Chapter 3
Environmental Health and Safety Regulations

The preamble to the U.S. Constitution states:

> "We the People of the United States, in Order to form a more perfect Union, establish Justice, insure domestic Tranquility, provide for the common defence, promote the general Welfare, and secure the Blessings of Liberty to ourselves and our Posterity, do ordain and establish this Constitution for the United States of America."

This clearly shows that protecting the people and the environment is a responsibility of the government. This responsibility is exercised by all three branches of government (i.e., executive, legislative, and judicial branches). One of the first laws asserting that responsibility was the Pure Food and Drug Act of 1906 which was adopted "For preventing the manufacture, sale, or transportation of adulterated or misbranded or poisonous or deleterious foods, drugs, medicines, and liquors, and for regulating traffic therein, and for other purposes."

Over the past 100 years, there has been a proliferation of environmental health and safety laws, regulations, and local ordinances that affect chemical usage. While these all have the same "protective" goal, specific laws and their application may vary from state to state and even among federal regulatory regions.

Health and safety laws include federal, state and local rules and regulations. These are administered by federal agencies like the US Occupational Safety and Health Administration (OSHA), US Environmental Protection Agency (EPA) and their Wisconsin counterparts, the Wisconsin Department of Commerce (DComm) and the Wisconsin Department of Natural Resources (DNR), respectively. Each year, the University is inspected by at least one of these agencies for compliance. Additionally, the City of Madison Fire Department (MFD) enforces fire codes, and the Madison Metropolitan Sewerage District (MMSD) regulates the use of the sanitary sewer.

In some cases, a state agency has been authorized to enforce a federal law.

Compliance with these laws is everyone's responsibility. The University Chemical Safety Committee and other campus safety committees (cf., Chapter 1) review policies and procedures to comply with these laws. The Safety Department submits environmental reports, investigates complaints and acts as the University's regulatory contact for inspectors on campus. Workers apply the rules in their daily work.

While it is not necessary for each individual to be an expert in all these rules, an understanding of the basic features of these rules and implications will enable you to insure that chemicals used in University laboratories complies with the standards which regulate use, storage and disposal of hazardous materials. To give you a better understanding of the rules, this chapter is divided into four sections:

A major responsibility of the UW Safety Department is to help you and the University comply with chemical and environmental safety laws.

- ✓ Laws that pertain to the safe use and storage of chemicals in laboratories
- ✓ Laws that cover the disposal of chemicals and chemical wastes, including disposal into the sanitary sewer
- ✓ Chemical spill and release laws that require prevention, response planning and notification of chemical spills or releases to the environment
- ✓ Other environmental laws that pertain to routine or incidental releases of chemicals to the environment

This chapter will help you understand and comply with the rules and regulations because, while individual safety is not always compromised, noncompliance with these laws can have serious repercussions. Some laws allow both civil and criminal penalties. Some allow citizens and organizations to sue for compliance, without even the involvement of a government agency. If you use chemicals or are responsible for people who do, you may be held personally liable. Thus, it is important that we work together to ensure the safe use, storage and disposal of chemicals, and maintain compliance with these laws.

This *Laboratory Safety Guide* will help you understand and comply with chemical and environmental safety laws.

Additionally, while faculty, staff and students do many things to protect the environment, the Safety Department occasionally receives complaints from the local community. We respond to and correct any problems we find, but sometimes the problem is one of perception, when a release or activity only appears to harm or threaten the environment. The solution is communication. If it is necessary to make a release that may result in some temporary aesthetic degradation of the environment, please tell Safety of your plans. We can then answer questions from the public or the DNR. If possible, try to prevent aesthetic degradation of the environment. When planning your work, consider how that activity might appear to the public or news media. Be sensitive to their perspective. You can call the Safety Department for an explanation of environmental laws or advice on preventing harm to health, property or the environment. So, if you have a question about compliance or chemical and environmental safety laws or know of a potential compliance problem, call the Safety Department's Chemical and Radiation Protection Section.

3.1 Occupational Safety and Health Administration (OSHA)

Workers expect to work in a safe environment and be able to retire in relatively good health. That was not always the case. A classic example of workplace risks is alluded to in the character of the Mad Hatter, from *Alice in Wonderland*. Few people who read the phrase today realize that there's a story of human suffering behind it; the term actually derives from an early industrial occupational disease.

Felt hats were once very popular in North America and Europe. The best sorts were made from beaver fur, but cheaper ones used furs such as rabbit instead. A complicated set of processes was needed to turn the fur into a finished hat. With the cheaper sorts of fur, an early step was to brush a solution of a mercury compound - usually mercurous nitrate - onto the fur to roughen the fibers and make them mat more easily, a process called *carroting* because it made the fur turn orange. The fibers were then shaved off the skin and turned into felt which was later immersed in a boiling acid solution to thicken and harden it. The finishing processes included steaming the hat to shape and ironing it. In all these steps, hatters working in poorly ventilated workshops would breathe in the mercury compounds and accumulate the metal in their bodies.

We now know that mercury is a cumulative poison that causes kidney and brain damage. Physical symptoms include trembling (known at the time as *hatter's shakes*), loosening of teeth, loss of coordination, and slurred speech; mental ones include irritability, loss of memory, depression, anxiety, and other personality changes. This was called *mad hatter syndrome*. It's been a very long time since mercury was used in making hats, and now all that remains is a relic phrase that links to a nasty period in manufacturing history. But *mad hatter syndrome* remains common as a description of the symptoms of mercury poisoning.

The Occupation Safety and Health Act of 1970 established Occupational Safety and Health Administration (OSHA). The mission of OSHA is to save lives, prevent injuries and protect the health of America's workers. OSHA aims to ensure worker safety and health by working with employers and employees to create better working environments. Since its inception in 1971, OSHA has helped to cut workplace fatalities by more than 60 percent and occupational injury and illness rates by 40 percent.

Why do accidents happen? OSHA accident investigation show that exposures to toxic agents in the laboratory can have severe consequences, including death and these injuries can occur in any type of laboratory where toxic chemicals are handled. However, most all chemical injuries would be preventable if:

- ✓ if these people had had the proper *equipment*,
- ✓ if they had been using the proper *techniques* and
- ✓ if they had had adequate *knowledge*,

Thus, it is no surprise that the OSHA regulations put the major responsibility for accident prevention on the employer. Some of the specific employer responsibility laid down in Part 1926.21(b) of the OSHA regulations include:

- ✓ The employer shall instruct each employee in the recognition and avoidance of unsafe conditions and the regulations applicable to his work environment to control or eliminate any hazards or other exposures to illness or injury [1926.21(b)(2)].
- ✓ Employees required to handle or use poisons, caustics, and other harmful substances shall be instructed regarding the safe handling and use, and be made aware of the potential hazards, personal hygiene, and personal protective measures required [1926.21(b)(3)].
- ✓ In job site areas where harmful plants or animals are present, employees who may be exposed shall be instructed regarding the potential hazards, and how to avoid injury, and the first aid procedures to be used in the event of injury [1926.21(b)(4)].
- ✓ Employees required to handle or use flammable liquids, gases, or toxic materials shall be instructed in the safe handling and use of these materials and mad aware of the specific requirements contained in ... this part [1926.21(b)(5)].

The State of Wisconsin agency which implements OSHA rules and regulations is the Department of Commerce (DComm). The City of Madison and Dane County also issue certain workplace standards to protect workers.

You don't want to harm:
- other persons
- environment
- yourself
- property
- your experiment or work

Thus, health and safety rules are promulgated by many government agencies. These are designed to protect workers and the environment from injury by hazardous materials by addressing a broad spectrum of chemicals or from a large number of similar types of pollution (e.g., pesticides, car emissions, etc.). People support prudent and safe practice laws, but sometimes one might feel that the broad spectrum of regulatory requirements do not distinguish scientifically among the varying levels of risk presented by some substances and procedures. Lets look at some of the rules.

3.1.a OSHA Laboratory Standard

Beginning in the early 1970s, groups and individuals representing laboratories contended that the existing OSHA standards were designed to protect workers from

Refer to Appendix B for more information about the OSHA Lab Standard.

exposure conditions in industry and were inappropriate for the very different exposure conditions in research laboratories. To correct this situation, OSHA developed a special regulatory section specific for laboratories. This Laboratory Standard, ***Occupational Exposure to Hazardous Chemicals in Laboratories***, is often referred to as the OSHA Laboratory Standard (see Appendix B for the full version of the law and to read a discussion of the OSHA Laboratory Standard in greater detail).

The major requirement of the OSHA Laboratory Standard is the development of a ***Chemical Hygiene Plan***. This is a written plan developed by the employer (e.g., university, school, department, institute, individual lab, etc.) addressing the specific safety issues related to the hazards at that work place. Appendix C is a Chemical Hygiene Plan template to help you develop a Chemical Hygiene Plan for your laboratory / department. A Chemical Hygiene Plan contains several major elements:

Every laboratory must be included in a Chemical Hygiene Plan.

- ✓ standard operating procedures for work with hazardous chemicals
- ✓ criteria for use of control measures such as engineering controls or personal protective equipment.
- ✓ means to ensure proper operation of fume hoods and protective equipment.
- ✓ circumstances under which a particular laboratory operation requires prior approval from the employer.
- ✓ employee information and training on the hazards of chemicals in the work area, including how to detect their presence or release, work practices and how to use protective equipment and emergency response procedures.
- ✓ provisions for medical consultations and examinations for employees.
- ✓ designation of a chemical hygiene officer.
- ✓ provisions for additional employee protection for work with particularly hazardous substances such as select carcinogens and reproductive toxins or substances which have a high degree of acute toxicity.

This *Laboratory Safety Guide* provides much of the information you will need to comply with the OSHA Laboratory Standard. To further help you comply with the OSHA standard the Safety Department can:

- test and label fume hoods for safe and proper operation
- serve as the campus repository for Material Safety Data Sheets (MSDS); if you cannot obtain an MSDS from your supplier, contact Safety for a copy.
- assist you in writing your Chemical Hygiene Plan by providing samples and advice in specific circumstances.
- conduct laboratory safety training classes which may satisfy the basic training requirement of the OSHA Laboratory Standard.
- conduct air sampling to determine chemical exposure levels

Principal investigators, laboratory directors, managers and supervisors have certain OSHA compliance responsibilities (see Appendix B). In summary, persons must:

Appendix C of this *Guide* is a Chemical Hygiene Plan template.

- keep chemical exposures below OSHA permissible exposure limits (PELs) for all personnel within the laboratory (see Chapter 2).
- write a Chemical Hygiene Plan for your laboratory (see Appendix C).
- designate an individual as the laboratory's Chemical Hygiene Officer, with a responsibility for implementing the Chemical Hygiene Plan.
- train and inform new personnel (see Appendix B and Appendix G).

- in certain circumstances (see Appendix B), provide your laboratory personnel with access to medical consultations and examinations.

Laboratory safety is each worker's responsibility. Workers help to insure compliance with the OSHA Laboratory Standard by:

Keep a file or binder of all your Material Safety Data Sheets, and refer to them often.

- follow the procedures described in their laboratory's Chemical Hygiene Plan.
- keep labels of supplied chemicals intact.
- read the MSDSs of all your supplied chemicals prior to using them.
- inform the principal investigator or supervisor if any signs and symptoms of chemical exposure are experienced.

3.1.b OSHA Standards for Specific Chemicals

OSHA has also developed comprehensive standards for several classes of ***particularly hazardous substances***. These are described in detail in Section 4.5, **Chemicals Requiring Special Precautions** and **Appendix D**. This class of chemicals includes ***select carcinogens***, ***reproductive toxins***, and substances with a ***high degree of acute toxicity***. The special provisions for working with these compounds (e.g., use of ***designated areas***, containment devices, special handling of wastes and decontamination procedures, etc.) are found in both 4.5 and Appendix D.

Chemicals for which a Substance Specific Standard exists are listed in Chapter 4 of this *Guide*.

Some listed chemicals have widespread use throughout the campus. The specific standards for these more commonly used compounds (e.g., formaldehyde, used as formalin for preservation of tissue samples, benzene and ethylene oxide) are of particular concern. Call the Safety Department if you are using any compounds listed in Appendix D. The Safety Department will assist you by:

- evaluating exposures, controls and work practices
- helping to improve controls (e.g., ventilation) and practices to reduce exposures
- monitoring laboratory personnel for exposure to these chemicals

You can assure compliance with the OSHA substance-specific standards by:

- determining if your laboratory uses any substance covered by a specific standard.
- reviewing information on the substance-specific standards in Chapter 4; the complete standards are available from the Safety Department
- reporting suspected exposures to your principal investigator or supervisor
- consulting with a Safety Department Industrial Hygienist if you need help to comply with a standard

The OSHA standards cover all aspects of the use of these specific chemicals with an overall goal to prevent personnel exposure. However, the OSHA substance-specific standards do not include all hazardous chemicals. The principal investigator / laboratory manager is responsible for applying scientific knowledge to safeguard all workers in the lab. Additionally, the OSHA standard applies only to "employees" of laboratory facilities. While students may technically not be considered "employees" within the scope of OSHA, it is prudent and practical to provide the same level of protection to students as to employees.

3.1.c Hazard Communication Standard (HazCom)

One of the missions of the Occupational Safety and Health Administration is to insure that employers provide their workers with a safe work place. This is accomplished by promulgating rules and practices directed toward the different types of

work environments. Thus, research laboratories which handle many very small quantities of hazardous chemicals follow a different set of rules than industrial operations which use very large quantities of a few different hazardous chemicals.

To address most non-industrial, non laboratory settings where hazardous chemicals are used, OSHA promulgated the Hazard Communication Standard, often known as the *Right-to-Know* act. The ***Hazard Communication Standard*** applies to all non-laboratory operations "where chemicals are either used, distributed or are produced for use ...."

Right-to-Know means that workers must be made aware of hazardous substances they may be working with and be provided with the information necessary to allow them to work safely with these substances. Implementing a HazCom program is relatively inexpensive and not too time consuming. It requires 6 simple tasks:

1. Keep an inventory of the hazardous chemicals used in the work area.
2. Maintain a file of Material Safety Data Sheets for each hazardous substance used
3. Insure all containers are properly labeled to identify the hazardous substance and practices that workers can employ to work safely with the chemicals.
4. Evaluate work place tasks and determine the appropriate personnel protective equipment for each use.
5. Initially train workers to recognize hazards specified on labels and how to use proper personnel protective equipment.
6. Document the training and evaluation.

3.1.d Pesticides

Federal law requires that pesticides be used and disposed of according to the label instructions and manufacturer's directions. This requirement pertains to all insecticide, fungicide, herbicide and other pesticide use in greenhouses, growth chambers and field studies. Application of restricted pesticides requires that the applicator be certified by the Wisconsin Department of Agriculture, Trade and Consumer Protection. Assure compliance by:

Read the label and other supplied safety information prior to using any pesticide.

- Using pesticides following the manufacturer's instructions and package label; contact the manufacturer or Safety if you have misplaced the manufacturer's information.
- Complying with OSHA laws if you use a respirator. These require a medical examination and a fit test. Call Safety to participate in the UW respiratory protection program.
- Avoiding pesticide exposures by using the chemical hygiene practices and engineering controls discussed in Chapter 4. Mix pesticides in a fume hood or well ventilated area, separate personal items from gloves, respirators and other personal protective equipment, and wash your hands often.
- Acquiring only the pesticide and amount needed in the immediate future; do not accept gifts, samples or an excess amount. Remember, the UW will ultimately have to pay to dispose of any unused or expired compounds.
- Storing pesticides in a ventilated area that will also contain leaks and spills; clean up spills promptly according to procedures in Chapter 5 of this *Guide.*
- Marking stored pesticide containers with date and user; review inventories regularly to dispose of surpluses and wastes.
- Preserving the container and its label so material is securely contained and label is readable (e.g., dusts in paper bags are a particular problem).

Do not use a pesticide without using, at a minimum, safety glasses and gloves. Chapter 4 of this *Guide* describes safe chemical use practices in detail.

- Noting alterations or changes made from original conditions of the material as formulated by manufacturer (e.g., degradation by air, moisture or light, separation out of solution, dilutions made for special applications, etc.).
- Disposing of surplus solutions and rinsate by using it appropriately at application rates; prepare mixtures carefully to avoid surpluses.

The Safety Department will dispose of your waste pesticides at no cost to you. Follow procedure **On-Site Service 1** in Chapter 7 of this *Guide*.

3.1.e Storage and Use of Flammable Liquids

Safety and compliance with flammable liquids laws should be a concern of all building occupants. One careless person can jeopardize the safety and work of an entire building.

The National Fire Protection Association (NFPA) has established a standard for the storage and use of flammable liquids in laboratories. This standard has been adopted by Wisconsin's Department of Commerce (DComm) and is enforced by the City of Madison Fire Department (MFD). The standard is designed to protect life and property from fire. MFD fire inspectors audit labs on campus for compliance with these codes. They have two concerns: (1) compliance with the code and (2) identification of substances which could pose an especially dangerous situation for emergency responders. Thus, compliance is necessary to protect yourself, your work, your coworkers and other building occupants. The Safety Department works to insure the University will comply with these laws and codes by:

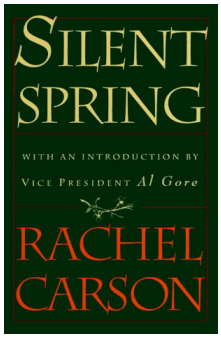
When not in use, store flammable liquids in a flammable liquid storage cabinet.

- With the help of the Madison Fire Department, monitoring the storage and use of flammable liquids in laboratories
- Advising laboratories, building managers and the Madison Fire Department on ways to comply with this law
- If necessary, proposing health and safety projects to improve flammable liquid storage facilities

You can keep your lab in compliance and help the University comply with the NFPA standard by following the guidelines in the ***Storage of Flammable and Combustible Chemicals*** section of Chapter 4. Specific requirements of this code include:

- For laboratory storage of flammable liquids outside of safety cans and flammable liquid storage cabinets, limit the amount to less than 10 gallons (38 liters) of flammable liquids per one hundred square feet
- Safety cans and flammable liquid storage cabinets must be used for storing flammable liquids greater than the above amounts
- Maximum sizes for storage containers in laboratories is 1 gallon (3.8 liters) for glass containers and 2 gallons (7.6 liters) for safety cans

3.2 The Resource Conservation and Recovery Act (RCRA)



Americans have always admired the pristine beauty of certain wilderness areas. Congress donated Yosemite Valley to California for preservation as a state park and, in 1872, Congress reserved Yellowstone in the Wyoming and Montana territories "as a public park or plesuring-ground for the benefit and enjoyment of the people." Initially people felt that the USA was so vast, that its potential was unlimited and the impact of man would be minor at worst. It was the appearance of Rachel Carson's book *Silent Spring*, that made the public realize pesticides and other chemical pollutants were having a decidedly negative impact on the environment and that government action was necessary to protect the environment.

Pesticide use was not the only concern. Hazardous chemicals have been used for many years and the waste products disposed as they were generated. In the case of Love Canal, disposal at the site began in the 1920s and continued through the 1950s. These dump sites were often at the edge of town and it was felt that burial would render any risks negligible. However, as civilization expanded and encroached on these "dumps" (e.g., in the case of Love Canal, the city coerced the chemical company to give them the site), not only was the detrimental impact of exposure to hazardous chemicals observed, but often the cost of cleaning up such a waste facility became exorbitant, especially if the manufacturer was no longer in business or did not possess the land.

The Resource Conservation and Recovery Act (RCRA) was passed by Congress in 1976 to address the problems of waste disposal and reduction. Under RCRA, the EPA is given responsibility for promulgating regulations governing the generation, transportation, treatment, storage and disposal of hazardous and non-hazardous waste. One of the goals of RCRA was to establish a framework for national programs to achieve environmentally sound management of both hazardous and nonhazardous wastes, essentially controlling hazardous waste from generation to disposal (i.e., "cradle to grave"). Under RCRA, a hazardous material is regulated from the time it becomes a "hazardous waste," not when it is first produced.

Each year the EPA inspects the UW for hazardous chemical waste compliance.

After RCRA, there have been many federal, state and local laws enacted to strictly regulate the disposal of hazardous chemicals, including the disposal of chemicals in the sanitary sewer. In general, you can ensure compliance with these laws by following the laboratory chemical disposal procedures in Chapter 7, ***Chemical Disposal Procedures*** and Appendix A, Disposal Procedure by Chemical.

3.2.a RCRA Definitions

The EPA defined or redefined many new terms as part of RCRA. It is important to understand the meanings of these terms because when you use these key terms when talking to Federal and State inspectors, they listen and apply the definitions. If your use is incorrect, inspectors may misunderstand what you are trying to say.

Generator

A generator is "any person, by site, whose act or process produces hazardous waste...." The EPA has three classes of generator.

The UW is a large-quantity generator.

- ***Large-quantity generators*** are those facilities that generate 1000 kg or more per month (about five 55-gallon drums) of hazardous or over 1 kg of "acutely hazardous (i.e., P list) waste" waste per month.
- ***Small-quantity generators*** generate more than 100 but less than 1000 kg of hazardous waste per month and accumulate less than 6000 kg at any one time and less than 1 kg of "acutely hazardous waste." Special rules apply to small-quantity generators.

UW labs located at Research Park may be conditionally exempt small-quantity generators.

- ***Conditionally exempt small-quantity generator*** produces 100 kg or less of hazardous waste per month and less than 1 kg of "acutely hazardous waste."

Individual Generator Site

The UW is an individual generator site.

RCRA defines an ***individual generator site*** as a contiguous site at or on which hazardous waste is generated. The UW's Madison campus is an individual generator

site and has a single EPA generator identification number. Thus, each individual laboratory generating waste is not a "generator" within RCRA criteria, but is part of the institution and must comply with the requirements of a large-quantity generator.

As noted, "on-site" is defined as "the same or geographically contiguous property which may be divided by public or private right-of-way, provided the entrance and exit between the properties is at a crossroads intersection, and access is by crossing as opposed to going along the right-of-way."

Some UW activities are not "on-site." The Wisconsin Psychiatric Research Institute in Research Park, the State Lab of Hygiene at Agriculture Drive, and other labs located in rental space are not on the contiguous campus. Most of the research labs would probably be conditionally exempt small-quantity generators, some might be small-quantity generators. Depending upon the generator class, specific rules, different from rules followed by labs on the UW campus, are followed by these labs.

Solid Waste

Under RCRA, a material can not be a hazardous waste unless it is a solid waste. RCRA defines a solid waste as: ". . .any garbage, refuse, sludge from a waste treatment plant, water supply treatment plant, or air pollution control facility and other discarded material, including solid, liquid, semisolid, or contained gaseous material resulting from industrial, commercial or mining and agricultural operations, and from community activities." Some otherwise hazardous wastes are excluded from regulation. These include samples sent for testing, household waste, agricultural waste (except pesticides), oil and gas production waste, and some wastes that are reused or recycled.

Not all RCRA "solid waste" is solid.

Remember, as defined in the code, a "solid waste" need not be solid. RCRA defines "solid waste" as "any ... discarded material, including solid, liquid, semisolid, or contained gaseous material...." Additionally, the term "discarded" includes any material that is abandoned, recycled, or "inherently wastelike."

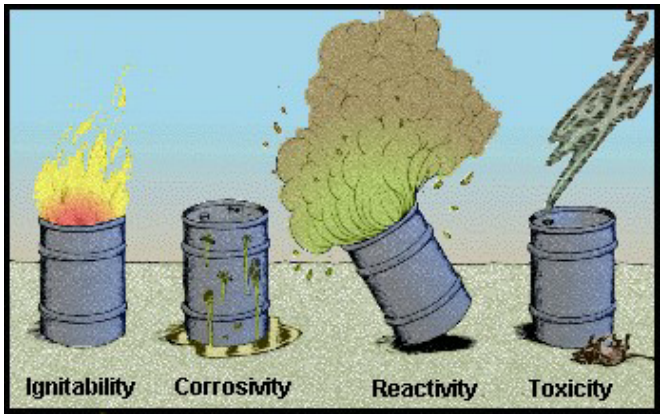
Hazardous Waste

RCRA defines ***hazardous waste*** as solid waste that, "because of its quantity, concentration, or physical, chemical, or infectious characteristics may: 1) cause, or significantly contribute to an increase in mortality or an increase in serious irreversible, or incapacitating reversible, illness or 2) pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, or disposed of, or otherwise managed." Thus, wastes are considered hazardous if they can pollute the air, water, and/or land if not handled or disposed of in a particular manner. To simplify things, hazardous waste is usually classified as belonging to one of two groups: (1) characteristic hazardous waste or (2) listed hazardous waste.

Characteristic Hazardous Waste

A waste is classified as a characteristic hazardous waste if it has any of the following characteristics:

1. ***Ignitability*** - It is a liquid waste, it is easily ignited and has a flash point less than 140 ^{o}F (60 ^{o}C). This includes paint wastes (e.g., lacquer thinner), some degreasers (e.g., mineral spirits), some solvents (e.g., acetone), and gasoline. It is not a liquid but is capable of causing a fire through friction, absorption of moisture or spontaneous chemical changes and, when ignited, burns so vigorously and persistently that it creates a hazard. It is an ignitable compressed gas. Ignitable wastes are assigned an EPA hazardous waste number D001.



2. ***Corrosivity*** - It dissolves metals and other materials, burns the skin, and has a pH less than or equal to 2 or greater than or equal to 12.5. Examples include acids, alkaline cleaning fluids, battery acid and some rust removers. Corrosive wastes are assigned EPA hazardous waste number D002.
3. ***Reactivity*** - It is unstable or undergoes a rapid or violent change upon contact with water or other materials. Examples include airbag inflator canisters (has sodium azide) and electroplating bath sludges (has cyanide). Reactive wastes are assigned EPA hazardous waste number D003.
4. ***Toxicity*** - It is toxic as determined by the EPA's Toxicity Characteristic Leaching Procedure (TCLP). These wastes contain amounts of metals, pesticides, herbicides, or organic chemicals that would be dangerous if released to groundwater. The TCLP list of toxic contaminants contains 8 metals, 4 pesticides, 2 herbicides and 25 organic chemicals. Wastes which are hazardous due to toxicity are assigned EPA hazardous waste numbers D004 through D043.

Listed Hazardous Waste

The EPA has already determined that some specific wastes are hazardous and they have been incorporated into one of 4 lists (K, F, P, or U) published by EPA. The lists are organized into three categories:

- **Source-Specific Wastes** (EPA waste code K001 - K148) includes wastes from *specific industries* such as petroleum refining and wood preserving. Examples include sludges and waste waters from treatment and production processes.
- **Non-Specific Source Wastes** (EPA waste code F001 - F039) are wastes commonly produced by manufacturing and industrial processes. Examples from this list include spent halogenated solvents used in degreasing and wastewater treatment sludges from electroplating processes as well as dioxin wastes, most of which are acutely hazardous wastes due to the danger they present to human health and the environment.
- **Commercial Chemical Products** (P list [acutely hazardous] and U list) list includes specific commercial *chemical products* such as creosote and some pesticides.

These wastes have been listed because they almost always exhibit at least one of the hazardous waste characteristics or because they contain chemicals that have been shown to be harmful to human health and the environment. The regulations list over 400 hazardous wastes.

Thus, if your wastes material exhibits any of the four characteristics (ignitability, corrosivity, reactivity, or toxicity), or if it is a listed waste (F, K, P, or U list), it is a ***Hazardous Waste*** and is subject to EPA's hazardous waste regulations. While characteristic wastes must satisfy some condition, all listed wastes are presumed to be hazardous *regardless of their concentrations* and must be handled according to EPA's hazardous waste regulations.

Accumulation Times and Amounts

Hazardous wastes can not be held indefinitely. A large-quantity generator like the UW may accumulate hazardous waste for up to 90 days without a special EPA permit if the waste container:

- is in good condition.
- material or liner is compatible with the waste contained.
- is kept closed except when actually adding or removing waste.
- is properly handled and stored.

Satellite Accumulation

Your lab is a Satellite Accumulation Area

A generator may accumulate up to 55 gallons of hazardous waste, or 1 quart of acutely hazardous (P list) waste, "at or near any point of generation where wastes initially accumulate which is under the control of the operator of the process generating the waste...." Thus individual laboratories become "satellite" locations and they may be allowed to accumulate and store hazardous waste, but the waste container must be labeled with to identify the contents of the container, it must be dated and removed within 3 calendar days after reaching the 55-gallon limit. Because 55 gallons is too large a container for laboratory use and may violate fire code, waste containers of less than 5 gallons are routinely used and the accumulation time is generally limited to less than 1 year. Additionally, waste containers must always be closed during storage except when it is necessary to add or remove waste.

Sewer Disposal

Remember, the Earth is a closed ecosphere. The refrain of Tom Lehrer's song, *Pollution*, taunts, "The breakfast garbage that you throw into the bay / They drink at lunch in San Jose." Indiscriminate disposal to the sanitary sewer of laboratory chemicals is not acceptable. Some chemicals can interfere with the proper functioning of sewage treatment facilities or affect the bodies of water into which they are discharged. In the drain system itself, some chemicals can cause fire, explosion, or local air pollution. While sewer disposal of some nonhazardous chemicals may be acceptable, such disposal of hazardous chemicals is permissible only under specifically prescribed circumstances (see Section **3.2.c** and Chapter 7).

Empty Containers

When is your container really "empty?"

When is a "empty" container considered to be empty? Under RCRA, a container that contained hazardous waste is "empty" if all waste has been removed and no more than 2.5 cm (1 inch) of residue, or 3% by weight (of containers less than 110 gallons), remains. In practice, all quantities of the substance should be removed. Once a container is "empty," it is no longer subject to RCRA. If the container held acutely hazardous (P list) substances, triple rinsing (with water or a detergent) is required and the rinsate itself is a hazardous waste. Rinsate from cleaning "ordinary" hazardous waste containers may or may not be considered hazardous waste, depending whether the original waste in the container was listed. Additionally, the regulations for empty containers applies to all hazardous waste containers, not just those from laboratories. Paint cans, insecticide containers, cleaning supply bottles, spray cans, etc. are also covered.

Treatment

RCRA defines ***treatment*** as "any method, technique, or process, including neutralization, designed to change the physical, chemical, or biological character or

composition of any hazardous waste...." Except as noted here, RCRA prohibits any treatment without an EPA permit. Some common laboratory exceptions include:

- Treatability studies and investigations of new methods of treating or detoxifying hazardous waste in which the quantities of hazardous waste treated are less than a specified amount. Records and reports are required.
- Treatment procedures in laboratories where the treatment procedure is part of the experiment. In this instance, the material has not been declared a "waste" subject to RCRA.
- Elementary neutralization of waste that is hazardous only because of the characteristic of corrosivity.
- Certain treatment by conditionally exempt small-quantity generators.

Waste Minimization

As noted above, a goal of RCRA was the reduction of hazardous waste prior to any treatment, storage, or disposal of the waste. Minimization focuses on source reduction (e.g., buy less, use less) or recycling activity that results in either a reduction of the total volume of hazardous waste or reduction of the toxicity of the hazardous waste. Every 2 years, large-quantity generators are required to report to EPA what reductions have actually been achieved.

3.2.b Hazardous Waste Disposal

The EPA and the Wisconsin DNR closely regulate the disposal of hazardous chemicals. These laws were discussed above and are also described in some detail in Appendix H. The Safety Department works to achieve compliance by:

- Obtaining and maintaining required permits and licenses for storage and transport of hazardous chemical waste.
- Maintaining and operating the University's hazardous waste storage facility.
- Transporting hazardous chemical waste generated on campus.
- Arranging for and supervising the environmentally sound transport, treatment and disposal of the University's hazardous chemical waste.
- Submitting reports and manifests, as required, describing the quantity of hazardous waste generated and the disposition of all hazardous wastes

Removal of hazardous chemical waste is a service of the Safety Department, at no cost to you.

Principal investigators, laboratory managers and laboratory workers insure compliance with EPA and DNR hazardous chemical waste laws by:

Do not dispose of waste by evaporation.

- Follow the chemical disposal procedures in Chapter 7 and Appendix A of this *Guide*, including the In-Lab Chemical Management Procedures. Use the Safety Department's On-Site Hazardous Materials Management Service.
- Do not evaporate any waste unless approved by the Safety Department.
- Insure all carboys are securely capped except when waste is being added.
- Completely describe (on the waste disposal form) chemicals to be removed by the Safety Department's On-Site Hazardous Materials Management Service.
- Do not dispose of any quantity of chemical or unemptied chemical container in the normal trash unless specifically approved in this *Guide*.

Keep caps on carboys.

Additionally, compliance is facilitated by your efforts to prevent pollution and minimize chemical wastes, as described in Chapter 6, ***Waste Minimization and Pollution Prevention***.

3.2.c Sanitary Sewer Use

Disposal of chemicals and chemical wastes in the sanitary sewer are regulated by the Sewer Use Ordinance of the Madison Metropolitan Sewerage District (MMSD). The MMSD and the University have agreed upon the criteria for the safe disposal of laboratory chemicals via the sanitary sewer.

Only dispose through the sanitary sewer those laboratory chemicals that are identified in Chapter 7 and Appendix A.

Several procedures for the disposal of chemicals and chemical wastes have been developed for prudent use of the sanitary sewer for disposal. These are explained in detail in Chapter 7, ***Chemical Disposal Procedures***. Chemicals suitable for disposal are listed alphabetically in Appendix A.

The Safety Department helps the University comply with the MMSD Sewer Use Ordinance by:

- Establishing procedures in Chapter 7 and Appendix A of this Guide that comply with MMSD ordinances.
- Agreeing with MMSD on the criteria for environmentally sound disposal of laboratory chemicals in the sanitary sewer.
- For special cases of potential sanitary sewer use, determining safe chemical disposal procedures in consultation with MMSD.

You can help comply with the Sewer Use Ordinance by:

- Following the chemical disposal procedures detailed in Chapter 7.
- Using the sanitary sewer to dispose only those materials identified in Appendix A and Chapter 7
- Keeping track of sewer disposal of laboratory chemicals that have an established limit (see procedure ***Sanitary Sewer 6*** in Chapter 7*)*.
- Making sure you are using a sanitary sewer, not a storm sewer. Most sewers and drains outside of a building are storm sewers. These do not empty into the sanitary sewer network, rather they drain directly to streams and lakes.

For off-campus activities using this guide, if your building is not in the City of Madison and you are connected to a sanitary sewer or other wastewater system, call the Safety Department for sewer use guidelines.

3.3 Chemical Spill and Release Laws

Several federal and state laws address chemical spills, accidental releases and other chemical emergencies. The Safety Department and UW Police have established chemical emergency response procedures for preparedness, response and reporting. Chapter 5, Emergency Procedures, provides a more thorough description of these notification procedures and how you can prevent and/or respond to chemical emergencies in your laboratory.

Chapter 5 discusses emergency procedures.

Additionally, EPA has promulgated a Spill Prevention Control and Countermeasure (SPCC) requirement (40 CFR 112) which mandates that facilities which store oil and hazardous substances develop and maintain a Spill Prevention, Control and Countermeasures Plan which describes the procedures and equipment in place to minimize the potential of spills, leaks or releases of oil and/or hazardous material to the environment, as well as to describe the reporting and response procedures in the event of a spill, leak or release to the environment.

3.3.a Chemical Spill and Release Notification

Federal and state chemical spill and release laws are multi-tiered with relatively complex reporting criteria. To ensure compliance, you should inform the Safety Department of any of the following circumstances:

Report all chemical spills and releases to the Safety Department.

- A chemical is spilled and may impact the environment in any way.
- Chemical gases, vapors or fumes are released to the atmosphere or a ventilation system that leads to the outside.
- The spilled or released chemical is one listed by the EPA as requiring a report.
- The spill or release results in an exposure to personnel.
- The Madison Fire Department's Hazardous Incident Team responded and initiated cleanup.
- A spill or release of any quantity of any substance.

Depending upon the type of release, it may require separate notification of federal, state and local authorities and the notification may be required even if the disposal, discharge or release was intentional.

Because of the complexity of these laws, please report all chemical spills and releases to the UW Safety Department (for non-emergency advice or assistance) and UW Police (in an emergency). The Safety Department can determine what level of response and report is necessary to ensure safety and compliance. In this regard, the Safety Department helps the University comply with these laws by:

- Determining safe response procedures in the event of a chemical emergency and coordinating response efforts.
- Determining legal reporting and response requirements in the event of a chemical emergency, and complying with those rules.
- Submitting required notifications and reports to federal, state and local agencies.
- Planning for University chemical emergency response with UW Police, the Madison Fire Department's Hazardous Incident Team and the Local Emergency Planning Committee.
- Arranging for chemical emergency response and cleanup services.
- Advising laboratory personnel on preparedness and response to chemical emergencies.

Chapter 5 describes how you can assemble a spill kit for your laboratory.

The Madison Fire Department's Hazardous Incident Team responds to serious spills on campus. In general, the Safety Department does not clean up significant chemical spills on campus, but will help you with smaller spills and incidents. You can help comply with these spill and reporting laws by:

- Notifying UW Police of any chemical spill, accidental release and other chemical emergency by dialing 911; UW Police will activate the emergency response plan and inform the Safety Department.
- Calling the Safety Department's Chemical & Radiation Protection staff (5-5518) if you have questions about reporting a chemical spill or release.
- Preventing and preparing for chemical emergencies, as discussed in Chapter 5, ***Emergency Procedures***.
- Consulting with the Safety Department if you are planning work that may result in a chemical spill or release to the environment so that we can determine prevention and control measures, and if the release is reportable.

Generally speaking, although the Safety Department will respond and provide cleanup guidance and assistance, laboratory personnel are responsible for the cleaning and decontamination of simple spills.

3.3.b Spill Cleanup and Soil Contamination

Contact the Safety Department if you discover a chemical spill, leak or soil contamination.

Spill cleanup usually requires specialized materials, equipment and techniques. Additionally, federal and state standards have been established for residual chemical contamination. This is especially true for spills that result in soil contamination, or other releases to the environment. To insure compliance, the Safety Department is responsible for:

- Identifying instances of chemical contamination.
- Determining cleanup requirements and standards.
- Managing projects to assess and cleanup chemical contamination.

Contact the Safety Department if you discover chemical contamination. We will work together to insure cleanup measures are safe and meet standards.

3.4 Other Environmental Laws

Other environmental laws have been promulgated to regulate air emissions from laboratories, the import and export of chemicals (including samples), the environmental impacts of field studies, pesticides, and laboratory use of polychlorinated biphenyls (PCB), stormwater and spill prevention and control.

3.4.a Air Emissions from Laboratories

Volatile organic solvents are a source of air emissions. We need your help and ideas to minimize these releases.

The Clean Air Act (CAA) regulates air emissions, rigorously regulating emissions of sulfur dioxide, volatile organic compounds (VOCs), hazardous air pollutants (HAPs), and ozone depleting chemicals. With two large heating plants and many smaller emission sources (e.g., ethylene oxide sterilizers, incinerators, etc.), the UW is considered a ***major source*** of emissions (i.e., potential to emit any of the listed hazardous air pollutants in amounts greater than 10 tons/year of a single hazardous air pollutant or 25 tons/year of total hazardous air pollutants). Federal and state laws require the University report air emissions from all campus sources. The information is distributed to the public and used to assess environmental and public health effects. The Safety Department drafts the campus report. Some of the commonly used laboratory compounds tracked are acetone, chlorine gas, chloroform and sulfuric acid. You can help reduce laboratory air emissions by following the suggestions given in Chapter 6, ***Pollution Prevention and Waste Minimization***. These include:

- Substitute less toxic materials for toxic organic solvents.
- Minimize the amount of volatile chemicals you buy, store and use.
- Reduce routine leaks and evaporation (i.e., fugitive emissions), keep containers capped and seal experiments and systems as much as possible.
- Except for surface drying processes (e.g., coating application or flat bed chromatography), do not intentionally evaporate any chemical.
- Avoid drips, dribble and spills when pouring from large into small containers.

3.4.b Toxic Substance Control Act (TSCA)

Laboratories engaged in research may have to satisfy the Toxic Substance Control Act, a program that is intended to ensure that the human health and environmental effects of chemical substances are identified and adequately addressed prior to production or transport of those substances. Some TSCA regulated activities are:

International shipments of chemical samples require a TSCA certification.

- research conducted for commercial purposes
- importation and exportation of chemicals
- shipment of chemicals to locations within the U.S.
- adverse significant reactions to chemicals
- significant risks of chemicals discovered during research

Thus, the EPA and the Customs Office requires that all chemicals, including chemical samples, imported into or exported out of the country be certified. The type of certification required depends on whether the chemical is listed by EPA under TSCA. These certification forms and additional information are available from the Safety Department.

3.4.c Environmental Impact Statements

Certain field research or studies may be subject to the requirements of the Wisconsin Environmental Policy Act (WEPA). For "major actions significantly affecting the quality of the human environment," WEPA requires:

- Consultation with agencies that have jurisdiction or special expertise with respect to the environmental impact involved.
- Proposals include a detailed statement on the environmental impact of the proposed action, adverse environmental effects, alternatives and other information.
- A public hearing that includes a public notice.

UW Research Administration has a screening worksheet for compliance with WEPA. Contact the Safety Department for more information on the law, for help in determining requirements and preparation of an environmental impact statement.

3.4.d Nonpoint Source Discharges

Industrial waste water is any (solid, liquid or gas) discharge resulting from an institutional activity. Most laboratory sinks and drains discharge to the sanitary sewer and are subject to the Madison Metropolitan Sewerage District (MMSD) ordinances described above. Be aware, however, that outdoor drains and sewers (i.e., storm sewers) discharge to Madison lakes and are subject to more stringent disposal limits for nonpoint source discharges. The EPA nonpoint source discharge laws also apply to wastewater discharges during field research / studies and include outdoor spills and leaks such as those that may occur at loading docks and service entrances. The Safety Department aids compliance with this law by:

Nonpoint source discharges refers to contaminants that do not enter the sanitary sewer or other wastewater collection systems, and usually enter rivers and lakes via the storm sewer. Nonpoint source pollution harms the quality of Madison's lakes.

- Obtaining and maintaining an EPA/DNR nonpoint source permit for the University.
- Sampling and studying storm sewer, illicit and other nonpoint source University discharges.

- Facilitating campus programs to prevent and clean up spills, and minimize the use of pesticides, salt and other pollutants.

You can help the UW comply with this law by:

- Promptly cleaning any chemical spills or leaks.
- Not using outdoor drains or storm sewers for waste disposal, unless approved by the Safety Department.
- Notifying the Safety Department of any chemical spills, leaks or releases.
- Consulting with the Safety Department for wastewater disposal procedures when the sanitary sewer is not available.

If you work with PCBs or PCB-containing material, contact the Safety Department so that we can keep the University's inventory accurate.

3.4.e Polychlorinated Biphenyls (PCBs)

Because of PCB's proven environmental toxicity, the manufacture and most uses of PCBs are banned in the US The EPA strictly regulates the use and disposal of PCBs, including any electrical transformers, capacitors or other electrical equipment that contain PCBs. Many universities have been fined for noncompliance with this law. The Safety Department works to comply with the PCB laws by:

- With the help of UW Physical Plant, testing electrical equipment, oils and other liquids for PCBs.
- Maintaining the University's inventory of PCBs stored and used, and records of disposal.
- Arranging for and supervising the environmentally sound transport, treatment and disposal of PCBs.
- Monitoring EPA's use and storage prohibitions for PCBs.

If you suspect that a liquid or an item contains PCBs, call the Safety Department. We will test it at no cost to you.

You can help the UW comply with this law:

- Report any PCB transformer or PCB capacitor greater than nine pounds (i.e., contains more than three pounds of PCBs) to the Safety Department so it can be included on the University's PCB inventory.
- Contact the Safety Department if you have electrical equipment or other chemicals that may contain PCBs. Safety will evaluate each item. For certain items, chemical analysis may be required.
- Contact the Safety Department for an evaluation of the legal requirements if you use any quantity of PCBs not contained in electrical equipment,. Some research uses of PCBs may require an exemption from the EPA.
- Dispose of PCBs according to ***Polychlorinated Biphenyls*** disposal procedures found in Chapter 7. All PCB and PCB-containing equipment must be disposed of through the Safety Department.

3.4.f Stormwater

Stormwater is any precipitation (rain or snow melt) that comes into contact with a facility or construction site, then drains from the site, and flows into any nearby water body. This water can collect from roof tops, parking lots, or saturated ground. The water may also flow into storm drains or directly into local ponds or rivers.

During rain and other wet weather, pollutants (e.g., oil and grease, pesticides, sediment, salt, animal waste, etc.) are flushed from sidewalks, roads, highways, recreational and landscape areas and parking lots. This flushing can result in the creation of polluted sotrmwater that drains from the UW campus into nearby lakes.

This stormwater pollution can be significant enough to cause water quality in the rivers and lakes to violate standards.

The UW in concert with the City of Madison and Dane County is working to develop practices to assist construction managers, ground crews and other to manage their operations in a manner that minimizes stormwater pollution.

3.4.g Spill Prevention and Countermeasures (SPCC)

The EPA requires that facilities that store oil and other hazardous materials to have a program to prevent and mitigate spills. This plan is described in the SPCC Plan. Spill prevention procedures include the maintenance of an accurate up-to-date inventory of oil-containing devices and areas along with inspections of these areas.

3.5 Review Questions

1. The primary purpose of the OSHA Laboratory Standard is to:
   a. protect human health and the environment
   b. help prevent laboratory accidents
   c. protect individuals who work with laboratory chemicals
   d. identify specific standards for laboratory construction

2. Laboratory workers can help the University of Wisconsin-Madison comply with chemical disposal laws by:
   a. keeping waste solvent collection carboys capped
   b. monitoring their exposure to certain, specified chemicals
   c. reporting all releases to the environment to the Safety Department
   d. contacting the Safety Department if they intend to ship research materials internationally

3. Workers comply with Madison Metropolitan Sewerage District Sewer Use Ordinances by:
   a. disposing of any unwanted chemicals in the sanitary sewer
   b. using the sanitary sewer to dispose of items listed in Appendix A or Chapter 7 of this *Guide*
   c. not disposing of any chemical in the sanitary sewer
   d. reporting all releases to the Safety Department

4. To comply with chemical spill laws:
   a. releases greater than 1 gallon need to be reported to the Wisconsin Department of Natural Resources (DNR)
   b. releases greater then 1 gallon and smaller than 10 gallons must be reported to the US Environmental Protection Agency (EPA)
   c. releases to the environment of any quantity are to be reported to the Safety Department
   d. any release that harms an individual must be reported to the Wisconsin Department of Natural Resources (DNR)

5. An Environmental Impact Statement may be required if you:
   a. do research or field studies that may have an impact on the environment
   b. report a release to the environment
   c. work with PCBs or PCB-containing materials
   d. use large quantities of chemicals