	98-09-9	Benzenesulfonyl chloride or benzenesulfonic acid chloride
U021	92-87-5	Benzidine or [1,1'-biphenyl]-4,4'-diamine
U064	189-55-9	Benzo[rst]pentaphene or dibenzo[a,i]pyrene
U022	50-32-8	Benzo[a]pyrene
U023	98-07-7	Benzotrichloride or (trichloromethyl)-benzene
U028	117-81-7	Bis(2-ethylhexyl) phthalate or 1,2-benzenedicarboxylic acid, bis(2-ethylhexyl) ester
U225	75-25-2	Bromoform or tribromomethane
U030	101-55-3	4-Bromodiphenyl ether or 4-bromophenyl phenyl ether or

------	----------	benzene, l-bromo-4-phenoxy-
U085	1464-53-5	1,3-Butadiene diepoxide or 1,2,3,4-diepoxybutane or 2,2'-
------	----------	bioxirane
U031	71-36-3	n-Butyl alcohol or 1-Butanol
U069	84-74-2	n-Butyl phthalate or 1,2-benzenedicarboxylic acid, dibutyl
------	----------	ester
U136	75-60-5	Cacodylic acid or Arsinic acid, dimethyl-
U032	13765-19-0	Calcium chromate or chromic acid, calcium salt
U279	63-25-2	Carbaryl or 1-naphthalenol methylcarbamate
U372	10605-21-7	Carbendazim or carbamic acid, 1H-benzimidazol-2-yl,
------	----------	methyl ester
U211	56-23-5	Carbon tetrachloride or tetrachloromethane
U033	353-50-4	Carbonyl fluoride or carbonic difluoride
U035	305-03-3	Chlorambucil or benzenebutanoic acid, 4-[bis(2-
------	----------	chloroethyl)amino]-
U036	57-74-9	Chlordane, alpha and gamma isomers
U142	143-50-0	Chlordecone or Kepone
U026	494-03-1	Chlornaphazine or N, N'-bis(2-chloroethyl)-2-
------	----------	naphthylamine
U037	108-90-7	Chlorobenzene
U038	510-15-6	Chlorobenzilate or benzeneacetic acid, 4-chloro-alpha- (4-
------	----------	chlorophenyl)- alpha-hydroxy-, ethyl ester
U042	110-75-8	2-Chloroethyl vinyl ether or (2-chloroethoxy)-ethene
U044	67-66-3	Chloroform or trichloromethane
U039	59-50-7	4-Chloro-m-cresol or 4-chloro-3-methylphenol
U046	107-30-2	Chloromethyl methyl ether or chloromethoxymethane
U047	91-58-7	2-Chloronaphthalene
U048	95-57-8	2-Chlorophenol
U050	218-01-9	Chrysene
U051	----------	Creosote
U052	1319-77-3	Cresol or cresylic acid or methylphenol
U053	4170-30-3	Crotonaldehyde or 2-butenal
U055	98-82-8	Cumene or (l-methylethyl)-benzene
U096	80-15-9	Cumene hydroperoxide or alpha, alpha-
------	----------	dimethylbenzylhydroperoxide or 1-methyl-1-
------	----------	phenylethyl-hydroperoxide
U246	506-68-3	Cyanogen bromide (CN)Br
U056	110-82-7	Cyclohexane or hexahydrobenzene
U057	108-94-1	Cyclohexanone
U058	50-18-0	Cyclophosphamide
U240	94-75-7	2,4-D or (2,4-dichlorophenoxy)acetic acid salts and esters
U059	20830-81-3	Daunorubicin or daunomycin
U060	72-54-8	DDD or 1,1-dichloro-2,2-bis(p-chlorophenyl)ethane
U061	50-29-3	DDT or 1,1'-(2,2,2-trichloroethylidene) bis[4-
------	----------	chlorobenzene]

U062	2303-16-4	Diallate or carbamothioic acid, bis (l-methylethyl)-, S-(2,3-
------	----------	dichloro-2-propenyl) ester
U091	119-90-4	Dianisidine or 3,3'-Dimethoxybenzidine or 3,3'-dimethoxy-
------	----------	[1,1'-biphenyl]-4,4'-diamine
U063	53-70-3	1,2:5,6-Dibenzanthracene or dibenz[a,h]anthracene
U066	96-12-8	Dibromochloropropane or 1,2-dibromo-3-chloropropane
U070	95-50-1	o-Dichlorobenzene or 1,2-dichlorobenzene
U071	541-73-1	m-Dichlorobenzene or 1,3-dichlorobenzene
U072	106-46-7	p-Dichlorobenzene or 1,4-dichlorobenzene
U073	91-94-1	3,3'-Dichlorobenzidine or 3,3'-dichloro-(1,1'-biphenyl) –
------	----------	4,4'-diamine
U074	764-41-0	1,4-Dichloro-2-butene
U075	75-71-8	Dichlorodifluoromethane
U079	156-60-5	trans-1,2-Dichloroethylene
U025	111-44-4	sym-Dichloroethyl ether or 1,1’-oxybis[2-chloroethane]
U027	108-60-1	Dichloroisopropyl ether or 2,2'-oxybis[2-chloropropane]
U024	111-91-1	Dichloromethoxy ethane or 1,1’-[methylenebis(oxy)]bis[2-
------	----------	chloroethane]
U081	120-83-2	2,4-Dichlorophenol
U082	87-65-0	2,6-Dichlorophenol
U084	542-75-6	1,3-Dichloropropene or 1,3-dichloropropylene
U395	5952-26-1	Diethylene glycol, dicarbamate
U086	1615-80-1	N,N'-Diethylhydrazine or 1,2-diethylhydrazine
U087	3288-58-2	O,O-Diethyl S-methyl dithiophosphate or
------	----------	O,O-diethyl S-methyl ester phosphorodithioic acid
U088	84-66-2	Diethyl phthalate or 1,2-benzenedicarboxylic acid, diethyl
------	----------	ester
U089	56-53-1	Diethylstilbesterol or (E)-4,4'-(1,2-diethyl-1,2-
------	----------	ethenediyl)bisphenol
U367	1563-38-8	2,3-Dihydro-2,2-dimethyl-7-benzofuranol or carbofuran
------	----------	phenol
U090	94-58-6	Dihydrosafrole or 5-propyl-1,3-benzodioxole
U092	124-40-3	Dimethylamine or N-methylmethanamine
U093	60-11-7	p-Dimethylaminoazobenzene or benzenamine, N, N-
------	----------	dimethyl-4-(phenylazo)-
U094	57-97-6	9,10-Dimethyl-1,2-benzanthracene or 7,12-
------	----------	dimethylbenz[a]anthracene
U097	79-44-7	Dimethylcarbamyl chloride or carbamic chloride, dimethyl-
U098	57-14-7	1,1-Dimethylhydrazine
U099	540-73-8	1,2-Dimethylhydrazine
U101	105-67-9	2,4-Dimethylphenol
U102	131-11-3	Dimethyl phthalate or 1,2-benzenedicarboxylic acid,
------	----------	dimethyl ester
U103	77-78-1	Dimethyl sulfate or sulfuric acid, dimethyl ester
U105	121-14-2	2,4-Dinitrotoluene or 1-methyl-2,4-dinitro-benzene

U106	606-20-2	2,6-Dinitrotoluene or 2-methyl-1,3-dinitro-benzene
U108	123-91-1	1,4-Dioxane or 1,4-diethyleneoxide
U109	122-66-7	1,2-Diphenylhydrazine or hydrazobenzene
U110	142-84-7	n-Dipropylamine or N-propyl-1-propanamine
U111	621-64-7	Di-n-propylnitrosamine or N-nitroso-N-propyl-1-
------	----------	propanamine
U041	106-89-8	Epichlorohydrin or (chloromethyl)-oxirane
U359	110-80-5	2-Ethoxyethanol or ethylene glycol monoethyl ether
U112	141-78-6	Ethyl acetate or acetic acid ethyl ester
U113	140-88-5	Ethyl acrylate or 2-propenoic acid ethyl ester
U114	111-54-6	Ethylenebisdithiocarbamic acid, salts and esters or
------	----------	carbamodithioic acid, 1,2-ethanediylbis-,
U067	106-93-4	Ethylene dibromide or 1,2-dibromoethane
U077	107-06-2	Ethylene dichloride or 1,2-dichloroethane
U115	75-21-8	Ethylene oxide or oxirane
U116	96-45-7	Ethylene thiourea or 2-imidazolidinethione
U117	60-29-7	Ethyl ether or 1,1’-oxybisethane
U076	75-34-3	Ethylidene chloride or l,l-dichloroethane
U118	97-63-2	Ethyl methacrylate or 2-methyl-2-propenoic acid, ethyl
------	----------	ester
U119	62-50-0	Ethyl methanesulfonate or methanesulfonic acid, ethyl
------	----------	ester
U176	759-73-9	N-Ethyl-N-nitrosourea or N-nitroso-N-ethylurea
U120	206-44-0	Fluoranthene
U005	53-96-3	N-2-Fluorenylacetamide or N-9H-fluoren-2-yl-acetamide or
------	----------	2-acetylaminofluorene
U122	50-00-0	Formaldehyde
U123	64-18-6	Formic acid
U124	110-00-9	Furan or furfuran
U125	98-01-1	Furfural or 2-furancarboxaldehyde
U126	765-34-4	Glycidylaldehyde or oxiranecarboxyaldehyde
U127	118-74-1	Hexachlorobenzene
U128	87-68-3	Hexachlorobutadiene or hexachloro-1,3-butadiene or
------	----------	1,1,2,3,4,4-hexachloro-1,3-butadiene
U130	77-47-4	Hexachlorocyclopentadiene
U131	67-72-1	Hexachloroethane
U132	70-30-4	Hexachlorophene or 2,2'-methylenebis[3,4,6-trichloro-
------	----------	phenol]
U243	1888-71-7	Hexachloropropene or 1,1,2,3,3,3-hexachloro-1-propene
U133	302-01-2	Hydrazine
U134	7664-39-3	Hydrogen fluoride or hydrofluoric acid
U135	7783-06-4	Hydrogen sulfide
U137	193-39-5	Indeno[1, 2, 3-cd]pyrene
U140	78-83-1	Isobutyl alcohol or 2-methyl-1-propanol
U161	108-10-1	Isopropylacetone or 4-methyl-2-pentanone or methyl

------	----------	isobutyl ketone
U141	120-58-1	Isosafrole or 5-(1-propenyl)-1,3-benzodioxole
U143	303-34-4	Lasiocarpine
U144	301-04-2	Lead acetate or acetic acid, lead(2+) salt
U145	7446-27-7	Lead phosphate or phosphoric acid, lead(2+) salt (2:3)
U146	1335-32-6	Lead subacetate or bis(acetato-O)tetrahydroxytri-lead
U129	58-89-9	Lindane
U147	108-31-6	Maleic anhydride or 2,5-furandione
U148	123-33-1	Maleic hydrazide or 1,2-dihydro-3,6-pyridazinedione
U149	109-77-3	Malononitrile or propanedinitrile
U150	148-82-3	Melphalan or 4-[bis(2-chloroethyl)amino]-L-phenylalanine
U151	7439-97-6	Mercury
U152	126-98-7	Methacrylonitrile or 2-methyl-2-propenenitrile
U153	74-93-1	Methanethiol or thiomethanol
U155	91-80-5	Methapyrilene or N,N-dimethyl-N'-2-pyridinyl-N'-(2-
------	----------	thienylmethyl)-1,2-ethanediamine
U247	72-43-5	Methoxychlor or 1,1'-(2,2,2-trichloroethylidene) bis[4-
------	----------	methoxybenzene
U154	67-56-1	Methyl alcohol or methanol
U029	74-83-9	Methyl bromide or bromomethane
U045	74-87-3	Methyl chloride or chloromethane
U156	79-22-1	Methyl chlorocarbonate or carbonochloridic acid, methyl
------	----------	ester
U157	56-49-5	3-Methylcholanthrene or Benz[j]aceanthrylene, 1,2-
------	----------	dihydro-3-methyl-
U158	101-14-4	4,4'-Methylenebis[2-chloroaniline] or benzenamine], 4,4'-
------	----------	methylenebis [2-chloro-
U068	74-95-3	Methylene bromide or dibromomethane
U080	75-09-2	Methylene chloride or dichloromethane
U159	78-93-3	Methyl ethyl ketone (MEK) or 2-butanone
U160	1338-23-4	Methyl ethyl ketone peroxide or 2-butanone peroxide
U138	74-88-4	Methyl iodide or iodomethane
U162	80-62-6	Methyl methacrylate or 2-methyl-2-propenoic acid, methyl
------	----------	ester
U181	99-55-8	2-Methyl-5-nitroaniline or 5-nitro-o-toluidine or
------	----------	2-methyl-5-nitrobenzenamine
U163	70-25-7	N-Methyl-N'-nitro-N-nitroso-guanidine or MNNG
U177	684-93-5	N-Methyl-N-nitrosourea or N-nitroso-N-methylurea
U164	56-04-2	Methylthiouracil
U010	50-07-7	Mitomycin C
U165	91-20-3	Naphthalene
U166	130-15-4	1,4-Naphthoquinone or 1,4-Naphthalenedione
U167	134-32-7	1-Naphthylamine or 1-naphthalenamine
U168	91-59-8	2-Naphthylamine or 2-naphthalenamine
U169	98-95-3	Nitrobenzene

U170	100-02-7	p-Nitrophenol or 4-nitrophenol
U171	79-46-9	2-Nitropropane
U172	924-16-3	N-Nitrosodi-n-butylamine or N-butyl-N-nitroso-1-
------	----------	butanamine
U173	1116-54-7	N-Nitrosodiethanolamine or 2,2'-(nitrosoimino)bis-
------	----------	ethanol
U174	55-18-5	N-Nitrosodiethylamine or N-ethyl-N-nitrosoethanamine
U178	615-53-2	N-Nitroso-N-methylurethane or carbamic acid,
------	----------	methylnitroso-, ethyl ester
U179	100-75-4	N-Nitrosopiperidine
U180	930-55-2	N-Nitrosopyrrolidine or 1-nitrosopyrrolidine
U182	123-63-7	Paraldehyde or 2,4,6-trimethyl-1,3,5-trioxane
U183	608-93-5	Pentachlorobenzene
U184	76-01-7	Pentachloroethane
U185	82-68-8	Pentachloronitrobenzene (PCNB) or quintozene
See F027	87-86-5	Pentachlorophenol
U187	62-44-2	Phenacetin or N-(4-ethoxyphenyl)acetamide
U188	108-95-2	Phenol
See F027	87-86-5	Phenol, pentachloro-
See F027	58-90-2	Phenol, 2,3,4,6-tetrachloro-
See F027	95-95-4	Phenol, 2,4,5-trichloro-
See F027	88-06-2	Phenol, 2,4,6-trichloro-
U189	1314-80-3	Phosphorus pentasulfide or sulfur phosphide
U190	85-44-9	Phthalic anhydride or 1,3-isobenzofurandione
U191	109-06-8	alpha-Picoline or 2-methylpyridine
U186	504-60-9	Piperylene or 1,3-pentadiene or 1-methylbutadiene
U193	1120-71-4	1, 3-Propane sultone or 1,2-oxathiolane, 2,2-dioxide
U373	122-42-9	Propham or phenylcarbamic acid 1-methylethyl ester
U411	114-26-1	Propoxur or 2-(1-methylethoxy)phenol methylcarbamate
U192	23950-58-5	Propyzamide or Pronamide or 3,5-dichloro-N-
-------	----------	(l,l-dimethyl- 2-propynyl)-benzamide
U387	52888-80-9	Prosulfocarb or carbamothioic acid, dipropyl-, S-
------	----------	(phenylmethyl) ester
U194	107-10-8	n-Propylamine or 1-Propanamine
U083	78-87-5	Propylene dichloride or 1,2-dichloropropane
U196	110-86-1	Pyridine
U197	106-51-4	Quinone or p-benzoquinone or 2,5-cyclohexadiene-1,4-
------	----------	dione
U200	50-55-5	Reserpine
U201	108-46-3	Resorcinol or 1,3-benzenediol
U202	81-07-2	Saccharin and salts or 1,2-benzisothiazol-3(2H)-one 1,1-
------	----------	dioxide, and salts
U203	94-59-7	Safrole or 5-(2-propenyl)- 1,3-benzodioxole
U204	7783-00-8	Selenious acid or selenium dioxide
U205	7488-56-4	Selenium disulfide or selenium sulfide

See F027	93-72-1	Silvex or 2-(2,4,5-trichlorophenoxy)propionic acid
U206	18883-66-4	Streptozocin or 2-deoxy-2-(3-methyl-3-nitrosoureido)-D-
------	----------	glucopyranose
See F027	93-76-5	2,4,5-T or (2,4,5-trichlorophenoxy)acetic acid
U207	95-94-3	1,2,4,5-Tetrachlorobenzene
U208	630-20-6	1,1,1,2-Tetrachloroethane
U209	79-34-5	1,1,2,2-Tetrachloroethane
U210	127-18-4	Tetrachloroethylene or tetrachloroethene
See F027	58-90-2	2,3,4,6-Tetrachlorophenol
U213	109-99-9	Tetrahydrofuran
U214	563-68-8	Thallium acetate or acetic acid, thallium(1+) salt
U215	6533-73-9	Thallium(I) carbonate or carbonic acid, dithallium(l+) salt
U216	7791-12-0	Thallium(I) chloride
U217	10102-45-1	Thallium(I) nitrate or nitric acid, thallium(l+) salt
U218	62-55-5	Thioacetamide or ethanethioamide
U410	59669-26-0	Thiodicarb
U409	23564-05-8	Thiophanate-methyl
U219	62-56-6	Thiourea
U244	137-26-8	Thiram
U095	119-93-7	o-Tolidine or 3,3'-dimethyl-[1,1'-biphenyl]-4,4'-diamine
------	----------	or 3,3'-dimethylbenzidine
U220	108-88-3	Toluene or methylbenzene
U221	25376-45-8	Toluenediamine or benzenediamine, ar-methyl-
U223	26471-62-5	Toluene diisocyanate or 1,3-diisocyanatomethylbenzene
U328	95-53-4	o-Toluidine or benzenamine, 2-methyl-
U353	106-49-0	p-Toluidine or benzenamine, 4-methyl-
U222	636-21-5	o-Toluidine hydrochloride or benzenamine, 2-methyl-,
------	----------	hydrochloride
U389	2303-17-5	Triallate or bis(1-methylethyl)carbamothioic acid S-
------	----------	(2,3,3-trichloro-2-propenyl) ester
U408	118-79-6	2,4,6-Tribromophenol
U034	75-87-6	Trichloroacetaldehyde or chloral
U226	71-55-6	1,1,1-Trichloroethane or methyl chloroform
U227	79-00-5	1,1,2-Trichloroethane
U228	79-01-6	Trichloroethylene or trichloroethene
U121	75-69-4	Trichloromonofluoromethane or trichlorofluoromethane
See F027	95-95-4	2,4,5-Trichlorophenol
See F027	88-06-2	2,4,6-Trichlorophenol
U404	121-44-8	Triethylamine or N,N-diethylethanamine
U234	99-35-4	1,3,5-Trinitrobenzene or sym-trinitrobenzene
U235	126-72-7	Tris-BP or tris(2,3-dibromopropyl) phosphate or 2,3-
------	----------	dibromo-1-propanol phosphate (3:1)
U236	72-57-1	Trypan blue
U237	66-75-1	Uracil mustard or 5-[bis(2-chloroethyl)amino]-2,4-
------	----------	(lH, 3H)-pyrimidinedione

U238	51-79-6	Urethan or urethane or ethyl carbamate or carbamic acid
------	----------	ethyl ester
U043	75-01-4	Vinyl chloride or chloroethene
U078	75-35-4	Vinylidene chloride or 1, 1-dichloroethene
U248	81-81-2	Warfarin and salts when present at concentrations
------	----------	of 0.3% or less; also called 4-hydroxy-3-(3-oxo-1-
------	----------	phenylbutyl)-2H-1-benzopyran-2-one
U239	1330-20-7	Xylene or dimethyl benzene
U249	1314-84-7	Zinc phosphide when present at concentrations of 10% or
------	----------	less

Adapted from the Nebraska Department of Environmental Quality; Title 128 – Nebraska Hazardous Waste Regulations; April 13, 2002. There is one entry per CAS number. Substance names are from the Merck Index twelfth edition, the Aldrich Chemical Company catalog and/or the NDEQ's Title 128.

PROCEDURE FOR PREPARING CHEMICALS FOR COLLECTION BY HAZARDOUS MATERIALS PROGRAM (HMP) PERSONNEL

The following procedure describes how to arrange for the collection of used or unwanted chemicals from your lab or work area. The basic procedure involves providing information for each container of chemical(s) on a two-part chemical collection tag and mailing the bottom half of the tag to the

The chemical collection tag is an important part of the documentation that EHS is required to keep. The information that you provide on the tag is the basis for chemical identification and the determination of safe storage and handling methods. Your cooperation in completing the chemical collection tags is appreciated and will help UNK stay in compliance with environmental regulations.

Completing the Chemical Collection Tags

Please request chemical collection tags by calling the Hazardous Materials Technician at308/627-5355 or by e-mail at HardingR@UNK.edu. Complete one tag for each container that you have ready for collection. Each tag is stamped with a unique number to track the container through collection and subsequent off-site disposal. Complete all items on the front side of the tag with the following information as requested.

Requester: Mark the name of the professor or manager in charge of the area. Do not use the names of students or temporary employees.

Department: Mark the name of the department that is responsible for the chemical(s).

Building Name and Room Number: Mark the name of the building and room number where the chemical will be stored until collection. This should be the area where the chemical was used or stored before deciding it was no longer wanted. Do not move the chemical to another storage area. Do not provide office or mailing addresses on the tag.

Date: Mark the date that the tag will be mailed. This should also be the date that the chemical is no longer needed, that the container of used chemical is full, or that no more chemical will be added to the used chemical container.

Phone: Mark your phone number, or the phone number of a person who is familiar with the chemical.

Chemical(s): List the full name of the chemical(s) to be collected. Do not abbreviate chemical names or list only empirical formulas, as these tags cannot be processed.

For products, include the ingredients that are listed on the label. (Example: Lime Green Paint - contains petroleum distillates, sodium silicate and mercury). Include the concentration of each ingredient as listed on the label.

For mixtures of chemicals in the container, list the approximate percentage or concentration of each constituent in the container. Every chemical in the container, including water, must be identified on the tag. Common ways of indicating concentration include percent of total, parts per million (ppm), and molarity/normality. This information is required so that the Hazardous Material Technican can arrange for proper disposal or recycling and to avoid unnecessary and costly analytical tests. Please refer to the following examples:

> Used Solvents: Acetone 35%, Toluene 20%, Acetonitrile 5%, Chloroform 10%, Xylene 15%, Methylene chloride 10%, Water 5%.
>
> Used Solvents with Pesticides: Formaldehyde 20%, Xylene 45%, Hexane 5%, Water 10%, Ethyl alcohol 20%, Malathion <500ppm.
>
> Acid with metals: Nitric Acid 60%, Water 40%, Mercury 100ppm, Cadmium 200ppm, Lead <50ppm, Zinc <20ppm, Selenium <20ppm, Thallium <20ppm.

Double check labels to ensure that the percentages total 100%.

For chemicals that are created as a result of research, keep the following records in your files: (a) procedures used to develop the new chemical; (b) chemical formula and structure; and (c) hazardous characteristics of the new chemical (i.e., ignitability, toxicity, corrosivity or reactivity, as defined by 40 CFR Part 261 Subpart C). These records must be kept indefinitely so that, in the event the chemical is designated as unneeded, the information can be attached to the collection tag.

If there is not enough room to write all of the chemical information on the tag, provide the additional information on a separate piece of paper and attach a copy to each half of the tag.

Used, Unused, Unopened: Check the box that applies according to the following definitions: "Used" means the chemical(s) was used in a process; "Unused" means that the container was opened but not all of the chemical was used; "Unopened" means that the container has never been opened. (This information is important so that the Hazardous Materials Technician can properly designate the material for disposal or recycling.)

Liquid, Gas, Solid: Mark the box(es) that best describes the chemical. (Example: Mark "solid" and "liquid" for solutions with precipitate or sludge in the bottom.)

Pint, Quart, Gallon, 5-Gallon: Mark the box that indicates as closely as possible the size of the container that the chemical is stored in.

Amount: Provide an estimate (to the nearest quarter of a pound) of the weight of the chemical in the container. Do not use volume measurements unless the density is also provided.

Container Type - Glass, Metal, Plastic: Mark the box that best describes the material that the container is made of.

Stop! Do not mark on the back of the tag

1. Securely attach the top half of the tag to the container.

2. Mail the bottom half of the tag to Hazardous Materials Technician.

3. Separate incompatible chemicals.

4. Pack containers that are smaller than 5 gallons into sturdy boxes and provide sufficient packing material to prevent damage to the containers during transportation.

The Hazardous Materials Technician will collect the chemical from your area only after reviewing the information on the tag and making the appropriate regulatory determinations. Contact the Hazardous Materials Technician if the chemical has not been collected within 5 working days.

Important Notes

Chemicals must be in non-leaking containers that have tight-fitting lids. The only exception is when chemicals such as pesticides are purchased in heavy paper bags. Original labels should remain on the bags. The container must be compatible with the contents (e.g., no acids in metal containers).

If an empty container is used to store another chemical, make sure that the original label is removed or defaced.

Unlabeled containers and unknown chemicals, or any container suspected of being mislabeled, will not be collected until all efforts to identify the chemical have failed. A sample of the contents will then be taken for analysis. Collection tags must be completed for unknowns (mark "unknown" in the space on the tag for listing chemicals), but these will not be collected until the arrangements for sampling can be made. The cost of analysis is expensive - your cooperation in proper labeling will significantly reduce these costs.

Storage at the UNK waste accumulation area is regulated by the EPA; therefore, your assistance in providing proper containers, and complete information on labels and collection tags, is important.

OUTLINE OF HAZARDOUS MATERIALS PROGRAM TRAINING

I. WHY ATTEND TRAINING?

A. To improve health and safety on campus.
B. To introduce campus community to EPA hazardous waste regulations.
C. EPA inspects labs and other work areas - assesses fines for violations.
D. EPA inspector has the right to speak with any personnel.

II. WHAT DOES THIS TRAINING COVER?

A. EPA hazardous waste regulations - not occupational health and safety (OSHA), transportation (DOT), or State Fire Marshal (NFPA) requirements.
B. EPA has jurisdiction over water and air regulations also, but primary emphasis with universities is on hazardous waste requirements.

III. WHAT IS A WASTE?

A. Something that is thrown away (to landfill, sanitary sewer, air, ground) because it is no longer useful.
B. Something that needs to be thrown away, but hasn't been yet - has no future use.

IV. WHAT IS A HAZARDOUS WASTE?

A. EPA regulations based on chemicals used by industry and existing pollution problems (ex. Love Canal).
    1. Toxicity (acute and chronic).
    2. Physical hazards to handlers (fire, explosion, corrosion).
    3. Fate in environment (ex. Ground water contamination).
B. Four major categories of chemicals targeted for regulation.
    1. Unused chemicals (excess or surplus)
        a. Chemicals with no future use.
        b. Off-specification chemicals.
        c. Container residues.
        d. Spill residues.
        e. Designated as "P-" and "U-list"
            (1) "P" listed are acutely hazardous - are regulated at much smaller quantities (ex. arsenic, cyanide).
            (2) "U" listed are just hazardous (ex. Acetone (U002) and 2,4-D (U240).
    2. Wastes from specific processes - manufacturers.
        a. Designated as "K" list.
        b. Doesn't apply to University of Nebraska.

3. Non-industry-specific wastes.
    a. Designated as the "F" list.
    b. Includes "spent" solvents.
        (1) F002 through F005 most common.
        (2) Examples are Acetone (F003); Methylene chloride (F002); and Methyl ethyl ketone and Carbon disulfide (F005).
        (3) Concentration of product constituents must be 10% or greater.
        (4) Includes still bottoms from distillation.
    c. Also includes other wastes such as dioxin precursors (F027), which are regulated like P-listed wastes.
4. "Characteristic" wastes (as opposed to the "listed" wastes mentioned above).
    a. Designated as "D-list" or TCLP list (Toxicity Characteristic Leaching Procedure) - designed to simulate waste in landfill.
        (1) 40 chemical constituents (heavy metals, pesticides, other organics).
        (2) Can be from any source.
        (3) Regulation based on concentration.
        (4) Examples are Lead (D008) > 5 parts per million (ppm); and Methyl ethyl ketone (D035) > 200 ppm.
    b. Ignitable wastes (D001).
        (1) Flammable liquids - flash point less than 140° F.
        (2) Flammable solids - example is powdered metals.
        (3) Oxidizers - examples are nitric acid and nitrates.
        (4) Compressed ignitable gases - example is aerosol cans of solvents.
    c. Corrosive wastes (D002) - strong acids and bases.
        (1) Liquids with pH less than 2 or greater than 12.5.
        (2) Liquids that corrode steel at specific rate.
    d. Reactive wastes (D003).
        (1) Water-reactive material.
        (2) Air-reactive material.
        (3) Shock-sensitive material.
        (4) Emits toxic gases when mixed with water.
        (5) Contains cyanides or sulfides and will give off toxic gases when mixed with corrosives.
        (6) Explosives.

V. WHO MAKES DETERMINATION IF WASTE IS "HAZARDOUS WASTE"?

A. Hazardous Materials Coordinator (HMC).
B. Can recycle or redistribute unused materials.
C. Will apply regulatory exemptions, keep EPA from prematurely regulating products.
D. Can also apply an ethical standard -
    1. Ensure proper disposal for chemicals that EPA doesn't regulate, but that are extremely poisonous.
    2. Reduce UNK's future liability.

VI. HOW TO HANDLE "USED" OR "EXCESS" CHEMICALS.

A. Keep all chemicals labeled with the name of the contents, including concentrations.
    1. Label as "used" if it has been through a process and is no longer needed or usable.
    2. Label as "excess" if it hasn't been used for anything, but it has no future use in the area.
    3. Do not use the words "waste" or "spent" because these words have specific regulatory meanings - the HMC will assign these labels.
B. Place the chemicals in adequate containers.
    1. Must be in good condition - or transfer contents to a container that is in good shape.
    2. Must be compatible with contents - example is no acids in metal containers.
    3. Lid must be tight-fitting - to prevent spills during handling.
    4. Must not have previously held an incompatible chemical - example is don't use a nitric acid bottle for used solvent, unless the container has been adequately washed.
C. Containerize and store properly.
    1. Lid must be kept closed except when adding or removing contents - no funnels in bottle neck in meantime.
    2. Don't place incompatible chemicals in same container - accident waiting to happen.
    3. Separate containers by compatibility class - to prevent reactions in case of container breakage.

VII. WHAT TO DO WITH EMPTY CONTAINERS.

A. Can throw most away with normal trash if emptied as much as possible and contains less than 3% residuals.
C. If held P-listed chemical, container must be triple rinsed and rinseate must be collected through HMC. (Send whole container to HMC – produces less waste.)
D. Pesticide regulations apply in addition to EPA rules.

VIII. WHAT TO DO DURING AN EPA INSPECTION.

A. Most important – Be honest.
B. Answer only questions asked.
    1. Don’t guess or extrapolate.
    2. Inspectors will pause – waiting for you to provide more information.
C. Defer to supervisor when necessary – inspector will want to talk with the person who can answer the question.

IX. WHAT QUESTIONS WILL EPA INSPECTORS ASK?

A. Are any hazardous waste generated?
B. What chemicals are used in this area?
C. Inspectors will also look at chemical stock.
    1. Do all chemicals have a future use?
    2. Do all chemicals "belong" to someone - don't want to have "orphaned" chemicals.
    3. How is this chemical used?
        a. May ask you to explain how a chemical (that could potentially become a hazardous waste) is used from beginning to end of process.
        b. What is done with resulting waste? (Answer should be: Is handled by HMC.)
    4. May ask hypothetical question:
        a. Even though the chemical is not currently used, how might it be used and subsequently disposed?
        b. Give hypothetical answer: Would go to HMC for disposal.
    5. For unlabeled or inadequately labeled chemicals:
        a. EPA considers them to be hazardous wastes.
        b. Do housekeeping to find any of these before inspection.
        c. Keep all containers labeled.
        d. Contact the HMC if an "unknown" chemical is found.

X. HOW DO I STAY IN COMPLIANCE?

A. Be knowledgeable about chemicals used in your area.

B. Follow all procedures and policies.

C. Alert supervisor regarding any problems.

D. Work closely with the HMC.

UNIVERSITY OF NEBRASKA AT KEARNEY

AEROSOL CAN WASTE ANALYSIS PLAN

January 2004

Purpose

The purpose of this waste analysis plan for aerosol cans is to meet the guidelines and requirements established by the Nebraska Department of Environmental Quality as set forth in Nebraska Title 128, Nebraska Hazardous Waste Regulations and subsequent guidance document titled: Aerosol Can Waste.

Scope

This plan applies to operations involving the generation and management of unwanted aerosol cans at the UNK campus (NED070129028). Specifically, this plan addresses the following categories of aerosol cans:

1. Aerosol cans that **do not** contain constituents regulated under Nebraska Title 128, and that are hazardous prior to their classification as "RCRA empty" **only** for their characteristic of reactivity (D003).

2. Aerosol cans that **do** contain constituents regulated under Nebraska Title 128, and that are hazardous prior to their classification as "RCRA empty" because of their characteristic of reactivity (D003) **and** other characteristics or specifically listed wastes associated with the contents of the can, excluding P-listed contents.

3. Aerosol cans that **do** contain constituents regulated under Nebraska Title 128, **and** are hazardous because of their characteristic of reactivity (D003) **and** P-listing of their contents.

Management

Regardless of the category of aerosol cans at UNK, the following management principles apply:

1. All unwanted aerosol cans that meet the definition in catagory one above, are punctured at the UNK 180-day waste accumulation area prior to disposal and/or management as scrap metal to treat their characteristic of reactivity and render them "RCRA empty."

2. Emptied (punctured) cans are accumulated and periodically delivered to a scrap metal recycler. Records of delivery to the scrap metal recycler are maintained to demonstrate that the cans are not accumulated speculatively. Emptied cans are containerized during accumulation and delivery.

3. Aerosol cans are punctured in a closed container operation.

4. Aerosol cans are punctured and drained within 180 days of entering the waste accumulation area.

5. UNK has notified the Nebraska Department of Environmental Quality as a Small Quantity Generator of hazardous waste.

6. Because aerosol cans are not disposed at a Subtitle D facility (Municipal Solid Waste Landfill), a one-time LDR notification and certification to NDEQ and UNK files is not required.

7. FIFRA regulated aerosol cans (”RCRA empty” or otherwise) are managed in accordance with label directions.

Specific management principles for each category of aerosol cans are as follows:

1. Unwanted aerosol cans that **do not** contain constituents regulated under Nebraska Title 128, and that are hazardous prior to their classification as “RCRA empty” only for their characteristic of reactivity (D003).

These cans are punctured to deactivate the characteristic of reactivity and meet the DEACT treatment requirement of Title 128, Chapter 20, Table 9, Waste Code D003, “Explosives Subcategory based on Chapter 3, 009.01F through 009.01H.” For aerosol cans that are not considered “RCRA empty” prior to puncturing, the act of puncturing creates a “RCRA empty” container that is not reactive and is excluded from further hazardous waste regulation. As a result, there is no requirement to identify or treat for underlying hazardous constituents as stated in the Non-wastewaters column for this Subcategory of D003 waste. The remaining “RCRA empty” can is recycled as scrap metal.

2. Unwanted aerosol cans that **do** contain constituents regulated under Nebraska Title 128, and that are hazardous prior to their classification as “RCRA empty” because of their characteristic of reactivity (D003) and other characteristics or specifically listed wastes associated with the content of the can, excluding P-listed contents.

These cans **may or may not** be punctured to deactivate the characteristic of reactivity and meet the DEACT treatment requirement of Title 128, Chapter 20, Table 9, Waste Code D003, “Explosives Subcategory based on Chapter 3, 009.01F through 009.01H.” For aerosol cans that are not considered “RCRA empty” prior to puncturing, the act of puncturing creates a “RCRA empty” container that is not reactive and is excluded from further hazardous waste regulation. As a result, there is no requirement to identify or treat constituents as stated in the Non-wastewaters column for this Subcategory of D003 waste. The remaining “RCRA empty” can is recycled as scrap metal.

The contents of the punctured cans are consolidated into drums and the individual constituents are noted to facilitate assignment of waste codes and declaration of Underlying Hazardous Constituents at the time of consignment to a RCRA permitted disposal facility.

The removed material is considered as generated at the time the can was punctured and is counted toward the monthly total for generator status determinations (if necessary).

Unwanted aerosol cans that are not punctured and drained for constituent removal are labeled as D003 reactive wastes as well as with the appropriate specific U-codes. The un-punctured cans and their contents are disposed at a RCRA permitted facility with appropriate manifesting and LDR notifications.

3. Aerosol cans that contain constituents regulated under Nebraska Title 128, and are hazardous because of their characteristic of reactivity (D003) and P-listing of their contents (other than FIFRA regulated materials).

These cans are not punctured nor drained for constituent removal. These cans are labeled as D003 reactive waste as well as with the appropriate specific P-code(s). The un-punctured cans and their contents are disposed at a RCRA permitted facility with appropriate manifesting and LDR notifications.

LAB SAFETY SURVEY FORM

Name of person(s) performing the survey: _____

Department being surveyed: _____

Date of survey: _____

Building Name: _____

Accompanied during survey by: _____
Phone number: _____

GENERAL REQUIREMENTS

1. (Y) (N) (NA) Is there a written safety plan for the department? Is the plan reviewed annually?

2. (Y) (N) (NA) Is safety training provided? If yes, what kind?

3. (Y) (N) (NA) Is safety training documented? If yes, how?

4. (Y) (N) (NA) Is a chemical inventory list on file? If yes, where?

5. (Y) (N) (NA) Is the inventory list kept up to date? What is date of latest revision?

6. (Y) (N) (NA) Are MSDS's readily available?

7. (Y) (N) (NA) Are there MSDS's for all products used?

8. (Y) (N) (NA) Is emergency response training included in the safety training (spill clean-up, fire extinguisher use, who to notify)? If yes, explain.

9. (Y) (N) (NA) Is NFPA placard in place?

10. (Y) (N) (NA) Are NFPA numbers correct? If no explain.

Additional Comments:

GENERAL SAFETY

Chemical Use

1. How are chemicals stored (i.e., alphabetically, chemical class, etc.)?

2. (Y) (N) (NA) Do chemicals appear to be used appropriately (i.e., no spills, safe handling, no sloppy use)? If no, explain.

3. (Y) (N) (NA) Are all chemical containers labeled?

4. (Y) (N) (NA) Are cryogenics (liquid gases) used? If yes, is the appropriate safety equipment available (i.e., gloves)?

5. (Y) (N) (NA) Are gas cylinders secured? If not, what is the location of the unsecured cylinder(s)?

Equipment Use

1. (Y) (N) (NA) Is glassware in good shape (i.e., no cracks or chips, clean)? If no, explain.

2. (Y) (N) (NA) Is rubber tubing in good shape (i.e., no cracks, rotting, etc.)? If no, explain.

3. (Y) (N) (NA) Are clamps/stands/apparatuses stable, secured, and safe? If no, explain.

4. (Y) (N) (NA) Are flammable liquids stored in refrigerators?

5. (Y) (N) (NA) Are refrigerators explosion proof?

Fume Hoods

1. Number of fume hoods in the department:

2. (Y) (N) (NA) Are fume hoods used properly (i.e., clean, not used for storage)? Date(s) last inspected?

3. (Y) (N) (NA) Do air/water/gas/vacuum hook-ups work?

4. (Y) (N) (NA) Do lights in hood work?

5. (Y) (N) (NA) Is perchloric acid used?

6. (Y) (N) (NA) Is there a perchloric acid fume hood?
NOTE: Perchloric acid hoods have a self-cleaning system.

7. (Y) (N) (NA) Are bio-hazardous materials used in the hood?

8. (Y) (N) (NA) Does the hood have the appropriate filters?

Work Areas

1. (Y) (N) (NA) Is lighting adequate for work that needs to be done?

2. (Y) (N) (NA) Are electrical outlets overloaded?

3. (Y) (N) (NA) Do walkways contain safety hazards (i.e., cords on floor, low overhead pipes, aisles too narrow)? If yes, explain.

4. (Y) (N) (NA) Is general housekeeping adequate? If no, explain.

5. (Y) (N) Are food or beverages being consumed in the laboratories or work areas?

6. (Y) (N) (NA) Are boxes, equipment, and chemicals stored on tops of cabinets? If yes, explain.

Additional Comments:

PERSONAL PROTECTION EQUIPMENT

1. (Y) (N) (NA) Are gloves, gowns, and goggles available and are they being used? If no, explain.

2. (Y) (N) (NA) Is there an eye wash station in working order?

3. (Y) (N) (NA) Is there a safety shower in working order?

4. (Y) (N) (NA) Is there a testing schedule for the eyewash station and the safety shower? If yes, who is responsible for testing? If no, explain.

5. (Y) (N) (NA) Is there a first aid kit?

6. (Y) (N) (NA) Is the first aid kit properly stocked? If no, explain.

7. (Y) (N) (NA) Is there a spill kit? If yes, what are the contents?

8. (Y) (N) (NA) Are emergency phone numbers posted near the phone?

9. (Y) (N) (NA) Is a sharps container (broken glass, razor blades, needles) present?

10. (Y) (N) (NA) Are radioactive materials used in this lab?

a. (Y) (N) (NA) Are radioactive placards in place and are radioactive use areas taped off?

b. (Y) (N) (NA) Is there adequate shielding?

c. (Y) (N) (NA) Are film badges being worn?

11a. (Y) (N) (NA) Are biologically hazardous materials used in the lab?

11b. (Y) (N) (NA) Does the lab have the appropriate biohazard placards?

12. (Y) (N) (NA) Do employees get annual physical exams?

Additional Comments:

FIRE SAFETY

1. How many fire extinguishers are in each room?

   a. When were they last inspected?

   b. (Y) (N) (NA) Are they readily accessible, secured, and no more than 5 ft. above the floor?

2. (Y) (N) (NA) Are exits clearly marked? If no, explain.

3. How close is the nearest fire alarm pull station?

4. (Y) (N) (NA) Are flammable liquids stored in flammable liquid cabinets? If no, explain.

5. (Y) (N) (NA) Are other flammable compounds stored properly (i.e., away from oxidizers)? If no, explain.

6. (Y) (N) (NA) Are peroxide forming chemicals (ether, tetrahydrofuran) dated?

   (Y) (N) (NA) Tested for peroxides?

Additional Comments:

HAZARDOUS WASTES

1. (Y) (N) (NA) Are unwanted chemicals labeled appropriately (i.e., "used")? If no, explain.

2. (Y) (N) (NA) Are all containers closed? If no, explain.

3. (Y) (N) (NA) Are there any unlabeled or unknown chemicals? If yes, explain.

4. (Y) (N) (NA) Are all chemicals being used?

5. (Y) (N) (NA) Is there a process for each?

6. (Y) (N) (NA) Does this lab do photographic development? If yes, how are wastes disposed of?

7. Where are unwanted chemicals stored?

8. What is done with unwanted chemicals?

9. Who is responsible for disposing of unwanted materials?

10. (Y) (N) (NA) Are there any radioactive isotopes present or in use?

Additional Comments:

"Confidential environmental audit prepared pursuant to a request to determine compliance by the UNCA Director of Institutional Regulatory Control." DATE_____

UNIVERSITY OF NEBRASKA AT KEARNEY
HAZARDOUS MATERIALS MANUAL

APPENDIX D2

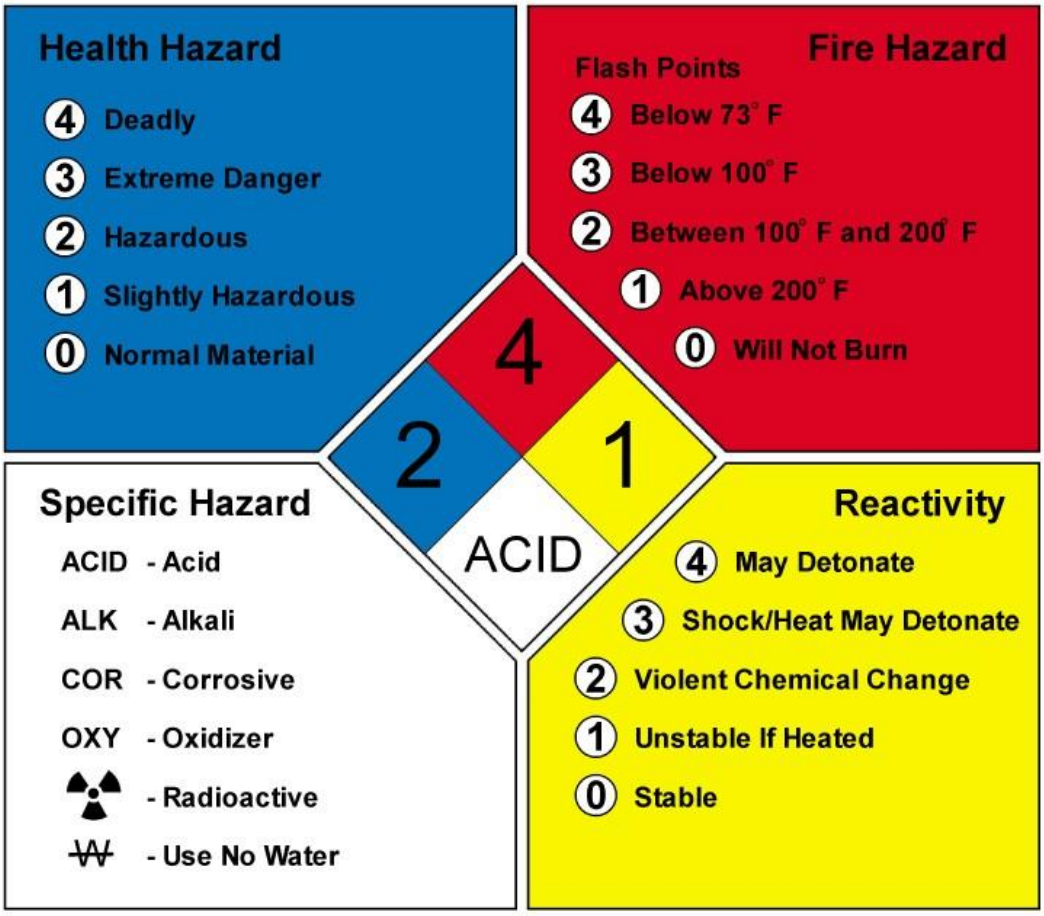
GENERIC MSDS FORM

A generic form for Material Safety Data Sheets (MSDS) follows:

(Latest Revision: May, 2005)

National Fire Protection Association

NFPA 704M Label



General Rating Summary

Health	Flammability	Reactivity
4 May be fatal on short exposure. Specialized protective equipment is required	4 Flammable gas or extremely flammable liquid	4 Explosive material at room temperature
3 Corrosive or toxic. Avoid skin contact or inhalation.	3 Flammable liquid flash point below 100 degrees F	3 May be explosive if shocked, heated under confinement or mixed with water
2 May be harmful if inhaled or absorbed.	2 Combustible liquid flash point of 100 to 200 degrees F	2 Unstable or may react violently if mixed with water
1 May be irritating.	1 Combustible if heated	1 May react if heated or mixed with water but not violently
0 No unusual hazard	0 Not combustible	0 Not reactive when mixed with water

SUMMARY OF NFPA 704 HAZARD RATING SYSTEM

Identification of Health Hazard Color Code: BLUE		Identification of Flammability Color Code: RED		Identification of Instability Color Code: YELLOW	
Signal	Type of Possible Injury	Signal	Susceptibility of Materials to Burning	Signal	Susceptibility to Release of Energy
	Materials that, conditions, can be lethal.	4	Materials that will rapidly or completely vaporize at atmospheric pressure and normal ambient temperature or that are readily dispersed in air and will burn readily.	4	Materials that in themselves are readily capable of detonation or explosive decomposition or explosive reaction at normal temperatures and pressures.
3	Materials that, under emergency conditions, can cause serious or permanent injury.	3	Liquids and solids that can be ignited under almost all ambient temperature conditions. Materials in this degree produce hazardous atmospheres with air under almost all ambient temperatures or, though unaffected by ambient temperatures, are readily ignited under almost all conditions.	3	Materials that in themselves are capable of detonation or explosive decomposition or explosive reaction, but that require a strong initiating source or that must be heated under confinement before initiation.
	Materials that, under emergency cause temporary incapacitation or residual injury.	2	Materials that must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur. Materials in this degree would not under normal conditions form hazardous atmospheres with air, but under high ambient temperatures or under moderate heating could release vapor in sufficient quantities to produce hazardous atmospheres with air.	2	Materials that readily undergo violent chemical change at elevated temperatures and pressures.
1	Materials that, under emergency conditions, can cause significant irritation.	1	Materials that must be preheated before ignition can occur. Materials in this degree require considerable preheating, under all ambient temperature conditions, before ignition and combustion can occur.	1	Materials that in themselves are normally stable, but that can become unstable at elevated temperatures and pressures.
	Materials that, under emergency conditions, would be beyond that of ordinary combustible materials.	0	Materials that will not burn under typical fire conditions, including intrinsically noncombustible materials such as concrete, stone, and sand.	0	Materials that in themselves are normally stable, even under fire exposure conditions.

From Appendix A of NFPA 704, Standard System for the Identification of the Fire Hazards of Materials, 2001 Edition.

TYPES OF FIRES AND FIRE EXTINGUISHERS

TYPES OF FIRES

CLASS "A"

- Class "A" fires are those involving only wood, paper, cloth, trash, etc. Suitable extinguishers use water or multipurpose dry chemical as their control agents.

CLASS "B"

- Class "B" fires are those involving flammable or combustible liquids such as gasoline, solvents, ether, etc. Suitable extinguishers are those containing carbon dioxide (CO2), halon, ordinary dry chemical or multipurpose dry chemicals.

CLASS "C"

- Class "C" fires are those fires of any nature which also involve "hot" electrical conductors. Such fires usually involve electrical wiring, motorized equipment, or electronic devices. Carbon dioxide (CO2), halon, ordinary or multipurpose dry chemical extinguishers are suitable.

CLASS "D"

- Class "D" fires are those involving burning metals such as magnesium titanium, zinc, sodium or potassium and certain water-reactive chemicals. These fires must be smothered using special agents selected for the type of material burning.

TYPES OF EXTINGUISHERS

<u>Water-Type Fire Extinguishers</u>:

These are very effective, if properly used on Class "A" fires (wood, paper, rags, ordinary trash, etc.), but are not suitable for Class "B" (flammable liquid), Class "C" (electrical) or Class "D" (metal) fires. Water may cause splashing of a burning liquid, spreading the fire to other areas. When water is used on fires which involve energized electrical circuits, the person using it could be severely shocked or electrocuted. When used against metal fires, it may increase the violence of the combustion or even cause toxic or explosive reactions. Water from these extinguishers shouldbe directed at the base of the flame for best control of the fire.

Dry Chemical Extinguishers:

These are of two types: One, the "ordinary" dry-chemical type, usually contains sodium bicarbonate powder and is good for Class "B" and "C" fires only; the other—or "multi-purpose dry-chemical" type—may contain ammonium phosphate or some other suitable extinguishing medium suitable for Class "A", "B", or "C" fires. Powder from these extinguishers is best used when directed at the base of flames in a smothering action.

Carbon Dioxide (CO2) Extinguishers:

These are not suitable for Class "A" fires, but are often selected for Class "B" and "C" fires because they do not leave a residue. This is especially critical in areas where expensive optical or electronic devices are present. The cold gas from CO2 extinguishers can be a disadvantage of times, due to thermal shocking of equipment. Direct discharge from these extinguishers as close to fire as possible, first at edge of flames and then gradually forward and upward. Watch for possible flashback.

Halon Extinguishers:

Halon extinguishers can be used with Class "A", most Class "B", and Class "C" fires. Like carbon dioxide, they leave no residue and have the additional advantage of avoiding thermal shock to equipment when properly used. The use of halon extinguishers is limited by a major factor—cost.

Class "D" Extinguishers:

These extinguishers use special agents to control fires and work by smothering the combustible product. They may also be needed for fires involving chemicals such as alkaline earths, which may be aggravated by halon, carbon dioxide, or dry powder or which may react violently with water. Class "D" extinguishers should be specifically selected for the type of material they are to protect, as there is no suitable general extinguishing agent for this class of fire.

HEALTH EMERGENCY POLICY

Student Health Services

Please review the following emergency policy indicating how to deal with students who are injured or become ill in your class or department.

Illness/Injuries

Student Health may be called (8218) if requested by the student, or if the situation requires first aid or wheelchair transportation for treatment in Student Health. When calling, make every effort to obtain the student's name (from the student or anyone in the area who can identify the student) and be prepared to stay on the line to talk with a nurse.

Non-urgent Illness/Injury

If the injury is of a less urgent nature, simply assisting the student to get help may be all that's needed. You may call Police Services at 8517 or 380-1422 and if an officer is available, she/he can assist you. If medical attention is needed the student should be advised to come to Student Health during clinic hours, or be taken to the hospital emergency department if the campus clinic is closed. Clinic walk-in hours are Monday - Friday, 8:30 a.m. - 3:30 p.m., however clinic staff are available from 8:15a.m. - 5:00 p.m. for medical advice.

Medical Emergencies

Should a medical emergency occur (i.e. profuse bleeding, stopped breathing, suspected heart attack, broken bone, serious head or spine injury, serious burns) CALL 911 IMMEDIATELY. It is not necessary to dial 9 for an outside line. Make every effort to obtain the student's name (from the student or anyone in the area who can identify the student). Stay on the line until the 911 dispatcher instructs you to hang up.

Do not move the individual unless necessary for safety reasons. Do not take time to notify Police Services or Student Health first; they may be called after summoning the emergency unit.

Fainting/Seizures

One of the more frightening medical conditions to observers is to have a person lose consciousness whether due to a fainting episode or a seizure. Although frightening, this may not require calling 911. Take a moment to assess the situation and decide how to respond.

If the person was not injured in the fall, they may be easily aroused within 2 to 3 minutes. In all instances, someone should remain with the individual while a Student Health nurse and/or a Police Services officer is called. Again, make every effort to obtain the student's name before calling.

Seizure activity may involve involuntary movement of all or some parts of the body. Do not attempt to restrain the movements, but do remove any nearby objects that may injure the student. After the seizure activity stops the student will be drowsy and may need a few minutes to lie down in a quiet place until completely awake.

Seizures do not require calling 911 unless the jerking movements do not stop after 3 to 5 minutes, or if the person has stopped breathing after the seizure activity stops (events that are extremely rare).

A Student Health nurse may be called if requested by the student upon waking up or if advice is desired.

****

In any situation, attempt to remain calm and dismiss curious onlookers. If someone trained in first aid offers assistance, it may be helpful to keep them nearby. Periodically review this policy with your department and keep this information handy. Please call Student Health (8218) if you have any questions.