CHAPTER 3.0 - CHEMICAL HYGIENE PLAN

The Occupational Safety and Health Administration (OSHA), part of the Department of Labor, administers a variety of regulations. These regulatory requirements are published in and referred to as the Code of Federal Regulations (CFR). The Code of Federal Regulations is a codification of the general and permanent rules published in the Federal Register by the Executive departments and agencies of the Federal Government. The Code is divided into 50 titles that represent broad areas subject to Federal regulation. Each title is divided into chapters with each chapter further subdivided into parts, subparts and sections. Part 1910 of Title 29 (cited as "29 CFR 1910"), section 1450 of subpart Z, "Occupational Exposures to Hazardous Chemicals in Laboratories", referred to as the "Laboratory Standard", specifically addresses mandated regulatory requirements. Many educational institutions, colleges, universities, industry, and other organizations that use hazardous chemicals in their laboratories are now required by the Laboratory Standard to develop Chemical Hygiene Plans.

The development of a detailed written chemical hygiene plan is necessary to establish continuity, to train personnel, and to help ensure that all employees recognize and comply with work place safety. It is extremely difficult to effectively communicate and enforce requirements without a detailed written chemical hygiene plan.

An effective chemical hygiene plan necessitates that mechanisms be in place and functioning to ensure that safety policies and procedures are being adhered to, personnel are meeting their safety responsibilities, and an effective form of monitoring and documentation is in place for confirmation purposes.

Laboratories are well advised to develop their written chemical hygiene plans in a manual form. This manual should provide policies and procedures that are feasible, specific, and encompass all the elements of laboratory activities in which the laboratory is engaged. The written safety manual should be distributed to appropriate employees and be a requirement of employee training programs.

The basic OSU Laboratory Safety Manual is intended to serve primarily as a general safety document for compliance with various state and federal environmental and occupational health and safety rules and regulations. **It is neither feasible nor technically valid to attempt to provide specific procedures or protocols in a general safety document. <u>However</u>, individual laboratories should be able to develop their own specific chemical hygiene plans by augmenting the OSU Laboratory Safety Manual.**

The development of a detailed written chemical hygiene plan and the implementation of this plan within employee training programs should result in a safer working environment and contribute to a reduction in work place accidents and injuries.

Section 3.1 - OSU LABORATORY CHEMICAL SAFETY POLICY

A. Introduction

On September 17, 1984, the State of Oklahoma adopted the Federal OSHA Standards, Title 29 of the Code of Federal Regulations (CFR) parts 1910 and 1926 (hereafter cited as 29 CFR 1910 and 29 CFR 1926), to apply to the state government and its political subdivisions. (Title 40 O.S. sections 401-424, Oklahoma statutes as amended.)

Oklahoma State University is therefore required by 29 CFR 1910 section 1450 of subpart Z (Occupational Exposures to Hazardous Chemicals in Laboratories) to develop a chemical hygiene plan for certain laboratories.

The Laboratory Standard (29 CFR 1910.1450) does not apply to all laboratories, but where it applies, it supersedes the Hazard Communication Standard 29 CFR 1910.1200. Even though Oklahoma State University has already implemented the Hazard Communication Standard, the Laboratory Standard takes precedence in those areas to which it applies. There is no option of choosing between the two standards. If the Laboratory Standard applies to an area, it must be implemented. If the Laboratory Standard does not apply, then the Hazard Communication Standard does apply.

It is therefore the intent of this Laboratory Chemical Safety Policy to define the guidelines for the implementation of the Laboratory Standard.

B. Scope and Definitions

The OSU Laboratory Safety Chemical Policy applies only to certain laboratories. Many laboratories use hazardous chemicals. OSHA defines a hazardous chemical as a substance for which there is a statistically significant evidence, based on at least one scientific study, showing that acute or chronic harm may result from exposure to that chemical. This broad definition clearly applies to almost all, of the chemicals typically used in laboratories.

The purpose of the OSU Laboratory Safety Chemical Policy is to protect laboratory employees, while they are working in a laboratory, from harm due to potential exposure of hazardous chemicals. In addition to employees who ordinarily spend their full time working in a laboratory space, for the purposes of this policy "laboratory employee" also includes office, custodial, maintenance, and repair personnel, and others who, as part of their duties, regularly spend a significant amount of their time within a laboratory environment. The appropriate University administrative units shall determine what constitutes a "significant amount" of working time. This definition is subject to review at the time of an OSHA visit.

The OSU Laboratory Chemical Safety Policy does not apply to all places where hazardous chemicals are used. Only laboratories meeting the following four criteria are subject to the OSU Laboratory Chemical Safety Policy:

1. Chemical manipulations are carried out on a laboratory scale. That is, the work with chemicals is in containers of a size that could be easily and safely manipulated by one person.

2. Multiple chemical procedures or chemicals are used.

3. Protective laboratory practices and equipment are available and in common use to minimize the potential for employee exposure to hazardous chemicals.

4. The procedures involved are not part of a production process whose function is to produce commercial quantities of materials, nor do the procedures in any way simulate a production process.

This fourth criterion would normally exclude quality control laboratories in industrial operations because they "are usually adjuncts of production operations that typically perform repetitive procedures for the purpose of monitoring a product or a process" [FR 55, 3312 (January 31, 1990)]. This criterion also would normally exclude pilot plant operations, which are typically closely connected with production processes. However, if pilot plant operations are an integral part of a research function for the purpose of evaluating a particular effect (for example, "the operations do not proceed to production but remain part of the research activity"), then that pilot plant operation may be covered under the OSU Laboratory Chemical Safety Policy.

Some laboratories may also be required to meet the requirements of substance-specific federal standards in addition to the Laboratory Standard. One set of such standards is contained in OSHA's 29 CFR 1910.1000 - 1999.

Action level - A concentration for a specific substance, calculated as an eight (8) hour time-weighted average, which initiates certain required activities such as exposure monitoring and medical surveillance. Typically it is one-half that of the PEL for that substance.

Acute - Severe, often dangerous conditions in which relatively rapid changes occur.

Carcinogen - Any substance that causes the development of cancerous growths in living tissue, either those that are known to induce cancer in man or animals or experimental carcinogens that have been found to cause cancer in animals under experimental conditions.

Designated Area - An area that may be used for work with "select carcinogens, reproductive toxins, or substances that have a high degree of acute toxicity." A designated area may be the entire laboratory, an area of a laboratory, or a device such as a laboratory hood. A designated area shall be placarded to reflect the designated hazard.

Employee - An individual employed in a laboratory work place who may be exposed to hazardous materials in the course of his or her assignments.

Health Hazard - A substance for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees. This term includes carcinogens, toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents that act on the hematopoietic systems, and agents that damage the lungs, skin, eyes, or mucous membranes.

MSDS - Material Safety Data Sheet.

(PEL) Permissible Exposure Limit - An exposure limit that is published and enforced by OSHA as a legal standard. PEL may be either a time-weighted-average (TWA) exposure limit (8 hour), a 15-minute short term exposure limit (STEL), or a ceiling (C). The PELs are found in Tables Z-1, Z-2, or Z-3 of 29 CFR 1910.100. This level of exposure is deemed to be the maximum safe concentration and is generally the same value as the threshold limit value (TLV).

(PPE) Personal Protective Equipment - Any devices or clothing worn by the worker to protect against hazards in the environment. Examples are respirators, gloves, and chemical splash goggles.

Respirator - A device that is designed to protect the wearer from inhaling harmful contaminants.

(STEL) Short Term Exposure Limit - Represented as STEL or TLV-STEL, this is the maximum concentration to which workers can be exposed for a short period of time (15 minutes) for only four times throughout the day with at least one hour between exposures.

(TLV) Threshold Limit Value - Airborne concentrations of substances devised by the ACGIH that represents conditions under which it is believed that nearly all workers may be exposed day after day with no adverse effect. TLVs are advisory exposure guidelines, not legal standards, that are based on evidence from industrial experience, animal studies, or human studies when they exist. There are three different types of TLVs: Time Weighted Average (TLV-TWA), Short Term Exposure Limit (TLV-STEL) and Ceiling (TLV-C). (See also PEL.)

Time Weighted Average - (TLV-TWA, Threshold Limit Value-Time Weighted Average) The time weighted average airborne chemical concentration for a normal eight hour work day and a 40 hour work week to which nearly all workers may be repeatedly exposed, day after day, without adverse effect.

Toxic - Substances such as carcinogens, irritants, or poisonous gases, liquids, and solids that are irritating to or affect the health of humans.

C. University Responsibilities

Oklahoma State University has certain obligations. Among these the University must:

1. Keep records of employee exposures to hazardous chemicals:
    a. Records should include measurements made to monitor exposures, if any, as well as any medical consultations and examinations, including written opinions.
    b. These records shall be kept by Environmental Health Services' Hazard Communications Section, University Personnel Services, and the laboratory or Department in which the exposure occurred. Records should be indexed according to the employee's social security number.
    c. Maintain these records as mandated in 29 CFR 1910.20, Access to Employee Exposure and Medical Records.
2. Provide University employees with:
    a. Training and information regarding chemical and physical hazards.
    b. Identification of other hazards (see Subparts D through T of 29 CFR).
    c. Access to medical consultation and examinations. (See part F of this policy)
    d. Respirators when necessary (see item 6 of this list).
3. For incoming hazardous chemicals:
    a. Require that the incoming hazardous chemicals have adequate labels. Do not allow the removal or defacement of these labels.
    b. Require that the MSDSs for incoming hazardous chemicals be on hand prior to receipt of hazardous chemicals whenever possible. Require that MSDSs be acquired for all hazardous chemicals on hand whenever possible.

c. Keep all material safety data sheets (MSDS) that the University receives.

d. Make MSDSs accessible to employees.

e. Maintain an accurate inventory of all chemicals in University laboratories.

4. When hazardous chemicals are generated in University laboratories:

a. If the hazardous properties are known, train University employees.

b. If the hazardous properties are not known, treat the chemical as though it is hazardous and provide protection as described in the laboratory Chemical Hygiene Plan.

c. If the chemicals are produced for use elsewhere, follow 29 CFR 1910.1200 and the various Environmental Protection Agency (EPA) and Department of Transportation (DOT) regulations that apply to that chemical.

5. If there is reason to believe that the action level, or PEL if there is no action level, has been exceeded for any chemical for which a substance-specific standard has been established, the University must measure the concentration of that chemical in the air.

If the level measured is greater that the PEL or action level, then:

a. Notify all affected laboratory employees of the results of the measurement, and

b. Comply with the OSHA exposure-monitoring provisions for that chemical, as stated in 29 CFR 1910.1000 through 1910.1199.

6. If respirators are necessary to keep exposures below the PEL or action level, follow the requirements of the Respiratory Protection Standard, 29 CFR 1910.134.

7. If select carcinogens, reproductive toxins, or acute toxins that are very highly toxic are used in the laboratory, identify and post one or more areas as "designated area(s).

8. Require that each University Department or similar University administrative unit that has laboratories subject to the Laboratory Standard appoint a Departmental Chemical Hygiene Officer (DCHO).

a. These individuals should be qualified by training and experience to provide technical guidance in the development and implementation of the Chemical Hygiene Plan. This assignment can be a second title for a person who has other responsibilities.

b. The University President has the ultimate responsibility for chemical safety. The Departmental Chemical Hygiene Officers act as the representative of the University President in this capacity.

9. Assign to the DCHO's the duty to prepare, implement, and maintain a written program for their Department, called a chemical hygiene plan (CHP), setting forth the work practices, procedures, personal protective equipment, and other equipment that will protect employees from harm arising from hazardous chemicals used in the laboratories in their Department.

a. The CHP must be capable of keeping employee exposures below the PEL of chemicals as listed in 29 CFR 1910 Subpart Z.

b. The CHP must be readily accessible to employees.

c. The CHP must be reviewed at least annually and updated as necessary.

D. Individual Responsibilities

Responsibility for chemical hygiene rests at all levels including the:

1. *University President*, who has ultimate responsibility for chemical hygiene within Oklahoma State University and must, with other administrators, provide continuing support for University chemical hygiene.

2. *Supervisor of a College, Department or other administrative unit*, who is responsible for chemical hygiene in that unit.

3. *Departmental Chemical Hygiene Officers*, who have overall responsibility for chemical hygiene in all departmental laboratories including responsibility to:

   a. Work with administrators and other employees to develop and implement appropriate chemical hygiene policies and practices;

   b. Help project directors develop precautions and adequate facilities;

   c. Ensure that workers know and follow the chemical hygiene rules and document that appropriate training has been provided;

   d. Determine the required levels of protective apparel and equipment and insure that this equipment is available and in working order;

   e. Monitor procurement, use, and disposal of chemicals in the lab;

   f. Ensure that the Hazard Communications Office and the master recordkeeper receive copies of all MSDSs received. (See University Policy and Procedure Letter 3-0535 "Hazard Communications Program."

   g. Maintain an accurate Departmental Chemical Inventory List. Complete and mail the Departmental Chemical Inventory List survey forms to the Hazard Communication Office on a timely basis. (See University Policy and Procedures Letter 3-0535 "Hazard Communications Program."

   h. Provide regular, formal chemical hygiene and housekeeping inspections including routine inspections of emergency equipment;

   i. Know the current legal requirements concerning regulated substances; and

   j. Seek ways to improve the chemical hygiene program.

4. *Project director or director of other specific operation*, who has primary responsibility for chemical hygiene procedures for that operation, and is responsible for:

   a. Insuring that the Departmental Chemical Hygiene Officer receives copies of all MSDSs received. (See University Policy and Procedure Letter 3-0535 "Hazard Communications Program."

b. Maintaining an accurate Laboratory Chemical Inventory List. Insure that the Departmental Chemical Hygiene Officer receives copies of this list as necessary. (See University Policy and Procedures Letter 3-0535 "Hazard Communications Program."

c. Ensuring that workers know and follow the chemical hygiene rules,

d. Ensuring that protective equipment is available and in working odor,

e. Ensuring that all containers in the work area are properly labeled,

f. Ensuring that MSDS's are maintained for each hazardous substance in the laboratory and ensuring that they are readily accessible to laboratory employees,

g. Ensuring that appropriate training has been provided to all employees,

h. Providing regular, formal chemical hygiene and housekeeping inspections including routine inspections of emergency equipment,

i. Knowing the current legal requirements concerning regulated substances,

j. Determining the required levels of protective apparel and equipment, and

k. Ensuring that facilities for use of any material being ordered are adequate.

5. *Laboratory worker*, who is responsible for:

a. Planning and conducting each operation in accordance with safe procedures; and

b. Developing and maintaining good personal chemical hygiene habits.

E. The Content of the Chemical Hygiene Plan

The chemical hygiene plan shall include each of the following elements and shall also indicate the specific measures to be taken to ensure that University employees are protected.

1. Standard operating procedures relevant to all laboratory operations, to be followed by laboratory employees.

2. Statements of the criteria that will be used to determine and implement control measures to reduce employee exposure to hazardous chemicals. These measures include engineering controls, use of personal protective equipment, and personal hygiene practices. Criteria to reduce exposure to extremely hazardous chemicals used in the laboratory shall be specifically included.

3. A requirement that fume hoods and other protective equipment shall function properly and descriptions of the methods to be taken to make sure that such equipment is functioning properly.

4. Provisions for employee training and information.

5. Circumstances under which a laboratory practice requires prior approval from a supervisor before implementation.

6. Provisions for medical consultation and examination.

7. Designation of personnel responsible for implementation of the chemical hygiene plan.

8. Provisions for additional protection for employees when working with particularly hazardous substances, including:

   a. Select carcinogens.

   b. Reproductive toxins.

   c. Substances with a high degree of acute toxicity.

9. Specific mention of the following provisions, including when appropriate:

   a. Establishment of a designated area.

   b. Use of containment devices such as fume hoods or glove boxes.

   c. Procedures for safe removal and disposal of contaminated and hazardous waste; and

   d. Decontamination procedures.

F. Exposure Assessments, Medical Consultations, and Examinations

1. Suspected Exposures to Toxic Substances

There may be times when employees or supervisors suspect that an employee has been exposed to a hazardous chemical to a degree and in a manner that might have caused harm to the victim. If the circumstances suggest a reasonable suspicion of exposure, the victim is entitled to a medical consultation and, if so determined in the consultation, also to a medical examination. All medical examinations and consultations shall be provided without cost to the employee, without loss of pay, and at a reasonable time and place.

a. Criteria for Reasonable Suspicion of Exposure

   (1) It is the policy of Oklahoma State University to promptly investigate all employee-reported incidents in which there is even a remote possibility of employee overexposure to a toxic substance.

   (2) Events or circumstances that might reasonably constitute overexposure include:

      (a) A hazardous chemical leaked or was spilled or was otherwise rapidly released in an uncontrolled manner.

      (b) A laboratory employee had direct skin or eye contact with a hazardous chemical.

      (c) A laboratory employee manifests symptoms, such as headache, rash, nausea, coughing, tearing, irritation or redness of eyes, irritation of nose or throat, dizziness, loss of motor dexterity or judgment, etc., and some or all of the symptoms disappear when the person is taken away from the exposure area and breathes fresh air, and the symptoms reappear soon after the employee returns to work with the same hazardous chemicals.

      (d) Two or more persons in the same laboratory work area have similar complaints.

b. Exposures

All exposure complaints and their disposition, no matter what the ultimate disposition may be, are to be documented by the respective Department Chemical Hygiene Officer using the Employer's First Notice of Injury Form and Employee Exposure Report Form. Copies of these forms shall be sent to University Personnel Services. If no further assessment of the event is deemed necessary, the reason for that decision shall be included on the Employee Exposure Report Form. If the decision is to investigate, a formal exposure assessment will be initiated by the Departmental Chemical Hygiene Officer. Environmental Health Services and University Personnel Services Office of Risk Management shall provide the Formal Exposure assessment.

(1) Exposure Assessment

In cases of emergency, exposure assessments are conducted after the victim has been treated, otherwise exposure assessments should be completed BEFORE medical consultations are undertaken.

NOTE: It is not the purpose of an exposure assessment to determine that a failure on the part of the victim, or others, to follow proper procedures was the cause of an exposure. The purpose of an exposure assessment is to determine that there was, or was not, an exposure that might have caused harm to one or more employees and, if so, to identify the hazardous chemical or chemicals involved. Other investigations might well use results and conclusions from an exposure assessment, along with other information, to derive recommendations that will prevent or mitigate any future overexposures. However, exposure assessments determine facts; they do not make recommendations.

(a) Unless circumstances suggest other or additional steps, these actions constitute an exposure assessment:

i. Interview the complainant and also the victim, if not the same person.

ii. List the essential information about the circumstances of the complaint, including:

- The chemical under suspicion.
- Other chemicals used by victim.
- All chemicals being used by others in the immediate area.
- Other chemicals stored in that area.
- Symptoms exhibited or claimed by the victim.
- How these symptoms compare to symptoms stated in the materials safety data sheets for each of the identified chemicals.
- Were control measures, such as personal protective equipment and hoods, used properly?
- Were any air sampling or monitoring devices in place? If so, are the measurements obtained from these devices consistent with other information?

(b) Monitor or sample the air in the area for suspect chemicals.

(c) Determine whether the victim's symptoms compare to the symptoms described in the MSDS or other pertinent scientific literature.

(2) Notification of Results of Monitoring

Within 15 working days of receipt of the results of any monitoring, notify affected employees of those results.

2. Medical Consultation and Examination

If employees feel that they have been exposed to hazardous chemicals, employees are required to contact their respective departmental Chemical Hygiene Officer who will assist them in arranging for an Exposure Assessment if necessary. The Exposure Assessment will be utilized by the consulting physician to determine if further medical consultations and examinations are warranted.

The details of medical consultations and examinations are determined by the physician.

The purpose of a medical consultation is to determine whether a medical examination is warranted. When, from the results of an Exposure Assessment, it is suspected or known that an employee was overexposed to a hazardous chemical or chemicals, the employee should obtain medical consultation from or under the direct supervision of a licensed physician.

When warranted, employees also should receive a medical examination from or under the direct supervision of a licensed physician who is experienced in treating victims of chemical overexposure. The medical professional should also be knowledgeable about which tests or procedures are appropriate to determine if there has been an overexposure; these diagnostic techniques are called "differential diagnoses."

These provisions apply to medical consultations and examinations:

a. All employees who work with hazardous chemicals must be provided an opportunity to receive medical consultation and examination when:

(1) The employee develops signs or symptoms associated with a hazardous chemical to which the employee may have been exposed in the laboratory.

(2) Monitoring, routine or otherwise, suggests that there could have been an exposure above the action level, or OSHA PEL if there is no action level, for a chemical for which an OSHA substance-specific standard has been established.

(3) There is a spill, leak, or other uncontrolled release of a hazardous chemical.

b. Provide the physician with:

(1) The identity of the hazardous chemical or chemicals to which the employee may have been exposed (Formal Exposure Assessment if available).

(2) The exposure conditions.

(3) The signs and symptoms of exposure the victim is experiencing, if any.

c. Ordinarily, physicians will furnish to the Oklahoma State University Personnel Services in written form:

(1) Recommendations for follow-up, if determined to be pertinent.

(2) A record of the results of the consultation and, if applicable, of the examination and any tests that were conducted.

(3) Conclusions concerning any other medical condition noted that could put the employee at increased risk.

(4) A statement that the employee has been informed both of the results of the consultation or examination and of any medical condition that may require further examination or treatment.

d. These written statements and records should not reveal specific findings that are not related to an occupational exposure.

e. Documentation

All memos, notes, and reports related to a complaint of actual or possible exposure to hazardous chemicals are to be maintained as part of the record.

f. Notification

Employees shall be notified of the results of any medical consultation or examination with regard to any medical condition that exists or might exist as a result of overexposure to a hazardous chemical.

G. Records and Recordkeeping

1. Employee Exposure and Medical Records

OSHA regulation 29 CFR 1910.20, Access to Employee Exposure and Medical Records, addresses the storage and access to employee exposure and medical records pertaining to toxic substances or harmful physical agents. The following is a summary of this regulation:

a. The medical record for each employee is to be preserved and maintained for at least the duration of employment plus thirty years.

b. Each employee exposure record shall be preserved and maintained for at least thirty years.

c. Each analysis using employee exposure or medical records shall be preserved and maintained for at least thirty years.

d. MSDSs and other descriptions of substances do not have to be retained as long as some record of the identity (chemical name if known) of the substance or agent, where it was used, and when it was used is retained for 30 years.

e. If an employee or their designated representative, requests a copy of the employee's health record, the University is to provide a copy within 15 days of the request, or provide facilities to make copies at no cost, or loan the records to employee or designated representative so that copies can be made.

Section 3.2 - OSU HAZARDOUS CHEMICAL WASTE DISPOSAL POLICY

Oklahoma State University will conform to applicable regulations of the State of Oklahoma, United States Environmental Protection Agency, United States Department of Transportation, and United States Department of Labor with regard to the safe use, handling, transportation and disposal of chemical substances and waste.

The Department of Environmental Health & Safety (Physical Plant Services) is the campus unit and authority having jurisdiction for progam oversight. For specific instructions, contact the Department of Environmental Health & Safety at
744-7241.

SECTION 3.3 - CHEMICAL SAFETY

Working with potentially hazardous chemicals is an everyday occurrence in a laboratory setting. Hazardous situations can occur if employees are not educated in general chemical safety, toxicological information, and procedures for handling and storage for the chemicals they are using. This section of the laboratory manual addresses these educational components and spells out specific protocols to minimize hazardous chemical exposures.

A. Modes of Entry

There are four major modes of entry to chemicals: inhalation, skin absorption, injection, and ingestion. Inhalation and skin absorption are the predominant occupational exposures you may expect to encounter in the laboratory and will be discussed in some detail. Accidental injection of chemicals can be eliminated by good laboratory safety practices. Accidental ingestion of chemicals can be eliminated by a combination of good laboratory and hygienic practices such as washing hands and prohibiting foods, drinks, cosmetics, and tobacco products in the laboratory workplace (see Section 2.1 - "General Safety and Operational Rules"). All potential exposures, i.e., inhalation, skin absorption, injection, and ingestion, are discussed in the Material Safety Data Sheets available for each chemical or product. The hundreds of chemicals that employees are routinely exposed to during the course of their work in the laboratory can be divided into three main types: volatile solvents, corrosives, and toxic solids. The particular hazards associated with exposure to these materials, and ways to avoid them, are discussed in detail below.

B. Basic Chemical Classifications

1. Volatile Solvents

Organic solvents are perhaps the most ubiquitous chemicals found in the laboratory setting. The potential chronic health effects of some of these materials warrant special attention as one is likely to be exposed to more solvents than any other type of chemical. For safety purposes, these chemicals are generally subdivided into two categories: chlorinated and non-chlorinated. This is done mainly because the chlorinated solvents are, in general, not flammable while non-chlorinated solvents are often flammable. It should be kept in mind, however, that the chlorinated solvents do decompose when burned. This results in high concentrations of toxic vapors, such as phosgene and hydrogen chloride.

Keeping in mind the difference in flammability between these two classes of solvents, we can discuss the health effects common to both classes. The primary route of exposure to these materials is through inhalation. In general, high concentrations of the vapor, when inhaled, produce drowsiness, dizziness and headaches. This can occur quite quickly, since chemical vapors are rapidly absorbed. Most of the solvents will also act as upper respiratory and/or eye irritants. One physical property common to most solvents is odor. Unfortunately, the odor of a solvent offers little in the way of determining whether or not the environment is immediately hazardous. Solvent odor thresholds vary widely and acclimation or odor fatigue is often rapid. Odor is also not generally indicative of the degree of hazard that the material presents. Butyl mercaptan has such an extremely disagreeable odor that one cannot tolerate a concentration necessary to be injurious. Chloroform, however, has a sweet odor to many people and tolerance levels can far exceed safe levels.

Chronic effects of solvent exposure vary widely. Of most concern is the potential for lung, liver, and kidney damage posed by some solvents. This, in general, applies to solvents that are not water soluble. Examples of these solvents would be benzene,

toluene, xylene, chloroform, carbon tetrachloride, and trichloroethylene. Instances of chronic disease caused by occupational exposure to these solvents have been documented. However, it must be kept in mind that everyone reacts differently and individual susceptibilities are quite variable.

Skin absorption is an additional mode of entry for which an exposure to a solvent may occur. Most commonly, solvents act to de-fat the skin. This will cause drying and cracking of the skin, and may lead to chronic dermatitis with prolonged and repeated exposure. Some solvents can also act as corrosives. Most amines and phenols act in this manner.

In addition, many of the solvents (dimethyl sulfoxide and dimethyl formamide, for example) will penetrate the skin and be absorbed into the body. In this case, the effects of exposure will be analogous to inhalation exposure. Carbon disulfide, n-butyl alcohol, and phenol are common solvents that can penetrate intact skin. For those solvents, there will be a notation of skin exposure noted on the Material Safety Data Sheet. Most skin contact with solvents can be avoided by wearing gloves suitable for that chemical. It is important that the glove be resistant to the material being handled. Using the wrong glove can give a false sense of security and overexposure via the skin may result. If a solvent penetrates the glove, a prolonged contact will result due to slowed evaporation rates. Rubber and neoprene gloves can be classed as good general purpose gloves, but a chemical resistance chart and the MSDS should always be consulted (See also Section 2.3 - "Personal Protective Equipment").

Direct liquid contact by solvents in the eyes can be very serious. The victim could easily panic. Get them to the eye wash immediately and flush the eyes for at least 15 to 30 minutes. Medical assistance should also be summoned.

In summary, volatile solvents can pose inhalation, skin, and ingestion hazards. Some of the solvents may also be flammable, which could cause fire and/or explosion hazards. Whenever possible, use volatile solvents in a properly operating fume hood to eliminate inhalation hazards, use correct skin and eye protection and use good laboratory and hygienic technique to eliminate any possible ingestion of volatile solvents.

2. Acid and Bases

Common to all acids and bases is their corrosive action on human tissues. Minor exposures are generally reversible, although often painful for a short period of time. The reversibility of the effects of acid or base exposure will depend on three factors: the duration of exposure, concentration of the material, and the first aid methods used.

Exposure can occur through skin absorption or inhalation. With inhalation exposure, remove the victim from the area (try to keep the victim from breathing too deeply, as this may exacerbate the effects) and summon medical help.

Skin contact is the most common route of exposure. Here the concentration and type of acid are the most important factors. In concentrated forms, all types of corrosives may cause severe penetrating burns. Dilute solutions do not have the same warning properties as concentrated forms, so guard against exposure. One should be particularly careful with hydrofluoric acid (see Section 2.2-3).

Neoprene gloves provide the best protection from skin exposure to both acids and bases, but in all cases, follow the recommendations in the MSDS. When using or dispensing

concentrated acids or bases, a lab coat or apron and a full face shield is required (see Section 2.3 - "Personal Protective Equipment").

If there is skin or eye contact with acids or bases, make sure to flush the area with water for 15 to 30 minutes and summon medical assistance.

3. Toxic Solids

Many of the chemicals used in the laboratory that are solid and toxic are used in solution, so skin absorption can be of a concern. This is particularly true when a substance is dissolved in a solvent that can penetrate the skin. Also, an oxidizing material dissolved in water can act directly on the skin causing irritation where the solid alone would be relatively less irritating. It is therefore important that proper personal protective equipment be worn (See Section 2.3 - "Personal Protective Equipment").

In the solid form, the greatest risk of exposure is through inhalation. This risk can be lessened by wearing the appropriate respirator and/or working in a fume hood.

C. Incompatible Chemicals

Certain hazardous chemicals cannot be mixed or stored safely with other chemicals due to potentially severe or extremely toxic reactions taking place. For example, keep oxidizing agents separated from reducing agents, initiators separated from monomers, and acids separated from alkalis, etc.

The chemical label and Material Safety Data Sheet will contain information on incompatibilities.

A list of incompatible chemicals is included in Appendix B.

D. Chemical Stability

Stability refers to the susceptibility of the chemical to decomposition. Ethers, liquid paraffins, and olefins can form peroxides on exposure to air and light. Since these chemicals are packaged in an air atmosphere, peroxides can form even though the containers have remained sealed. Some inorganic chemicals also are unstable.

Unless inhibitor was added by the manufacturer, closed containers of ethers shall be discarded after one year. See Section 3.4 - "Chemical Waste" for disposal procedures. Appropriate use of peroxide inhibitors is suggested.

Examples of potential peroxide forming materials are included in Appendix A.

E. Shock-Sensitive Chemicals

Shock-sensitive refers to the sensitivity of the chemical to decompose rapidly or explode when struck, vibrated, or otherwise agitated.

The label and Material Safety Data Sheet will indicate if a chemical is shock-sensitive.

Shock-sensitive chemicals should be procured as needed to minimize storage problems. Shock-sensitive materials should be considered individually and disposed of as soon as practical.

Many chemicals become increasingly shock-sensitive with age. The date received and date opened shall be clearly marked on all containers of shock-sensitive chemicals.

Inhibitors are not to be added to shock-sensitive materials unless specific instructions from the manufacturer are provided. See Section 3.4 - "Chemical Waste" for disposal procedures.

A partial list of potential shock-sensitive materials is included in Appendix C.

F. Material Safety Data Sheets

The Material Safety Data Sheet (MSDS) is a format for describing what chemical or product you are working with, potential chemical hazards, and ways of minimizing these hazards. These sheets shall be on hand in the laboratory for people who use these chemicals. Information that is contained in the Material Safety Data Sheets is also required by law to be conveyed to employees on a chemical-by-chemical basis.

MSDSs are generally written for chemicals that are used in the industrial setting and it will become apparent that some of the information provided on the MSDS may not be applicable to laboratory usage. The use of chemicals in a laboratory is generally in a more controlled environment than in the industrial setting and much smaller quantities of the chemical are being used at any one time. Nevertheless, a great deal of information on hazards associated with laboratory chemicals can be obtained by reading the MSDS. (See also Section 9.3 - "Material Safety Data Sheets")

G. Procurement of Chemicals

The achievement of safe handling, use, and disposal of hazardous substances begins with the persons who requisition such substances and those who approve their purchase orders. These persons must be aware of the potential hazards of the substances being ordered, know whether or not adequate facilities and trained personnel are available to handle such substances, and should ensure that a safe disposal route exists.

Before a new substance is received, information concerning its proper handling methods, including proper disposal procedures, should be given to all those who will be working with it. It is the responsibility of the laboratory supervisor to ensure that the facilities are adequate and that those who will handle any material have received proper training and education to do so safely.

For most substances, Material Safety Data Sheets, which give physical property data and toxicological information, can be obtained by request to the vendor. However, the quality and depth of information on these sheets varies widely.

The US Department of Transportation (DOT) requires that shippers furnish and attach DOT prescribed labels on all shipment of hazardous substances. These labels indicate the nature of the hazard(s) of the substance(s) shipped and thus provide some indication to receiving personnel of the type of hazard received.

No container or cylinder should be accepted that does not have an identifying label. For chemicals, it is desirable that this label correspond to ANSI Z129.1, which requires, at a minimum, the following components:

1. Identification of contents of container;

2. Signal word and summary description of any hazard(s);

3. Precautionary information - what to do to minimize hazard or prevent an accident from happening;

4. First aid in case of exposure;

5. Spill and cleanup procedures; and

6. If appropriate, special instructions to physicians.

Every effort should be made to ensure that this label remains on the container and legible.

H. Spill Prevention

A hazardous chemical spill means that an uncontrolled release of a hazardous chemical has occurred. The release may involve a gas, liquid, or solid, and usually requires some action be taken to control the point of release or the spread of the chemical. A chemical is hazardous if it possesses a physical or health threat to humans, the environment, or property. More specifically, a substance is considered hazardous when:

a. It is flammable, explosive, or reactive;

b. It generates harmful vapor or dust;

c. It is a carcinogen;

d. It is a corrosive and attacks skin, clothing, equipment, or facilities;

e. It is poisonous by ingestion, inhalation or absorption.

Spills involving hazardous materials will require different tactics depending on the magnitude of the spill, the material's toxicity, reactivity, and flammability, routes of entry of the material into the body, and the promptness with which the spill can be safely managed.

For information on handling of chemical spills see Section 1.1 - "Chemical Spills."

Many spills can be prevented or controlled by careful planning, use of trays, and absorbent paper. (Remember, hoods don't prevent or control spills; they just relocate them!)

Proper techniques for transporting hazardous chemicals and proper storage techniques may help prevent spills.

I. Handling and Transportation of Chemicals

Many laboratory accidents occur through the simple operation of carrying chemicals from one place to another or transferring them from one container to another. The chemicals used in a laboratory are often corrosive, toxic, or flammable and any accident involving these has the potential for personal injury. Therefore, it is good practice to assume that **all** chemicals are potentially hazardous.

1. When large bottles of acids, solvents, or other liquids are transported within the laboratory without a cart, only one bottle should be carried at a time. The bottle should be carried with both hands, one on the neck of the bottle and the other underneath. Avoid the temptation to hook a finger through the glass ring on top of the bottle, allowing it to dangle while being transported. Never carry or attempt to pick up a bottle by the cap.

2. When transporting bottles within the laboratory, a wheeled cart may be used. Carts should be stable under load and have wheels large enough to negotiate uneven surfaces (such as expansion joints and floor drain depressions) without tipping or stopping

suddenly. Do not place the bottles near the edge of the cart, nor should they be touching each other or other glassware during transport. Be cautious rolling the cart over door sills or other possible obstructions. Incompatible chemicals should not be transported on the same cart. A list of incompatible chemicals is included in Appendix B.

3. Freight-only elevators should be used, if possible, when transporting chemicals, to avoid exposure to persons on passenger elevators.

4. Special padded or rubber bottle carriers, pails, or carts should be used to prevent breakage by accidental striking against walls or floor, and to contain the material if breakage does occur.

5. Large quantities of concentrated mineral acids, e.g., sulfuric, nitric and hydrochloric acids, shall be kept in storage rooms, in cabinets for corrosive substances, or chemical transfer rooms. Bottles of concentrated acids must be carried from the aforementioned areas in an approved acid bottle carrier.

6. Organic solvents shall also be stored in specialized flammable storage areas. These solvents shall be carried from storage areas in special rubber carriers. Organic solvents can present fire hazards as well as inhalation hazards.

7. For information on transportation and storage of compressed gases, see Section 2.4 - "Compressed Gas Safety."

J. Chemical Storage

The principle concerns in achieving proper storage are to maximize employee safety with regard to chemical compatibility, spill control, fire/explosion control, to provide security, identification, and provide a "user friendly" system with respect to point-of-use.

1. Every chemical in the laboratory should have a definite storage place and should be returned to that location after each use.

2. Storage must conform to compatibility restrictions as described in Appendix B. Typically, solvents, acids, bases, reactives, oxidizers, and toxins will be stored separately. Separation basically refers to physical separation of containers and isolation of potential spills and releases with the goal of preventing chemical reactions. Ideally, separate cabinets or isolated areas within a central storage area should be utilized for segregated storage of incompatibles.

3. Adequate containment for spills and accidental releases shall be provided.

4. Hazardous chemicals should never be stored on the floor. Containers should be kept on low shelves or in cabinets. The shelves should have a lip on the forward edge to prevent bottles from slipping off. Chemicals tend to "creep" toward and over the edge of a shelf. Shelving units should be securely fastened to the wall or floors. Shelves should not be overloaded.

5. Utilize a compatible/suitable container for experiments, stored chemicals and collected wastes. In instances of corrosive wastes or halogenated solvents, the use of metal containers is often unsuitable, even if the solvents were originally shipped in metal containers. In these instances, plastic carboys (high density polyethylene) or lined metal containers may be more suitable. See the Material Safety Data Sheet for specific information.

6. There shall be constant vigilance for any sign of chemical leakage. Containers storing chemical waste must be inspected weekly for any sign of chemical leakage. Containers of all types should be free of rust and deformation.

7. Caps and covers for containers shall be securely in place whenever the container is not in immediate use.

8. Storage shall be physically secure.

9. NFPA labeling shall appear on cabinets and room doors at approximately waist level or lower to allow adequate visualization in dense smoke conditions.

10. All containers used for storage (even short term) shall be labeled in accordance with Hazard Communication regulations and NFPA and University fire codes. At a minimum, all containers must be labeled with regard to content and general hazard.

11. Flammable liquids in quantities greater than one liter should be kept in metal safety cans designed for such storage. The cans should be used only as recommended by the manufacturer, including the following safety practices:

    a. Never disable the spring-loaded closure.

    b. Always keep flame-arrestor screen in place; replace if punctured or damaged.

12. Flammable liquids shall not be stored in your laboratory unit in amounts greater than the limits for flammable liquid storage given in Section 8.1 - "Standard Operating Procedures."

13. Metal drums used for storage and dispensing of flammable chemicals shall be properly grounded. Ground cables shall be available and utilized in any lab using metal storage containers for flammable liquid storage.

14. Chemicals should be stored as close as feasible to the point of use in order to maximize efficiency and minimize transport distance. Chemical storage should be limited only to areas in which the particular chemical is used. Storage locations must be identified on an emergency floor plan posted in each work area and should be equipped with a fire extinguisher, spill kit, eye wash, first aid kit, and telephone or other communication system to allow for adequate emergency notification.

15. Small quantities of chemicals can be held at individual work stations if this quantity is to be promptly used in a test and does not compromise acceptable ambient organic vapor levels or procedures for spill control and fire safety. These containers must be properly labeled.

16. Only limited quantities of chemicals and solvents should be stored in the laboratory. Large drums or multiple bottles of chemicals should be stored in a centralized chemical storage area.

17. Out-of-date chemicals shall be disposed of on a periodic basis to reduce overall hazard potential and minimize inventory tracking and updating. (See Section 3.4 - "Chemical Waste")

K. Prior Approval

Employees must obtain prior approval to proceed with a laboratory task from their laboratory supervisor and/or their Departmental Chemical Hygiene Officer whenever:

1. A new laboratory procedure or test is to be carried out.

2. It is likely that toxic limit concentrations could be exceeded.

3. There is a change in a procedure or test, even if it is very similar to prior practices. "Change in procedure or test" means:

   a. A 10% or greater increase or decrease in the amount of one or more chemicals used.

   b. A substitution or deletion of any of the chemicals in a procedure.

   c. Any change in other conditions under which the procedure is to be conducted.

   (Communication is critical; ensure employees are well informed.)

4. There is a failure of any of the equipment used in the process, especially of safeguards such as fume hoods or clamped apparatus.

5. There are unexpected results.

6. Members of the laboratory staff become ill, suspect that they or others have been exposed, or otherwise suspect a failure of any safeguards.

SECTION 3.4 - CHEMICAL WASTE

The OSU Environmental Health Services Hazardous Materials Section (OSU HAZMAT) is responsible for coordinating the pickup of surplus and waste chemical substances from generating departments. To assure compliance with regulations, safe handling, and efficiency of operations, OSU HAZMAT has established the following standards applicable to the collection, storing, labeling, and packaging of these substances by departments. Under no circumstances will OSU HAZMAT personnel pickup chemical substances that do not strictly follow the procedures and requirements listed in this section.

OSU HAZMAT has been given the responsibility for determining the status of substances as surplus or hazardous wastes.

- Department personnel shall not accept any chemical, hazardous substance, or item(s) containing hazardous substances as gifts or donations on the behalf of the University without notifying OSU HAZMAT prior to the transfer. This is to assure that no unanticipated future hazardous waste costs result from such a transfer.

- Department personnel shall not give or sell university property, including hazardous substances, to any person or organization outside the university except through the legally established procedures of the Purchasing Department or in the instance of hazardous materials, through OSU HAZMAT's Chemical Surplus Program.

- Under no circumstances is any person to dispose of a hazardous substance down the drain or in the refuse disposal system where the applicable regulations, procedures, and policies regarding its disposal as described in this document or the MSDS for the product prohibit this action or are unknown. Prior to disposal of hazardous substances (via sanitary sewer or as solid waste), the OSU Lab Safety Manual, applicable local and federal regulations, or the MSDS for the product shall be consulted. If any of the aforementioned documents prohibit drain or trash disposal, the material or product must be handled as hazardous waste.

- OSU HAZMAT shall not pickup, or handle, surplus or hazardous substances that have not been properly identified, containerized, labeled, packaged, or manifested according to the procedures described herein.

- OSU HAZMAT cannot accept any unidentified substance(s) for disposal. However, OSU Environmental Health & Safety has made arrangements with our current waste contractor to conduct a hazard characterization for chemicals of unknown composition. The generating department shall make every effort to identify unknown chemicals prior to the characterization. In instances where unknown chemicals have been generated, the generating department shall provide a separate storage area to hold these materials until characterization can be conducted. Also, the generating department may be required to provide lab space and a fume hood for the characterization procedure.

A. <u>Basic Procedures</u>

1. Collect substances in original or other suitable primary container.

2. Properly label containers as to contents and hazards.

3. Properly store containers until ready for disposal.

4. When accumulation exceeds the available storage limits within the laboratory area, arrange for the transfer of the substances with your Departmental Chemical Hygiene Officer (DCHO) who shall coordinate the pickup with OSU HAZMAT section.

5. The generator or DCHO shall prepare individual containers with a unique container number and complete the Chemical Surplus Removal Request Form.

6. Individual containers, except in prearranged situations, shall NOT be boxed together.

7. OSU HAZMAT will pick up surplus substances from the laboratory or collection area upon request only. In certain instances, OSU HAZMAT may request that a department store unwanted chemicals until a chemical pickup by a hazardous waste management firm is arranged.

8. OSU HAZMAT will then determine the status of substances as surplus, for reuse, for recycling, or for waste disposal.

B. Containers

A container refers to any of the following that serves as a primary container; or as an outer or secondary packaging over one or more primary containers.

- Any steel, plastic, or fiberboard drum
- Metal cans and pails
- Plastic carboys
- Steel cylinders and tanks
- Plastic-coated paper bags
- Plastic baggies
- Glass and plastic bottles, jars, vials
- Sturdy cardboard boxes
- Mercury containers

C. Container Condition

1. Where possible, materials should be kept in their original containers.

2. Containers shall be in good condition; leaking or damaged containers are not acceptable. If leaking or damaged, either repackage or call OSU HAZMAT to determine the proper packaging for disposal.

3. Containers shall be equipped with a properly fitting cap or other closure means. **Properly secured** means with the original device or method provided by the manufacturer, or when unavoidable, with a substitute means of equal or better quality that will prevent leakage or incidental exposure during routine handling or in the event of the container tipping or falling over. Makeshift covers such as tape to hold down a screw cap or a rag stuffed in an opening are unacceptable.

4. Containers shall be compatible with substances contained therein.

5. Plastic bags, where acceptable as containers (double bagging is preferred), shall be without punctures or tears and shall be tightly sealed. Ordinary garbage (2 mil or less) bags shall not be used as a primary or secondary container for hazardous chemical waste.

6. Containers should be inspected weekly for signs of leaks or deterioration.

7. Compressed gas cylinders shall not be handled or transported until the regulating device is removed and the safety cap installed. Every effort should be made to return compressed gas cylinders to the manufacturer or original supplier.

D. Container Volumes and Sizes

1. Glass containers shall not exceed one gallon (4 liters) in size and shall not be filled into the neck of the fill/pour spout.

2. Where containers have flat tops, the liquid level shall be at least 1 inch from the fill/pour opening. Glass carboys are unacceptable.

3. Due to increased disposal costs, risks of handling larger containers, and restrictions by the University Waste Disposal Contractor, metal or plastic containers greater than 5 gallons (20 liters) in size require special approval by OSU HAZMAT section.

4. Plastic baggies utilized as primary containers shall be packaged in a secondary container such as glass, hard plastic, metal, or cardboard box. Ordinary garbage bags (2 mil or less) shall not be used as a primary or secondary container for hazardous chemical waste.

E. Labeling of Containers

Please see Appendix J for an example Hazardous Chemical Surplus Tag.

1. Each container shall bear the Hazardous Chemical Surplus Tag that clearly and neatly indicates the chemical or common name of each substance that is at least 1% by volume of the total contents or mixture. Carcinogens or highly toxic substances that are 0.1% or more by volume must also be listed. Any amount of a heavy metal (e.g. As, Ba, Cd, Cr, Hg, Ni, Se, Ag, Th) greater than 1 part per million (1 ppm) in the container must be listed.

2. Indicate the strength or concentration of the substance where applicable. Example: Hydrochloric Acid may have a strength of 10%, 28%, 38%.

3. Do not use chemical formulas, chemical symbols, chemical equations or abbreviations.

4. Indicate the physical and/or health hazards of the substance, if known.

5. Indicate the name of the building, room, and principal investigator or person responsible for generating the waste (or someone with direct knowledge of the process).

6. In the instances of time sensitive substances such as ethers, the date of container opening or initial accumulation shall be included on the form.

7. Remove or obliterate any other labels or wordings not related to the current substance.

8. Do not allow the creation of "UNKNOWNS" through lack of secure readable labeling.

F. Disposal of Empty Containers

Containers that are empty and no longer needed must be disposed of properly. Container disposal shall be as directed by 40 CFR 261.7 "Residues of hazardous waste in empty containers." Containers that have held acute hazardous materials as defined in 40 CFR 261.31, 261.32, or 261.33 require special handling. To assist you in determining if an empty container is regulated, here are some further guidelines.

A container shall be considered "empty" if all the following conditions exist (for this section, a container shall be considered to be a primary container or an inner liner):

1. The container contained none of the chemicals that are listed in 40 CFR 261.33(e) [attached] or Tri- Tetra- or Penta-phenol, *and*

2. All chemicals have been removed that can be removed using practices commonly employed to remove materials from that type of container eg pouring, pumping, aspirating, etc., *and*

3. There is less than one inch of residue left in the bottom of the container, *and*

4. There is less than 3% by weight of residue left in the container (0.3% for >110 gal. containers), *and*

5. For compressed gas cylinders only, when the pressure in the container approaches atmospheric.

If a container does contain chemicals listed below, or Tri- Tetra- or Penta-phenol, the container shall be considered empty **only** if the container has been triple rinsed using a solvent capable of removing the chemical *or* cleaned by another method that has been shown in the scientific literature to achieve equivalent removal. The rinsate then becomes a hazardous waste. If the container has not been cleaned as stated above, the container shall become hazardous waste.

Once a container has been declared "empty" by the above criteria, it can be placed in the normal refuse.

[Above adapted from 40 CFR 261.7]

P001 Warfarin & Salts > 0.3%
2H-1-Benzopyran-2-one, 4-Hydroxy-3-(3-oxo-1-phenylbutyl)-, & Salts, > 0.3%
4-Hydroxy-3-(3-oxo-1-phenyl-butyl)-2H-1-benzopyran-2-one, & Salts, > 0.3%
3-(αAcetonylbenzyl)-4-hydroxy-coumarin & Salts > 0.3%
81-81-2 ✸

P002 1-Acetyl-2-thiourea
Acetamide, *N*-(Aminothioxo-methyl)-
N-(Aminothioxomethyl)acetamide
591-08-2

P003 Acrolein
2-Propenal
Acrylaldehyde
Allyl Aldehyde
107-02-8

✸ CAS Number For Parent Compound Only

P004 Aldrin
1,4,5,8-Dimethanonaphthalene, 1, 2,3,4,10,10-Hexachloro-1,4,4a, 5,8,8a-hexa-hydro-, (1α,4α,4aß, 5α,8α,8aß)-
1,2,3,4,10,10-Hexachloro-1,4,4a, 5,8,8a-hexahydro-1,4:5,8-di-methanonaphthalene
(1R,4S,5S,8R)-1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a-hexa-hydro-1,4:5,8-di-methano-naphthalene
2-Methyl-2-(methylthio)propion-aldehyde *O*-(methylcarbamoyl)-oxime
1,2,3,4-Hexachloro-1,4,4a,5,8,8a-hexahydro-1,4,5,8-*endo*,*exo*-di-methanonaphthalene
309-00-2

P005 Allyl Alcohol
2-Propen-1-ol
Propenyl Alcohol
107-18-6

P006 Aluminum Phosphide AlP
20859-73-8

P007 Muscimol
5-(Aminomethyl)-3-isoxazolol
3(2H)-Isoxazolone, 5-(Amino-methyl)-
5-(Aminomethyl)-3(2H)-isoxazolone
2763-96-4

P008 4-Aminopyridine
504-24-5

P009 Ammonium Picrate
Phenol, 2,4,6-Trinitro-, Ammonium Salt
2,4,6-Trinitrophenol Ammonium Salt
Picric Acid Ammonium Salt
131-74-8

P010 Arsenic Acid H_3AsO_4
7778-39-4

P011 Arsenic Pentoxide
Arsenic Oxide As_2O_5
1303-28-2

P012 Arsenic Trioxide
Arenic Oxide As_2O_3
1327-53-3

P013 Barium Cyanide $Ba(CN)_2$
542-62-1

P014 Thiophenol
Benzenethiol
108-98-5

P015 Beryllium
7440-41-7

P016 Dichloromethyl Ether
Methane, Oxybis[chloro-
Oxybis[chloromethane]
Bis(chloromethyl) Ether
542-88-1

P017 Bromoacetone
2-Propanone, 1-Bromo-
1-Bromo-2-propanone
598-31-2

P018 Brucine
Dimethoxystrychnine
2,3-Dimethoxystrychnidin-10-one
357-57-3

P020 Dinoseb
Phenol, 2-(1-Methylpropyl)-4,6-dinitro-
2-(1-Methylpropyl)-4,6-dinitro-phenol
2-*sec*-Butyl-4,6-dinitrophenol
2,4-Dinitro-6-*sec*-butylphenol
88-85-7

P021 Calcium Cyanide $Ca(CN)_2$
592-01-8

P022 Carbon Disulfide
Carbon Bisulfide
75-15-0

P023 Chloroacetaldehyde
Acetaldehyde, Chloro-
2-Chloro-1-ethanal
107-20-0

P024 p-Chloroaniline
Benzenamine, 4-Chloro-
4-Chlorobenzenamine
106-47-8

P026 1-(o-Chlorophenyl)thiourea
Thiourea, (2-Chlorophenyl)-
(2-Chlorophenyl)thiourea
1-(2-Chlorophenyl)-2-thiourea
5344-82-1

P027 3-Chloropropionitrile
Propanenitrile, 3-Chloro-
542-76-7

P028 Benzyl Chloride
Benzene, (Chloromethyl)-
(Chloromethyl)benzene
100-44-7

P029 Copper Cyanide Cu(CN)
Cuprous Cyanide
544-92-3

P030 Cyanides (Soluble Cyanide Salts), Not Otherwise Specified
(No CAS #)

P031 Cyanogen
Ethanedinitrile
Oxalonitrile
460-19-5

P033 Cyanogen Chloride (CN)Cl
506-77-4

P034 2-Cyclohexyl-4,6-dinitrophenol
Phenol, 2-Cyclohexyl-4,6-dinitro-
Dinitrocyclohexylphenol
131-89-5

P036 Arsonous Dichloride, Phenyl-
Dichlorophenylarsine
Phenyl Arsonous Dichloride
Phenyldichloroarsine
696-28-6

P037 Dieldrin, & Metabolites
2,7:3,6-Dimethanonaphth[2,3-b]-oxirene, 3,4,5,6,9,9-hexachloro-1a,2,2a,3,6,6a,7,7a-octahydro-, (1aα,2ß,2aα,3ß,6ß,6aα,7ß,7aα)-, & Metabolites
(1aα,2ß,2aα,3ß,6ß,6aα,7ß,7aα)-3,4,5,6,9,9-Hexachloro-1a,2,2a,3,6,6a,7,7a-octahydro-2,7:3,6-dimethanonaphth[2,3-b]-oxirene, & Metabolites
(1R,4S,5S,8R)-1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a-hexahydro-1,4:5,8-dimethano naphthalene & Metabolites
1,2,3,4,10,10-Hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-1,4-*endo*,*exo*-1,2,3,4,10,10-hexa-8-dimethano naphthalene, & Metabolites
60-57-1 ✸

✸ CAS Number For Parent Compound Only

P038 Diethylarsine
Arsine, Diethyl-
692-42-2

P039 Disulfoton
Di-Syston
O,*O*-Diethyl *S*-[2-(ethylthio)ethyl]-phosphorodithioate
Phosphorodithioic Acid *O*,*O*-Diethyl *S*-[2-(ethylthio)ethyl] Ester
298-04-4

P040 Thionazin
O,*O*-Diethyl *O*-pyrazinylphosphorothioate
Phosphorothioic Acid *O*,*O*-Diethyl *O*-pyrazinyl Ester
O,*O*-Diethyl *O*-pyrazinylphosphorothioic Acid Ester
297-97-2

P041 Paraoxon
Diethyl-p-nitrophenylphosphate
Phosphoric Acid Diethyl-4-nitrophenyl Ester
Diethyl-4-nitrophenyl Phosphoric Acid Ester
311-45-5

P042 Epinephrine
Adrenalin
1,2-Benzenediol, 4-[1-Hydroxy-2-(methylamino)ethyl]-
4-[1-Hydroxy-2-(methylamino)-ethyl]-1,2-benzenediol
3,4-Dihydroxy-_-[(methylamino)-methyl]benzyl Alcohol
1-Methylaminoethanolcatechol
51-43-4

P043 Diisopropylfluorophosphate
DMP
Phosphorofluoridic Acid Bis(1-methylethyl) Ester
Bis(1-methylethyl) Phosphorofluoridic Acid Ester
Isoflurophate
Phosphorofluoridic Acid Diisopropyl Ester
55-91-4

P044 Dimethoate
Phosphorodithioic Acid *O*,*O*-Dimethyl *S*-[2-(methylamino)-2-oxoethyl] Ester
O,*O*-Dimethyl-*S*-(*N*-methylcaramoylmethyl)phosphorodithioate
60-51-5

P045 Thiofanox
2-Butanone, 3,3-Dimethyl-1-(methylthio)-, *O*-[(Methylamino)-carbonyl]oxime
O-[(Methylamino)carbonyl]oxime-3,3-dimethyl-1-(methylthio)-2-butanone
3,3-Dimethyl-1-(methylthio)-2-butanone-*O*-(methylamino)-carbomyl oxime
39196-18-4

P046 Phentermine
α,α-Dimethylphenethylamine
Benzeneethanamine,α,α-Dimethyl-
α,α-Dimethylbenzeneethanamine
122-09-8

P047 4,6-Dinitro-o-cresol, & Salts
Phenol, 2-Methyl-4,6-dinitro-, & Salts
2-Methyl-4,6-dinitrophenol, & Salts
534-52-1 ✸

P048 2,4-Dinitrophenol
Phenol, 2,4-Dinitro-
51-28-5

P049 Dithiobiuret
Thiomidodicarbonic Diamide
$[(H_2N)C(S)]_2NH$
541-53-7

P050 Endosulfan
6,9-Methano-2,4,3-benzodioxathiepin, 6,7,8,9,10,10-Hexachloro-1,5,5a,6,9,9a-hexahydro-, 3-oxide
6,7,8,9,10,10-Hexachloro-1,5,5a,6,9,9a-hexahydro-6,9-methano-2,4,3-benzodioxathiepin-3-oxide
1,4,5,6,7,7-Hexachloro-5-norbornene-2,3-dimethanol Cyclic Sulfite
115-29-7

✸ CAS Number For Parent Compound Only

P051 Endrin, & Metabolites
2,7:3,6-Dimethanonaphth[2,3-b]-oxirene, 3,4,5,6,9,9-Hexachloro-1a,2,2a,3,6,6a,7,7a-octahydro-, (1aα,2ß,2aα,3α,6α,6aß,7ß,7aα)-, & Metabolites
3,4,5,6,9,9-Hexachloro-1a,2,2a,3,6,6a,7,7a-octahydro-2,7:3,6-dimethanonaphth[2,3-b]oxirene & Metabolites
1,2,3,4,10,10-Hexachloro-6,7-epoxy-1,4,4a,5,6,7,8,8a-octahydro-*endo*,*endo*-1,4:5,8-dimethanonaphthalene, & Metabolites
(1R,4S,5R,8S)-1,2,3,4, 10,10-Hexachloro-1,4,4a,5,6,7,8,8a-octahydro-6,7-dimethano naphthalene & Metabolites
72-20-8 ✸

✸ CAS Number For Parent Compound Only

P054 Ethylenimine
Aziridine
151-56-4

P056 Fluorine
7782-41-4

P057 Fluoroacetamide
Acetamide, 2-Fluoro-
2-Fluoroacetamide
640-19-7

P058 1080
Sodium Fluoroacetate
Acetic Acid, Fluoro- , Sodium Salt
Fluoroacetic Acid Sodium Salt
62-74-8

P059 Heptachlor
4,7-Methano-1H-indene, 1,4,5,6,7,8,8-Heptachloro-3a,4,7,7a-tetrahydro-
1H-1,4,5,6,7,8,8-Heptachloro-3a,4,7,7a-tetrahydro-4,7-methano-indene
76-44-8

P060 Isodrin
1,4,5,8-Dimethanonaphthalene, 1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a-hexa-hydro-, (1α,4α,4aß,5ß,8ß,8aß)-
(1α,4α,4aß,5ß,8ß,8aß)-1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a-hexahydro-1,4-*endo*,*endo*-5,8-dimethanonaphthalene
1,2,3,4,10,10-Hexachloro-1,4,4a,5,8,8a-hexahydro-1,4-*endo*,*endo*-5,8-dimethanonaphthalene
465-73-6

P062 HETP
Hexaethyl Tetraphosphate
Tetraphosphoric Acid Hexaethyl Ester
757-58-4

P063 Hydrogen Cyanide
Hydrocyanic Acid
74-90-8

P064 Methyl Isocyanate
Methane, Isocyanato-
Isocyanatomethane
Isocyanic Acid Methyl Ester
624-83-9

P065 Mercury Fulminate
Fulminic Acid Mercury(2+) Salt
Mercury Cyanate
628-86-4

P066 Methomyl
Ethanimidothioic Acid *N*-[[(Methyl-amino)carbonyl]oxy]-, Methyl Ester
N-[[(Methylamino)carbonyl]oxy]-ethanimidothioic Acid Methyl Ester
N-[(Methylcarbamoyl)oxy]thioacet-imidic Acid Methyl Ester
S-Methyl-*N*-(methylcarbamoyloxy)-thioacetimidate
16752-77-5

P067 1,2-Propylenimine
2-Methylaziridine
Aziridine, 2-Methyl
75-55-8

P068 Methylhydrazine
Hydrazine, Methyl-
60-34-4

P069 Acetone Cyanohydrin
2-Methyllactonitrile
Propanenitrile, 2-Hydroxy-2-methyl-
2-Hydroxy-2-methylpropanenitrile
75-86-5

P070 Aldicarb
Propanal, 2-Methyl-2-(methylthio)-, *O*-[(Methylamino)-carbonyl]oxime
2-Methyl-2-(methylthio)propanal *O*-[(methylamino)carbonyl]oxime
2-Methyl-2-(methylthio)propionaldehyde *O*-(methylcarbamoyl)-oxime
116-06-3

P071 Methyl Parathion
Phosphorothioic Acid *O*,*O*-Dimethyl *O*-(4-nitrophenyl) Ester
O,*O*-Dimethyl *O*-(p-nitrophenyl)-phosphorothioate
298-00-0

P072 ANTU
_α-Naphthylthiourea
Thiourea, 1-Naphthalenyl-
1-Naphthalenylthiourea
86-88-4

P073 Nickel Carbonyl
Nickel Tetracarbonyl
Nickel Carbonyl $Ni(CO)_4$, (T-4)-
13463-39-3

P074 Nickel Cyanide $Ni(CN)_2$
557-19-7

P075 Nicotine, & Salts
Pyridine, 3-(1-Methyl-2-pyrrolidinyl)-, (*S*)-, & Salts
3-(1-Methyl-2-pyrrolidinyl)pyridine, & Salts
54-11-5 ✸

P076 Nitric Oxide
Nitrogen Oxide NO
10102-43-9

P077 p-Nitroaniline
Benzenamine, 4-Nitro-
100-01-6

P078 Nitrogen Dioxide
Nitrogen Oxide NO_2
10102-44-0

P081 Nitroglycerine
1,2,3-Propanetriol Trinitrate
55-63-0

P082 *N*-Nitrosodimethylamine
Methanamine, *N*-Methyl-*N*-nitroso-
N-Methyl-*N*-nitrosomethanamine
62-75-9

P084 *N*-Nitrosomethylvinylamine
Vinylamine, *N*-Methyl-*N*-nitroso-
N-Methyl-*N*-nitrosovinylamine
4549-40-0

P085 Octamethylpyrophosphoramide
Diphosphoramide, Octamethyl-
152-16-9

P087 Osmium Tetroxide
Osmium Oxide OsO_4, (T-4)-
Osmic Acid
20816-12-0

P088 Endothall
7-Oxabicyclo[2.2.1]heptane-2,3-dicarboxylic Acid
7-Oxalobicyclo-[2.2.1]-heptane-2,3-dicarboxylic Acid
145-73-3

✸ CAS Number For Parent Compound Only

P089 Parathion
Ethyl Parathion
Phosphorothioic Acid *O*,*O*-Diethyl *O*-(4-nitrophenyl) Ester
O,*O*-Diethyl *O*-(4-nitrophenyl)-phosphorothioic Acid Ester
O,*O*-Diethyl *O*-(p-nitrophenyl)phosphorothioate
56-38-2

P092 Phenylmercury Acetate
Mercury, (Acetato-*O*)phenyl-
(Acetato)phenylmercury
Phenylmercuric Acetate
62-38-4

P093 Phenylthiourea
Thiourea, Phenyl-
103-85-5

P094 Phorate
Phosphorodithioic Acid *O*,*O*-Diethyl *S*-[2-(ethylthio)methyl] Ester
O,*O*-Diethyl *S*-[2-(ethylthio)-methyl]phosphorodithioate
298-02-2

P095 Carbonic Dichloride
Phosgene
75-44-5

P096 Hydrogen Phosphide H_3P
Phosphine
7803-51-2

P097 Famphur
Famophos
O,*O*-Dimethyl-*O*-[p-dimethylsulfamoyl)phenyl]phosphorothioate
Phosphorothioic Acid *O*-[4-[(Dimethylamino)sulfonyl]phenyl] *O*,*O*-dimethyl Ester
52-85-7

P098 Potassium Cyanide K(CN)
151-50-8

P099 Potassium Silver Cyanide
Argentate(1-), Bis(cyano-C)-, Potassium
Potassium Bis(cyano-C)-argentate(1-)
Potassium Dicyanoargentate (I)
506-61-6

P101 Propanenitrile
Ethyl Cyanide
Propionitrile
107-12-0

P102 Propargyl Alcohol
2-Propyn-1-ol
107-19-7

P103 Selenourea
630-10-4

P104 Silver Cyanide Ag(CN)
506-64-9

P105 Sodium Azide NaN_3
26628-22-8

P106 Sodium Cyanide Na(CN)
143-33-9

P107 Strontium Sulfide SrS
1314-96-1

P108 Strychnine, & Salts
Strychnidin-10-one, & Salts
57-24-9 ✸

P109 Sulfotep
Thiopyrophosphoric Acid Tetraethyl Ester
Ethylthiopyrophosphate
Tetraethyldithiopyrophosphate
Thiodiphosphoric Acid Tetraethyl Ester
Tetraethylthiodiphosphoric Acid
3689-24-5

P110 Tetraethyl Lead
Plumbane, Tetraethyl-
Tetraethylplumbane
78-00-2

P111 TEPP
Tetraethylpyrophosphate
EthylPyrophosphate
Diphosphoric Acid Tetraethyl Ester
Pyrophosphoric Acid Tetraethyl Ester
107-49-3

P112 Tetranitromethane
Methane, Tetranitro-
509-14-8

P113 Thallic Oxide
Thallium Oxide Tl_2O_3
Thallium Sequioxide
1314-32-5

P114 Thallium (I) Selenite
Selenious Acid Dithallium(1+) Salt
12039-52-0

P115 Thallium (I) Sulfate
Thallous Sulfate
Sulfuric Acid Dithallium(1+) Salt
7446-18-6

P116 Thiosemicarbazide
Aminothiourea
Hydrazinecarbothioamide
79-19-6

P118 Trichloromethanethiol
Methanethiol, Trichloro-
75-70-7

P119 Ammonium Vanadate (V)
Vanadic Acid Ammonium Salt
Ammonium Metavanadate
7803-55-6

P120 Vanadium Pentoxide
Vanadic Acid Anhydride
Vanadium Oxide V_2O_5
1314-62-1

P121 Zinc Cyanide $Zn(CN)_2$
557-21-1

P122 Zinc Phosphide Zn_3P_2 > 10%
1314-84-7

P123 Toxaphene
Chlorinated Camphene, Technical
8001-35-2

✸ CAS Number For Parent Compound Only

G. Storage of Waste Chemicals

Waste Chemicals shall be stored in the same manner and using the same procedures as other chemicals. It may be advantageous to further segregate chemical waste. A typical segregation of waste chemicals would be:

- Acids
- Caustics
- Chlorinated Solvents
- Non-chlorinated Solvents
- Mercury Wastes
- Oxidizing Agents
- PCB Wastes*
- Reactive Chemicals*
- Waste Oil
- Wastes with Heavy Metal Contamination

*Consult with Environmental Health & Safety regarding proper storage and disposal requirements.

These chemicals shall be accumulated in separate containers and need to be isolated from one another to some degree, at least to the extent that spills or leaks would remain isolated from other containers. This is particularly true of acids, bases, and solvents.

Mineral (inorganic) acids, straight-chain fatty acids, and bases should be neutralized by the laboratory generating these wastes. Neutralization procedures may be found in Appendix D - "Neutralization of Spent Acids and Bases."

H. "Bulking" or mixing of waste chemicals

Bulking or mixing of waste chemicals shall not be done without prior approval from OSU HAZMAT. Where permission has been granted by OSU HAZMAT, Standard Operating Procedures found in Section 8.1 of this manual are to be used as a guide.

I. Overpacking or "Boxing Up" of Multiple Chemical Containers

Laboratory personnel usually will not be involved in "boxing up" chemical containers inside overpack or boxes for transport, but where permission has been granted by OSU HAZMAT, Standard Operating Procedure will be found in Section 8.1 of this manual.

J. Chemical Surplus Removal Request Form

Each container must bear an unique identification number. The unique container number consists of the 2 to 4-letter departmental code, the 6-digit date, and the sequential numerical numbering starting with the number "001".

Example of a container identification number:

CHEM-010391-001

All materials picked up from departments by OSU HAZMAT must be accompanied by a completed Chemical Surplus Removal Request Form. This form and Hazardous Chemical Surplus Tags are available from OSU HAZMAT. Photocopies of this form are acceptable if the form is still legible.

The instructions for completing the Chemical Surplus Removal Request Form are as follows (See Appendix J for example):

1. Request made by:

   Name of the person responsible for making the request for chemical removal.

2. Phone:

   Phone or extension number of person responsible for making the request for chemical removal.

3. Department:

   Name of department generating the hazardous substance(s).

4. Date of Request:

   Today's date. This date should correspond to the 6-digit date on the container ID labels.

5. Name:

   Name of departmental contact person responsible for coordination of hazardous substances waste and surplus pickup operations (DCHO).

6. Phone:

   The telephone number or extension at which the listed contact person may be reached.

7. Building and Room #:

   Building and room number where the DCHO can be found.

8. Is it necessary to call...?

   Self-explanatory.

9. Chemicals for pick-up are located:

   Where the chemicals are being stored for removal.

10. Department Head Signature:

    Signature of department head (or administrative equivalent) or their authorized representative who can attest that all items are properly classified, described, packaged, marked, and labeled, and are in proper condition for transportation according to the applicable requirements of the OSU Environmental Health Services Hazardous Materials Section as described in this document or other information provided to the generating department concerning hazardous chemicals and chemical waste disposal. Only one signature is needed per request/pick-up (not every page).

11. 6-Digit Date:

    Use the 6-digit date of the day you start listing chemicals on the Request. Example: July 15, 1990, would be 071590 (do not use hyphens). Continue to use the same 6-digit date as long as container numbering is consecutive or until the manifesting is completed. Do not change the 6-digit date because you are continuing to add chemicals to the list over a

period of several days. When the 6-digit date is changed, container numbering starts over with "001".

12. Departmental Code:

List the departmental code on each container. (See Appendix G for departmental code assignments).

13. Container Number:

Each container must be assigned a consecutive number starting with the number "001". Any time the 6-digit date category is changed, container numbering starts with "001" again.

14. Description of Contents:

Provide the following information on each container, using as many manifest lines as necessary:

a. Common name of the substance(s) or chemical abstract name.

b. Strength (concentration) of individual substance, where applicable.

c. Percentages of mixed chemicals in container (by volume).

d. Other information for transporting personnel, as deemed important by the generating department.

15. Physical State:

List the physical state of the material at the time of the manifest utilizing one of the following codes listed on the form.

16. Volume of Material in Each Container:

List the approximate volume of material in each container, not the original container volume.

17. Hazard Code(s):

Check the appropriate hazard code for the material (See "Hazard Identification"). The Hazard codes are listed as on the form.

K. Hazard Identification

Each material shall be identified with a "Hazard Code" abbreviation to be used as a general description to provide information on handling hazards and responsive action in the event of an accident.

Each material shall be identified on the form by the hazard that most closely indicates the greatest hazard presented by the material. The following is a list of hazards and their definitions. The codes are listed on the form.:

Flammable: Any compressed gas, liquid, or any solid material (other than an explosive, heat sensitive or shock sensitive material) that is liable to cause fires through friction, absorption of moisture, spontaneous chemical changes, retained heat from processing, or which can be ignited readily, and when ignited burns so vigorously and persistently as to create a serious transportation hazard.

Examples: Acetone, methyl alcohol, dimethylamine, propane, sodium dithionite, nitrocellulose.

Corrosive: Any gas, liquid, or solid that causes destruction of human tissue or a liquid that has a severe corrosion rate on steel or aluminum. Aqueous solutions that have a pH equal to or less than 2 or equal to or greater than 12.5 are corrosive. Other liquids are defined as corrosive if they corrode SAE 1020 steel at a rate greater than 6.35 mm/year at 55^{o}C.

Examples: Hydrochloric acid, sulfuric acid, acetic acid, sodium hydroxide.

Oxidizer: A substance such as chlorate, permanganate, inorganic peroxide, nitrocarbonitrate, or a nitrate that yields oxygen readily to stimulate the combustion of organic matter. (Organic peroxides are to be listed under "OTHER", and the hazard listed on the bottom of the form.)

Examples: Sodium nitrate, potassium permanganate, manganese dioxide.

Toxic: Substances such as carcinogens, irritants, or poisonous gases, liquids, and solids that are irritating to or affect the health of humans.

Examples: Phosgene, phenol, 1-naphthylamine, arsenic compounds, mercury.

Water Reactive: Substances that react violently when in contact with water. They can be either be flammable solids or corrosives. (Mark the label with both Water Reactive and flammable or corrosive).

Note: In many cases the water reactive material can be chemically treated, thereby removing the reaction characteristic. The material may still contain other hazardous constituents. Please contact OSU HAZMAT for further information and guidance.

Examples: Lithium, potassium or sodium metal, antimony pentachloride, acetic anhydride, calcium carbide.

Carcinogens: Any substance that causes the development of cancerous growths in living tissue, either those that are known to induce cancer in man or animals or experimental carcinogens that have been found to cause cancer in animals under experimental conditions.

Examples: 1-Naphthylamine, benzidine, dimethyl sulfate.

Teratogens/Mutagens: Teratogens are agents that cause growth abnormalities in embryos, genetic modifications in cells, etc. Mutagens are substances that are able to induce mutations in DNA and in living cells.

Examples: Diethylstilbestrol (DES), diethyl sulfate.

Other: Special hazards such shock or heat sensitive, organic peroxides, pyrophorics (reacts with air), peroxide formers.

Examples: Picric acid, urea nitrate, 2,4-dinitrophenylhydrazine, benzoyl peroxide, phosphorus, isopropyl ether.

L. Hazardous Materials Surplus Program

One method of assuring maximum use of non-radioactive chemical substances that are readily usable but deemed of no further use to individual departments, is to establish a program of redistribution or reuse among other University departments or units. OSU HAZMAT has full responsibility for regulating and coordinating the Intra-University Surplus Program. Procedures for participating in the program are as follows:

1. Departments identifying a substance as surplus to their needs shall contact OSU HAZMAT for pickup and transfer to the OSU HAZMAT facility.

2. Surplus chemicals reallocated to University departments shall be provided at no charge to the receiving department nor shall there be compensation to the department that originally offered the chemical as surplus. However, departments have the option of requesting the return of previously surplused chemicals, if still available, at no charge.

3. When a department transfers the surplus chemical to OSU HAZMAT, the container shall be in good condition and shall be properly labeled with the substance name, hazard(s), date of manufacture if known, and if opened, date opened.

4. A report will be sent out to departmental heads, listing the substances available by name, quantity, unit volume, age if known, and whether or not opened.

5. Departments may utilize the list to make requests via phone or memo for surplus transfer or may make an appointment to visit the central storage area. In either case, OSU HAZMAT will provide transfer of the substance(s) to the requesting department.

6. Departments are encouraged to advise OSU HAZMAT whenever non-University entities are identified that could benefit from the use of our surplus hazardous materials. Such users will be considered when there are no identified users on campus.

7. A limited number of chemicals, including (but not limited to) the following will NOT be placed in surplus due to their potentially dangerous nature (the following list of chemicals should be rendered inactive by the user prior to disposal):

   - Alkyl boranes
   - Aluminum Alkynes
   - Ammonium Nitrate
   - Benzoyl Peroxide
   - Calcium Carbide
   - Chromic Acid
   - Cyanides
   - Ethers
   - Grignard Reagents
   - Hydrogen Peroxide
   - Iron Sulfide
   - Metal Alkyls
   - Metal Hydrides
   - Peracetic Acid Solution
   - Peroxide Forming Compounds
   - Picric Acid
   - Sulfides
   - Water reactive metals (Lithium, Potassium, Sodium, Cesium)

   (NOTE: Due to the explosive characteristics inherent to the addition of a carbon source to Ammonium Nitrate, Ammonium Nitrate shall not be placed in surplus.)