BALL STATE
UNIVERSITY

CHEMICAL HYGIENE PLAN

Prepared by the:

Ball State University

Environmental Health and Safety Office

Revised

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1.0 PURPOSE

The Ball State University (BSU) Chemical Hygiene Plan (CHP) is intended to provide guidelines, directives, and policies for individuals working in the campus laboratory community. The Laboratory Supervisors, Safety Managers, Principal Investigators, or Individual Departments should produce standard operating procedures to accompany this CHP or choose to customize this CHP to suit their individual needs to more precisely portray the hazards and controls of their individual laboratories. This CHP includes policies, procedures, equipment, personal protective equipment, and work practices that are required and capable of protecting laboratory personnel from the general health hazards in laboratories. It is intended to satisfy the requirements of the federal Occupational Safety and Health Administration (OSHA) *Laboratory Safety Standard*, also known as "*Occupational Exposure to Hazardous Chemicals in Laboratories*"– when supplemented or revised with laboratory-specific protocols by the various University Departments, Principal Investigators, or Laboratory Managers. The CHP will be administered by the BSU Environmental Health and Safety (EHS) Office on a University-wide basis, with the individual Academic and Research Departments being responsible for its implementation on a Department and Research or Educational Laboratory-specific basis. The CHP also applies to the BSU School of Art and College of Architecture and Planning studios and workshops that meet the definition of "laboratory", or where "laboratory use" of chemicals occurs, as defined or intended by the OSHA Standard. Student employees and paid graduate students are also governed by this Plan. While not directly covered by the OSHA standards, which apply only to "employees", all BSU students are nevertheless expected to abide by the procedures, mandates, and prohibitions presented in this Plan. Faculty and instructors should include its content, as well as general laboratory and studio safety, in their curriculum as part of their student's Science or Arts Education and toward developing a "safety culture" in these settings and for these activities.

OSHA regulations require employers to evaluate their workplaces for the presence of hazardous substances, harmful physical agents, and infectious agents and to provide training to laboratory personnel concerning those substances or agents to which laboratory personnel may be exposed. Written information on agents—in particular, Safety Data Sheets (SDSs), or Pathogen Safety Data Sheets (PSDS)--must be readily accessible to laboratory personnel. Laboratory personnel have a conditional right to refuse to work if assigned to work in an unsafe or unhealthful manner with a hazardous substance, harmful physical agent, or infectious agent. Labeling requirements for containers of hazardous substances and equipment or work areas that generate harmful physical agents are also included in the OSHA Standard. The development and use of *Standard Operating Procedures* (SOPs) for laboratory work involving hazardous chemicals is another important requirement of the OSHA Standard. This CHP also addresses the identification, handling, and disposal of hazardous and other waste materials from BSU laboratory and support operations.

While the expressed purpose of the OSHA *Laboratory Safety Standard (OLSS)* is to ensure the safety of *employees* (faculty, staff, researchers, etc.) in laboratory settings and operations; many, if not all, of the precautions and procedures established in this Plan are also relevant for the safety and training of BSU students and its content should be included in instructional programs.

2.0 SCOPE AND APPLICATION

The OLSS applies where 'laboratory use' of hazardous chemicals occurs. Laboratory use of hazardous chemicals means handling or use of such chemicals in which all the following conditions are met:

i. the handling or use of chemicals occurs on a 'laboratory scale', that is, the work involves containers which can easily and safely be manipulated by one person;
ii. multiple chemical procedures or chemical substances are used; and
iii. protective laboratory practices and equipment are available and in common use to minimize the potential for laboratory personnel exposure to hazardous chemicals.

At a minimum, this definition covers laboratory personnel (including student employees and interns, technicians, supervisors, and principal investigators) that use chemicals in teaching, research, and clinical laboratories at Ball State University. Certain non-traditional laboratory settings may be included under this standard at the option of individual Departments within BSU. For the purposes of this Plan, the term *Laboratory Safety Manager* is used to designate the *Principal Investigator, Laboratory Manager, Laboratory Supervisor, Laboratory Technician,* or other employee of the BSU Department who is intended or designated as the responsible party for laboratory safety in a lab or group of laboratory operations, under this Plan and the OLSS. The various BSU Departments operating laboratories may have different titles for the individual so designated or intended by the Department to ensure compliance with the OLSS for the laboratory or laboratories under their management or jurisdiction. The designated *Laboratory Safety Manager* may be responsible for a single laboratory, multiple laboratories, or all laboratories within a BSU Department, interdepartmental, or inter-disciplinary laboratory research, demonstration, or educational effort.

3.0 RESPONSIBILITIES

Implementation of the Laboratory Safety Standard at BSU is a shared responsibility. Laboratory personnel, Principal Investigators, Supervisors, Laboratory Safety Managers, Department heads, Deans, upper administrative staff, EHS and The Office of Research Integrity (ORI) all have roles to play. These roles are outlined below.

3.1 UNIVERSITY WIDE

Ball State University, in conjunction with its academic and non-academic Schools or Departments, is responsible for developing and supporting a broad-based chemical hygiene program that will protect its laboratory program personnel from health effects or hazards associated with hazardous chemicals. Deans, Directors, and Department Chairs are responsible for integrating laboratory and chemical safety into all their activities, for promoting the same attitude among all levels of employment and students at the University, and for providing adequate time and recognition for all laboratory personnel that are given laboratory safety responsibilities.

3.2 COLLEGES, ACADEMIC DEPARTMENTS, AND NON-ACADEMIC DEPARTMENTS

Each academic and non-academic School or Department that engages in the laboratory use of hazardous chemicals must identify at least one *Laboratory Safety Manager* to serve as a focal point for laboratory health and safety activities within the Department and as liaison with the Ball State University Environmental Health and Safety (EHS) Office. Each academic, and non-academic Department may modify this generic *Chemical Hygiene Plan* to incorporate location-specific information. Each unit will also identify the assigned Laboratory Safety Manager(s) within their Department or administrative entity.

3.3 LABORATORY SAFETY AND CHEMICAL HYGIENE COMMITTEE

The BSU Laboratory Safety and Chemical Hygiene Committee (LSCHC) was formed in late 2021 as an advisory and policy-making committee. The Mission Statement of the LSCHC is as follows:

Ball State University provides a safe and secure academic research environment for all faculty, staff and students. In furtherance of this commitment, the Laboratory Safety and Chemical Hygiene Committee (LSCHC) provides general oversight and guidance to the campus through promotion of a safe and secure work environment in all research and teaching laboratories, associated scientific operations and facilities. The Committee consists of members that reflect the diversity of scientific disciplines and regulatory issues involved with laboratory safety, integrity, and security on campus.

The responsibilities of the Committee are to:

- Create an atmosphere conducive to safe, effective, and regulatory compliant laboratory-based programs to enhance our overall research and education efforts.
- Advise senior BSU officials on strategic issues effecting research safety and security;
- Develop, update and maintain policies and procedures in compliance with applicable Federal regulations;
- Develop BSU specific policies and procedures, best practice guidance and applicable research safety guidelines;
- Establish plans and develop training programs applicable to the health and safety of all research personnel;
- Establish strategies to ensure ongoing and adequate hazard identification, compliance, and risk evaluation of laboratory activities;
- Review findings of campus inspection, hazard surveillance, environmental compliance, and faculty, staff, and student safety programs related to laboratories;
- Work collectively with other campus research review and safety committees to ensure open lines of communications, consistency in research policies and practices and to enhance collaborative efforts;
- Encourage participation in biological, chemical, and radiological security efforts for laboratory personnel and related activities, supplies, agents, and products;
- Serve as an educational and informational resource to the BSU scientific community;

In addition to providing oversight and guidance, the Committee may recommend the modification, suspension, or termination of any laboratory activities that are deemed to pose an unacceptable risk to life, security, or safety.

3.4 CHEMICAL HEALTH AND SAFETY OFFICER

The Chemical Health and Safety Officer for BSU is: (OSHA definition) --*An employee who is designated by the employer and is qualified, by training or experience, to provide technical guidance in the development and implementation of the provisions of the Chemical Hygiene Plan (CHP) and the OSHA Laboratory Safety Standard*.

Qualifications:

Proficiency, by education and/or related experience of applicable safety, technical, and regulatory requirements, e.g., OSHA, EPA, CDC, IFC, FDA, DEA, DHS, DOT, etc., standards as they relate to practices and safety in educational and research laboratories.

Responsibilities: The *Chemical Health and Safety Officer* for BSU is responsible for:

- Preparing, revising as necessary, and updating, on an annual basis, BSU's *Chemical Hygiene Plan* (CHP);
- Consultation and advocacy for laboratory, chemical, and biological safety assistance with administrative entities, other committees, and the general University population;
- Implementing and documenting laboratory safety and regulatory compliance programs for the University;
- Performing or overseeing exposure monitoring of employees when required or advisable;
- Overseeing programs for the routine inspection, presence, and operability of fume hoods, glove boxes, biosafety cabinets, laboratory pressure differentials and ventilation, autoclaves, eyewashes/emergency showers, fire extinguishers, medical and spill response kits and other safety equipment and appurtenances;
- Conducting or overseeing audits and inspections of the laboratory spaces, preparation rooms, and chemical and biological storage facilities for conformance with the CHP, BSU policies, and other rules and standards related to safety and hygiene;
- Interacting with the Occupational Safety and Health Agency (OSHA), Environmental Protection Agency, Department of Homeland Security, their state counterparts, and state and local fire, water, and wastewater jurisdictions regarding occupational and safety programs for laboratory work;
- Assisting the laboratory departments or other units in tailoring and implementing the CHP for their needs or laboratories;
- Ensuring that Standard Operating Procedures (SOPs) for laboratories are developed and implemented where needed;
- Acting as liaison with BSU Facilities Planning and Management regarding building design and HVAC concerns;
- Developing, implementing, and ensuring safe and compliant plans and procedures for the storage, handling, transport, and use of chemical and biological materials.
- Overseeing solid and hazardous waste and chemical and biological waste management and disposal for the various departments;
- Training departmental staff regarding their responsibilities for safety and compliance with regulations and BSU standards that apply to laboratory and other safety and environmental measures, and assisting in the safety training of graduate assistants and students when requested;
- Ensuring that an annual chemical inventory is conducted for each department, laboratory, and related workspaces or stockrooms for both compliance and internal university purposes.
- Monitoring the progress of the various departments' toward achieving and maintaining compliance with this Plan and OSHA and other regulations and standards;
- Investigating laboratory-related accidents and chemical exposures within the various departments.
- Providing or assisting with response to any chemical, biological, or radiological spills or releases and the resulting cleanup and assessment; and,
- Identifying, reporting and assisting in correcting unsafe conditions or practices.

3.5 LABORATORY SAFETY MANAGER (REPRESENTATIVE OR OFFICER)

The *Laboratory Safety Manager is* the title, for the purposes of this Plan, intended to identify the individual delegated or assigned to perform the following roles:

- Interacting with the Chemical Health and Safety Officer to ensure a safe and healthful laboratory environment;
- Assuring that potential hazards of specific projects have been identified and addressed before work is started;
- Ensuring that they, other laboratory workers, and students have received general laboratory safety training and laboratory-specific safety indoctrination.
- Develop and implement a specific Chemical Hygiene Plan for the laboratory including necessary Standard Operating Procedures (SOPs) for attachment or reference to this generic CHP;
- Ensuring there are written, laboratory-specific standard operating procedures for the protocols carried out in the laboratory that incorporate directions about how to mitigate the hazards of the procedures;
- Informing and training laboratory personnel and students regarding the specific hazards in their area and in the work, they will be doing;
- Instructing laboratory workers in the safe and adequate response to spills or releases of hazardous chemicals or biological agents;
- Providing for any necessary personal protection equipment (PPE) to laboratory personnel;
- Scheduling time for laboratory personnel to participate in training;
- Documenting and maintaining records of safety training, including certification that all lab personnel have read and understand the Chemical Hygiene Plan;
- Enforcing BSU safety policies and safe work practices;
- Conducting periodic audits of the laboratory or research space under their control;
- Ensuring that all laboratory safety equipment is available and in good repair;
- Reporting hazardous conditions, or employee monitoring or PPE needs, to the Chemical Health and Safety Officer and/or Facilities Management; and
- Investigation of laboratory accidents, documenting the investigation, and sending copies of the report with recommendations to the Chemical Health and Safety Officer for review.

If a *Laboratory Safety Manager* is not delegated or otherwise identified by the BSU Department, the immediate supervisor of the laboratory (Laboratory Supervisor, Manager, or Technician), Principal Investigator, or Department Chair is then responsible for assuming the role of Laboratory Safety Manager under this Plan and the OSHA Laboratory Standard and to perform or oversee the above functions for each laboratory under their control.

3.6 FACULTY, STAFF, AND LABORATORY PERSONNEL

Faculty, staff, and laboratory personnel who have significant responsibility for directing their own laboratory work, or those of students, are responsible for assuring that general laboratory safety and the potential hazards of specific projects or lessons have been identified and addressed before work is started. All laboratory personnel are responsible for:

- Following the policies, procedures, and precautions in this Chemical Hygiene Plan and the requirements of the OSHA Laboratory Standard;

- Attending required laboratory safety training sessions;
- Following and enforcing safety guidelines applicable to the laboratory, the chemicals being handled, and the specific procedures being carried out;
- Assuring that required safety precautions are in place before work is started;
- Cooperating with the Chemical Health and Safety Officer and any Departmental Laboratory Safety Manager(s), and
- Reporting hazardous conditions or exposures as they are discovered or occur.

4.0 GENERAL LABORATORY PROCEDURES

4.1 BEHAVIOR IN THE LABORATORY

1. Appropriate personal protective equipment shall always be worn in the laboratory.

2. Employees should not work alone with hazardous chemicals using potentially dangerous procedures.

3. Any visitor to the laboratory is to be escorted by an employee and is the responsibility of that employee. Appropriate safety rules and PPE requirements must be observed.

4. Employees shall be aware of the location and proper operation of laboratory safety equipment.

5. Employees shall seek to correct or stop unsafe practices when observed by other employees or students and/or report the same to the Laboratory Safety Manager and/or Office of Research Integrity (ORI).

4.2 AVOIDANCE OF ROUTINE EXPOSURES

1. Avoid direct contact with any chemical. Keep chemicals off hands, face, and clothing, including shoes. Always minimize exposure to chemicals.

2. Do not smell or taste chemicals.

3. Use a vacuum or pipette bulb - do not pipette by mouth.

4. Vent any experiment that may discharge toxic or noxious chemicals into a local exhaust device, (i.e., a chemical fume hood, slot or snorkel vent, paint booth).

5. Flammable, corrosive, or toxic volatile materials must be trapped when they are evaporated, for example with rotary evaporators or similar devices.

6. Use only those chemicals or biologic agents for which the protective and air movement quality of the available ventilation system(s) is appropriate.

7. Never underestimate the risk. Chemicals involving two or more substances may form reaction products that are significantly more toxic than the starting reactions. Assume that all substances of unknown toxicity are toxic.

8. Do not use an open flame to heat a flammable liquid or to carry out a distillation under reduced pressure.

9. When transferring flammable liquids in metal or conductive plastics equipment, use bonding and ground straps to avoid static-generated sparks.

10. Ventilation should be utilized to prevent the formation of flammable atmospheres.

11. Chemicals should only be used if their identity, characteristics, incompatibilities and potential reaction byproducts are known to the user and an SDS is available and has been reviewed.

4.3 PERSONAL HABITS AND CONDUCT IN THE LABORATORY

1. Eating, drinking, gum or tobacco chewing, and cosmetic application are not permitted in the laboratory.

2. Gloves shall be doffed, and hands washed thoroughly after laboratory chemical handling. Hand to mouth and face contact should be consciously minimized.

3. Smoking is not allowed in any laboratory or building on the BSU Campus.

4. Food may not be stored in a refrigerator that has been or is being used to store chemicals. Refrigerators storing chemicals should be so labeled.

5. Ice produced by ice machines for laboratory use shall not be used for beverages, food, or food storage.

6. No glassware or utensils that are used for laboratory operations shall be used for storage, handling, or consumption of food or beverages.

7. Hands should be washed before and after using the restrooms and before eating or smoking. Areas of exposed skin, i.e. forearms, should be washed frequently if there is potential of contact with chemicals.

8. Long hair, jewelry, and loose clothing should be confined or restrained.

9. Closed shoes, long sleeves, and long pants are the normal attire for laboratory work.

10. Keep work area clean and uncluttered, with chemicals and equipment being properly labeled and stored.

11. Deposit chemical waste in appropriately labeled receptacles and follow all other waste disposal procedures of the laboratory and this Chemical Hygiene Plan.

12. Access to exits, emergency equipment (fire extinguishers, eye washes), and utility controls (emergency gas shut-offs) shall never be blocked.

13. Ensure that all chemical containers bear the original manufacturers label and safety information and do not remove, damage, or deface that information. If damaged or removed, the original information must be reproduced and affixed to the container;

14. Working containers to which transfers of chemicals from a labeled container occur must be labeled with the product or solution common name, concentration, and the associated hazard warnings (pictograms, NFPA or HMIS labels).

15. Laboratory workers shall be alert to unsafe conditions and shall see that they are corrected when detected.

16. Any spills or accumulations of chemicals on work surfaces shall be removed as soon as possible using techniques that minimize residual surface contamination.

17. Fume hoods and biosafety cabinets must be used properly by ensuring working order. Fume hood sashes must be at proper height, and face remaining outside of the sash plane with work at least 6 inches within the hood sash plane. Do not use the hood for storage of chemicals or appurtenances. Verify the hood is working before use.

18. Be aware of the location and operation of all emergency equipment and protocols including eye washes, emergency showers, first aid and spill control kits, fire extinguishers, alarms, and emergency exit routes.

4.4 GLASSWARE

1. Inspect all glassware before use. Do not use broken, cracked, or badly scratched glassware.

2. Exercise great care in removing frozen glass connections such as stopcocks and ground glass stoppers.

3. When cutting or breaking glass tubing, protect your hands with a thick cloth or gloves. The break point should be well etched and scored. Make the break away from your body. Fire or grit polish the ends to remove sharp edges.

4. When inserting glass tubing into a rubber stopper, lubricate the surface of the glass tubing before insertion using water, glycerin, or stopcock grease.

4.5 ELECTRICALLY POWERED LABORATORY APPARATUS

1. Laboratory workers should know the basic procedures for removing a person from contact with a live electrical conductor.

2. Laboratories should be maintained so that all 110-Volt AC outlet receptacles accept a three-prong grounding plug.

3. Ground fault circuit interrupters (GFCIs) are recommended on selected indoor electric receptacles.

4. Outlets for ventilation hoods should be located outside of the hood to prevent any possible electrical sparks inside of the hood.

5. Electrical cords that provide power to the hood should not be in a path that the cord could accidentally become unplugged.

6. Overload protection should be provided on equipment that is likely to be left on and unattended for long periods of time.

7. Non-sparking induction motors and intrinsically safe equipment should be used in laboratories where volatile flammable materials may be present.

8. Any exposed moving parts (i.e., belts, pulleys) must be equipped with proper machine guards.

4.6 PRESSURIZED AND VACUUM OPERATIONS/COMPRESSED GAS

1. Never use a gas cylinder that does not have a clearly marked label as to its contents. Color-coding is not a reliable means of identification due to the colors from different suppliers.

2. All gas lines leading from a compressed gas supply should be clearly labeled stating: the identity of the gas, the laboratory served, and relevant emergency telephone numbers.

3. Compressed gas cylinders should always be firmly secured and placed so that the cylinder valve is easily accessible. Preferably two (2) straps or clamps should be used located at the 1/3 and 2/3 height of the cylinder.

4. Never bleed a cylinder completely empty. Leave a slight pressure to keep contaminants out of the cylinder.

5. Keep a minimal number of cylinders on hand. Always store empty cylinders as though they are full with caps on. Identify full and empty cylinders as such.

6. Prevent sparks, flames electrical apparatus, or circuits from meeting cylinders.

7. Store flammable and oxidizing gases either twenty (20) feet apart or separated by a half-hour fire wall, five feet high.

8. Use appropriate gauges, fittings, and materials compatible with the gas being handled.

9. No more than two (2) cylinders should be restrained by the same strap or chain.

4.7 HOUSEKEEPING

1. Lab areas are to be kept clean and uncluttered. This will help prevent spillage, breakage, personal injuries and unnecessary contact with chemicals.

2. Contaminated glassware should be cleaned daily.

3. Spills shall be cleaned up immediately from work areas and floors.

4. Doorways and walkways within the lab shall not be blocked or used for storage.

5. Access to exits, hallways, emergency equipment, and utility controls shall never be blocked.

6. Chemical containers shall be properly emptied and cleaned prior to disposal. Glass bottles will be uncapped, washed out with an appropriate solvent, triple rinsed with water and placed in a container for disposal.

7. Equipment and instrumentation shall be cleaned to remove spillage and contamination before repair or calibration service is requested, and service personnel will be informed of any hazardous contamination prior to servicing.

8. Laboratory fume hoods are provided for the safety of workers during laboratory exercises and research. These are not to be used for storage of chemicals and appurtenances and such obstacles should be minimized to prevent the disruption of air flow through the fume hood.

9. Chemicals and biologicals are not to be stored or placed on the floor unless in DOT approved packaging or safety containers.

10. If biological agents are being used, the area, surfaces, equipment, and devices must be decontaminated following established cleaning and decontamination procedures. Spills or releases must be cleaned up and the area promptly disinfected.

4.8 EMPLOYEE RESPONSIBILITIES

Laboratory employees are responsible for obtaining approval from the Laboratory Supervisor if any of the following operations will occur:

1. Laboratory operations that will be left unattended.

2. Modification of any established laboratory procedure.

3. Modification to laboratory chemical inventory.

4. Continuation of any laboratory procedure if unexpected results occur.

5. Use of particularly hazardous materials in locations where no engineering controls (e.g., fume hood) are to be used.

6. Any operation for which employees are not aware of the hazards or are confident in their ability to be adequately protected.

4.9 LABORATORY CONDITIONS AND EQUIPMENT

1. All laboratories and associated rooms or areas must always be maintained in a safe condition and be provided with adequate supplies and functioning equipment. Notify the Department, BSU Work Control, or the CHSO if any problems or concerns exist.

2. All laboratories must be provided with the following equipment, notices, or materials:

a. A sign at or on the entry door(s) providing information as to the nature of the hazards therein, the contact person(s), required PPE, and level of admissible entry.
b. Adequate general and local ventilation for the type of work being performed and the chemicals/biologicals in use. This includes chemical fume hoods and biological safety cabinets as necessary.
c. Fire extinguisher(s) if any flammable chemicals are stored or handled.
d. Eye wash / emergency shower(s) if corrosives, or other chemicals or activities make such necessary – this will be the case in nearly all laboratory and art studio/workshop operations.
e. Chemical and biological spill response kit(s). Special neutralizers may be necessary for some chemicals – aldehydes, hydrofluoric acid, etc.
f. Adequate containers for all chemical substances and waste that are compatible with the chemicals contained therein and properly labeled.
g. Safety Data Sheets (SDSs) for all chemical substances stored or used in the laboratory or associated area.
h. Biological or Pathogen Safety Data Sheets or similar biological information on any potentially infectious agents.
i. Standard Operating Procedures (SOPs) or lesson plans with similar information for the research or educational activities performed in the laboratory.
j. A copy (or readily available electronic version) of the BSU Chemical Hygiene Plan.
k. Laboratory safety training records.
l. An accurate written or electronic inventory of the chemicals and maximum quantities in the laboratory, studio, or storeroom.
m. A supply of chemical waste containers and lab waste labels.
n. As necessary, broken glass box(es), autoclave containers, biohazard waste bags or boxes, and sharps containers.

3. If windows are provided in the laboratory doors, those should not be covered to obscure vision into and out of the room. If necessary for tests or other short periods of time, the windows may be covered for that limited duration.

5.0 CHEMICAL PROCUREMENT, DISTRIBUTION AND STORAGE

5.1 PROCUREMENT

1. Before purchasing any new chemical, the following information is to be considered by the Laboratory Supervisor or Safety Officer (and the Department):

a. Regulatory status of the chemical.
b. Proper storage, labeling, and handling procedures.
c. Waste characteristics and proper disposal procedures.
d. Presence of adequate facilities to handle and store the material safely.
e. Adequate training for personnel handling the material.
f. Compatibility and reactivity of the chemical.
g. Whether chemicals of lesser toxicity, reactivity, or flammability may be substituted.

2. The decision to procure a chemical shall be a commitment to handle and use the chemical properly from initial receipt to ultimate disposal.

3. All Safety Data Sheets (SDSs) that are received with shipments to the lab shall be maintained on file at a convenient location as required under this CHP. An SDS should be requested and kept on file for all hazardous chemicals that are present or used in the lab. The chemical SDS should be entered in the Risk and Safety Solutions database if not already in the general database.

4. No chemical container should be accepted without an adequate identifying label. The label should include, at a minimum, the chemical name and an appropriate hazard warning and target organ effects.

5. All chemicals must have the approval of the Department Chairperson prior to purchase. Prior to purchasing approval, the following must be considered:

    a. Proper storage and handling procedures.
    b. Whether facilities are adequate to safely handle the material.
    c. Is there a designated area for use in the laboratory?

6. Avoid purchase of non-recyclable, "lecture" size, compressed gas bottles whenever possible due to the associated disposal costs for these non-recyclable containers.

7. Pyrophoric chemicals are not allowed to be stored or used in structures or laboratories that are not equipped with an automatic fire suppression system.

8. Be aware that many chemical substances and biological materials or agents are classified as *Hazardous Materials* under the U.S. Department of Transportation regulations at 49 CFR 171, et.seq. As such they must be classified, packaged, and labeled in accordance with those shipping regulations. Hazardous materials may not be shipped or received by persons who have not had the required DOT Hazardous Material Shipping training which must be repeated every 3 years.

5.2 HAZARDOUS CHEMICAL INVENTORY

Each laboratory will, at least annually, conduct and document a **Hazardous Chemical Inventory**. The inventory will always be accurately maintained. The inventory shall follow the *BSU Hazard Communication Program*. The inventory must include, at minimum: the chemical/product name, quantity, and the building name and room number.

The annual inventory process for chemicals stored in each laboratory, storage room, or waste management area shall ensure container integrity, label maintenance, chemical expiration dates, and provide for the proper segregation of incompatibles and for the disposal of spent, expired, unneeded, or unwanted chemicals, as well as those chemicals that may have become reactive.

5.3 Risk and Safety Solutions

BSU is a member of Risk and Safety Solutions platform which is a web-based application that can:

1. Maintain accurate inventory of chemicals and other materials.

2. Produce local, state and federal regulatory reports and increase compliance with fire, building safety, and other codes.

3. Enhance safety by quickly providing health, safety, and hazard information to lab personnel, emergency responders, risk managers, and EHS personnel.

4. Numerous search features by single or multiple criteria – hazard type, regulations, storage code, building/room location, department, etc.

5.4 DISTRIBUTION OF CHEMICALS AND BIOLOGICS

1. Chemicals to be hand-carried should be placed in a compatible outside container, a bottle carrier, flammable, combustible, or corrosive safety cans, or a corrosive-carrying bucket to protect against breakage, or spillage.

2. When a cart is used to transport chemicals, the cart should be stable under the load and easily manipulated. The chemicals should be secured on the cart in smaller containers or by other means as necessary. Secondary containment for liquids should be provided. Carts with integral secondary containment are preferred, but that can be otherwise provided using plastic tubs.

3. Use freight elevators whenever possible to avoid possible exposure to persons on passenger elevators. Do not use a passenger elevator if it is occupied by other persons at the time of transporting the chemical.

4. Verify that the material identity and known hazard information is indicated on the label when a hazardous chemical is transported.

5. The transportation of hazardous chemicals and wastes, by BSU employees in the performance of their University duties, is not normally regulated by the U.S. Department of Transportation, Hazardous Material Regulations. However, the shipping of hazardous materials to off-site locations by commercial carriers is regulated – including for the shipper. Contact the EHS Office for assistance.

5.5 STORAGE

1. Stored and working amounts of hazardous chemicals shall be kept to the minimum quantity necessary. Determine the quantity that should be stored in the laboratory by considering the capability of the laboratory workers, the extent of the safety features available, the location of the laboratory, the nature of the chemical operations, and the accessibility of the stockroom or storage room.

2. All primary containers should bear the original manufacturers label. All secondary chemical containers must have a legible and firmly attached label with, at a minimum, the name of the compound and appropriate hazard information.

3. Chemicals shall always be stored in closed containers with which they are chemically compatible.

4. Flammable substances must be stored in a safety cabinet or refrigerator designed for flammable liquid storage when required by the Indiana Fire Code (IFC) and International Fire Code (IFC) requirements or recommendations.

5. Compressed gas cylinders must always be properly secured. Cylinder caps should be in place on cylinders when not in use. Use straps, chains, or stands to support the cylinders. Label empty cylinders as such, replace the cylinder caps, and secure the containers as though they were fully charged. Remember that "empty" cylinders are designed to maintain some residual pressure and contents.

7. Incompatible chemicals must be segregated. At a minimum, acids, bases, flammables, and oxidizers should be segregated within the laboratory. Nitric acid should be stored separately from organics including solvents and organic acids such as acetic acid. Water reactive materials must be separated from all other chemicals. It is suggested to separate hazardous chemicals in storage following the *Stanford University Compatible Storage Group Classification System*.

8. Food and drink shall not be stored in refrigerators with chemicals, biological agents, or other material.

9. Refrigerators shall be appropriately labeled with respect to any chemical materials stored inside.

10. Highly toxic materials should be stored in a secure manner.

11. Glass or other breakable chemical containers must not be stored on the floor. The storage of any chemicals on the floor is discouraged unless in a secure and protected location away from foot traffic.

5.6 PRIOR APPROVALS REQUIRED

The Laboratory Safety Manager, or the Principal Investigator/Laboratory Supervisor (PI/LS), is responsible for providing institutional notifications and approvals as defined below:

1. Any purchase, possession or use of **Explosive Materials** (as defined by the US Department of Alcohol, Tobacco, Firearms and Explosives) must be approved by the EHS Office, University Public Safety Department, and local Fire Department. Pursuant to 18 U.S.C. 841(d) and 27 CFR 555.23, the Department must publish and revise at least annually in the **Federal Register** a list of explosives determined to be within the coverage of 18 U.S.C. 841 *et seq.* The list covers not only explosives, but also blasting agents and detonators, all of which are defined as explosive materials in that statute. The most recent List of Explosive Materials may be found through the ATF website at *http://www.atf.gov/publications/explosives-arson/*.

2. Any modification to a chemical fume hood or other laboratory local or general exhaust system must be reviewed and approved through Facilities Planning and Management and/or the EHS Office before it may be used to control exposure to hazardous materials.

3. Any use of hazardous chemicals that may present a hazardous condition due to inadequate ventilation must be reviewed and approved by the Chemical Health and Safety Officer prior to initiation of the operation.

4. Any research involving animals must be reviewed and approved by the BSU Institutional Animal Care and Use Committee (IACUC).

5. Any possession or use of radioactive materials or radiation-producing devices must be reviewed and approved by the Radiation Safety Officer.

6. Any possession or use of Controlled Substances listed as Scheduled drugs by the Drug Enforcement Agency (DEA) requires registration and licensing by the Indiana Board of Pharmacy and the DEA, and must be reported to EHS. The purchase or possession of any DEA List 1 or 2 chemicals (precursors) must be reported, and the same record-keeping and disposal procedures followed as required for Scheduled Controlled Substances. Additional recordkeeping, background checks, and security will also be required.

7. The use of any X-Ray equipment (XRF) or devices (TEM/SEM) must be registered with the Indiana State Department of Health, and EHS notified. Training, record-keeping, and dosimetry will be required in some instances for the use of this equipment.

8. Class 3B and Class 4 Laser systems are regulated by OSHA through an ANSI standard. Several training and safety precautions are required. EHS must be notified before any work with these lasers may begin.

9. Any research work involving human subjects must be reviewed and approved by the *Institutional Review Board (IRB)*.

10. Any purchase, possession or use of infectious agents or recombinant DNA molecules must be reviewed and approved by the BSU *Institutional Biosafety Committee*.

11. The Muncie Sanitary District Ordinance prohibits the discharge of many chemicals to the sewerage system. Treatment (e.g., neutralization, deactivation) or drain disposal of any waste must follow the Waste Disposal to Sinks and Drains guidelines.

12. Any use of respirators must be reviewed and approved by the BSU Respiratory Protection Program Administrator.

6.0 HAZARD IDENTIFICATION AND LABELING

The consistent and legible identification of chemical hazards and labeling of chemical containers is a major requirement of the OSHA *Laboratory Standard* and necessary for the safe hazard identification, transportation, handling, storage, use, and disposal of chemicals in the laboratory.

In laboratories the primary means of ensuring general hazard identification and recognition of specific chemical hazards is through the availability and review of Safety Data Sheets (SDSs) and

sound container labeling practices. It is very important to implement consistent labeling standards that all employees understand. To achieve this goal, container labeling shall follow the rules below:

6.1 GLOBALLY HARMONIZED SYSTEM

The UN *Globally Harmonized System of Hazard Classification and Labelling (GHS)* was adopted by the U.S. OSHA, having been adopted earlier by the U.S. Department of Transportation (U.S. DOT) and many other countries as an International system. This system replaces the former Material Safety Data Sheets (MSDSs) with a new, more standardized, Safety Data Sheet (SDS). The SDS's must have 16 Sections in a defined order with information found in each section to be consistent between the SDS's for different products and between different manufacturers and distributors regardless of country of origin.

6.2 SDSs AND GENERAL CHEMICAL LABELING REQUIREMENTS

SDSs for hazardous chemicals in a given laboratory shall be readily available to all employees in that laboratory by accessing an SDS database (Risk and Safety Solutions) or files with an accessible computer or with hard copies which are accessible and convenient. All laboratory personnel (and students) must be made aware of the location of the SDSs and the means for their rapid retrieval and review.

1. If a chemical substance is produced in the laboratory for another use outside of the laboratory, the SDS and labeling provisions of the *OSHA Hazard Communication Standard* and this CHP apply. The Laboratory Supervisor / Principal Investigator shall ensure these requirements are met.

2. The OSHA exemptions from labeling requirements for chemical transfers from a labeled container into a container that is intended only for the immediate use of the employee who performed the transfer do not apply in laboratory or studio situations. The number and variety of chemical containers and proximity of laboratory workers in laboratories, art studios, and workshops does not allow for use of that exemption for general workplaces.

3. Laboratory areas that have special or unusual hazards (radiation, x-ray, laser operations, flammable materials, biological hazards, etc.) should be posted with the appropriate warning signs. This signage may be in addition to the BSU Laboratory door signs to be affixed at entry ways to fulfill specific regulatory requirements.

6.3 ORIGINAL (PRIMARY) CONTAINER LABELS

Under the new OSHA GHS Standard, original (primary) containers of chemicals as purchased from the supplier or manufacturer must contain additional information. At a minimum, the following six elements must be provided on all primary containers from distributors that are shipped after December 1 of 2015:

1. Chemical identity or product name.

2. Appropriate hazard warnings (e.g., pictograms, symbols, statements, NFPA or HMIS label providing health, flammability, reactivity hazards, *etc.*).

3. Name and address of chemical manufacturer or responsible party.

4. Often, labels will include supplementary safety information including a written description of hazards, first aid, and disposal guidelines. If so, this information should be maintained.

5. Original container labels must be protected so that the identity of the contents and the hazards those contents present are known. All laboratory workers will ensure that original container labels are legible, not removed, or defaced, *unless the container is emptied of all original contents.*

6. If the original container label is damaged or defaced, it must be replaced with a label bearing the same information or be placed in a secondary container.

A new visual feature of the GHS labels is the pictogram. There are nine (9) of these symbols, each signifying different health or physical hazards. The new GHS pictograms may also be used to signify the hazards presented by the chemical or solution – either singly with a product identifier or on a label that also has space for the chemical name. Normally, the information necessary to complete any of these hazard warning systems is available on the chemical's Safety Data Sheet.

6.4 SECONDARY CONTAINER LABELS

Secondary or "working" containers must also be labeled with certain information under the new GHS Standard in all workplaces. At a minimum, the secondary container must (1) identify the chemical or solution by common name and (2) provide the appropriate hazard warnings for the substance.
Important Note: In laboratories and studios though, if a chemical substance is freshly prepared or is to be stored in a container other than the original manufacturer's bottle, the following information must also be available on the container (in addition to the above information):

1. Concentration or approximate purity (*e.g*., molarity, normality, percent, *etc*.).

2. Date of formulation.

3. Name and contact information of the user.

4. Chemical substances developed in the laboratory shall be assumed to be hazardous in the absence of other information. Chemical mixtures or solutions, unless reaction results are otherwise known or verified, should, at a minimum, be considered to retain the greatest hazard characteristics of each of its components.

6.5 WASTE LABELS

Laboratory Waste Labels: All wastes from laboratories, must undergo a "waste determination" by the generator or the Chemical Health and Safety Officer to determine whether or not they constitute a "hazardous waste" as defined by the Federal Resource Conservation and Recovery Act (RCRA). Significant penalties may be applied for failure to correctly make this determination or handle, store, and dispose of the wastes properly.

Under this approach, all chemical (and for our purposes, biological) wastes generated in laboratories are considered "LAB WASTES". Several rules apply to this program:

1. Laboratory personnel generating wastes must receive training in these procedures.

2. All *Lab Wastes* must be kept in closed containers that are compatible with the contents.

3. A *Lab Waste* labels must be affixed to the container when waste is first deposited into the container or at the time a container is determined to be a waste and the "start of accumulation date" recorded.

4. The *Lab Waste* label information must be completed so that lab staff, emergency responders, and waste managers are aware of the health and physical hazards presented by the waste and so that adequate information is conveyed to make the required hazardous waste determination.

5. All *Lab Waste* containers should be removed from the laboratory promptly.

6. Waste managers must have additional training to make the "hazardous waste determination".

The written *BSU Laboratory Waste Management Plan* and the more general *BSU Waste Management Guide* should also be reviewed.

Other Waste Labels: Other (non-hazardous) waste labels may be required or advisable (mercury-contaminated articles, PCB-containing items, etc.), for chemicals or items. The EHS Office should be contacted regarding the proper labeling of waste containers, as well as to arrange for their proper disposal.

Numerous other container labeling systems exist, some of which are proprietary or offered by chemical supply houses. Any of these labeling systems may be acceptable if they are better suited to lab or studio activities, so long as laboratory staff and students are trained in their use, the information conveyed, and its meaning.

The use of DOT labels to identify the hazards of a chemical may also be acceptable, and these are often received on shipping containers and gas cylinders. It is not recommended, however, that BSU personnel apply these labels for hazard recognition in the laboratory or workplace. These would normally only be applied by BSU staff who are DOT- trained in the shipping of hazardous materials and applied to containers or packages that will be shipped in commerce.

6.6 IDENTIFICATION OF OTHER HEIGHTENED CHEMICAL HAZARDS

Laboratory Safety Officers, PIs, or Laboratory Managers are also responsible for identifying the following hazardous chemicals (Particularly Hazardous Substances, and chemicals with unknown hazards and characteristics) that are required to be used in an area specially designated for such use:

1. Select Carcinogens.
2. Reproductive toxins.
3. Acute toxins.

4. Unknowns: Chemicals which are synthesized in the laboratory and which are byproduct for which the composition and/or health or physical hazards are unknown.

The identification of the first three of these categories of chemicals in the laboratory, *Select Carcinogens*, *Reproductive Toxins*, and *Compounds with a High Degree of Acute Toxicity,* is important, as under the *OSHA Laboratory Standard,* they are *Particularly Hazardous Substances*. These are substances that pose such significant threats to human health that the *Standard* requires special provisions to be established to prevent harmful exposure of researchers, faculty, or students.

7.0 EXPOSURE INCIDENTS AND MONITORING

All employees must follow the directions on the container, in the SDS or in the SOP for the actions or precautions to be taken in the event of an exposure to any chemical, biological, or radioactive substance. OSHA has established PELs for laboratory employees' exposures to certain regulated substances. Other organizations, including National Institutes for Occupational Safety and Health (NIOSH) and the American Conference for Governmental Industrial Hygienists (ACGIH) have also developed occupational exposure levels for specific substances that may be referenced. Exposure levels to certain chemical substances must be determined and monitored under certain circumstances according to OSHA regulations. A medical surveillance program may also need to be established for certain specified employees whose work assignments involve regular and frequent handling of toxicologically significant quantities of a chemical. The BSU Environmental Health and Safety Office is responsible for making determinations regarding the conduct of, or requirements for, area and/or personal exposure monitoring in specific circumstances.

PELs are specified in the **OSHA regulation 29 CFR 1910, Subpart Z Toxic and Hazardous Substances.** In addition, PELs are usually indicated on the SDS, and can be obtained from the BSU EHS Office.

These limits are defined as:

Eight-hour time weighted average (TWA)
: The average concentration to which an employee may be exposed to a chemical for up to eight hours per day, five days per week.

Short Term Exposure Limit (STEL)
: The average concentration to which an employee may be exposed to a chemical for up to fifteen minutes per day.

Ceiling (C) limit
: The maximum concentration to which an employee may be exposed to a chemical at any time.

Immediately Dangerous to Life or Health (IDLH)
: Condition that poses a threat of exposure to airborne contaminants when that exposure is likely to cause death or immediate or delayed permanent adverse health effects or prevent escape from such an environment. Workers should not be exposed to such an environment without proper personal protective equipment.

Often, a notation of *Skin* is printed with an exposure limit. This indicates that skin absorption of that chemical occurs readily which would contribute to an employee's overall exposure. Employee exposure to dermal absorption of chemical substances can often be monitored by biological testing.

7.1 EXPOSURE INCIDENTS

The University has established procedures for responding to job-related injuries. These procedures should be followed in the event of hazardous exposure due to the use of hazardous chemicals in the laboratory.

Examples of events or circumstances which might result in hazardous exposure include:

1. A spill, reaction, or leak which rapidly releases a hazardous chemical in an uncontrolled manner.
2. Direct skin or eye contact with a hazardous chemical.
3. Ingestion or inhalation of a chemical.

Examples of occurrences that may indicate exposure to a chemical include the following:

1. Symptoms such as headache, rash, nausea, tearing, irritation or redness of eyes, irritation of nose or throat, dizziness, loss of motor dexterity or judgement which disappear when the employee is removed from the exposure area and which reappear when the employee returns to working with the same hazardous chemical.
2. Two or more employees in the same laboratory work area exhibit similar symptoms.
3. Exposure monitoring indicates exposures above regulated or recommended limits.

If an employee is exposed to a chemical and the exposure results in an injury or illness that requires treatment by medical personnel:

1. Ensure that medical personnel see the individual immediately.
2. Provide a copy of the SDS to the medical personnel involved. Along with the SDS, provide any additional information you have on the chemical, it's concentration, and when, where, and how it was used and how the exposure occurred.
3. If the exposure was to a secondary chemical or compound, provide all available information from the labeled container(s).
4. Clean up any incidental spillage and/or notify the EHS Office so that the incident can be investigated, and any necessary spill control quickly undertaken.

7.2 ACCIDENT REPORTING

The following procedure governs the reporting of accidents, injuries, or illness incidents at Ball State University:

7.3 EXPOSURE REPORTING

In-addition to any injury reports for Human Resources, all incidents of hazardous exposure (including disposition) or accidents resulting in injury should be reported to, and documented by, the EHS Office. If no further assessment of the incident is deemed necessary, the reason for that decision should be included in the documentation. If the event is determined to require investigation, a formal exposure assessment or incident investigation will be initiated by the EHS. The purpose of an exposure assessment or investigation is not to determine whether there was a failure to follow proper procedures, but to identify the hazardous chemical(s) involved and determine whether an exposure might have caused harm to an employee. An exposure assessment may include the following items:

1. Interviews with the employee and/or complainant (if different).
2. Obtaining the following information:

    - The names of chemicals which may be involved.
    - Other chemicals used by the employee.
    - All chemicals used by others in the immediate area.
    - Other chemicals stored in the immediate area.
    - Symptoms exhibited or claimed by the employee comparison of symptoms with those referenced in the Safety Data Sheet for each involved chemical.
    - Observation of control measures and personal protective equipment in use during the event.
    - Notation of any on-site exposure monitoring performed before or during event.

3. Monitoring or sampling the air or surfaces in the area for suspect chemicals (when appropriate).
4. Determination of whether the current control measures were adequate during the time of the incident.
5. Completion of an **Incident Report** on the accident, exposure, release, or spill and submittal to the EHS Office.

8.0 MEDICAL PROGRAM

8.1 GENERAL PROVISIONS

The BSU Medical Program includes the following provisions and requirements:

1. An opportunity for medical surveillance, including medical consultation and follow-up shall be provided under the following circumstances:
    a. Where exposure monitoring of contaminant concentrations exceeds the action level for an OSHA regulated substance that has medical surveillance requirements;
    b. Whenever an employee is exposed to or working at contaminant concentrations exceeding OSHA PELs or other recognized exposure standards;
    c. Whenever a laboratory employee develops signs or symptoms that may be associated with a hazardous chemical, radiological, or biological agent to which the employee may have been exposed to in the laboratory;
    d. Whenever two (2) or more laboratory employees exhibit similar exposure symptoms following work or exposure;
    e. Whenever a spill, leak, or explosion result in the likelihood of a hazardous exposure, as determined by the Chemical Hygiene Officer;
    f. To all employees required to wear a respirator; and,
    g. To all emergency spill and exposure response team members.

2. All examinations shall be provided by, or under the supervision of, a licensed physician, at no cost to the employee, without loss of pay, and at a reasonable time and place. A physician experienced in occupational medicine shall be used whenever possible. Normally, the service is provided by the BSU Health Center.

3. First aid kits with contents approved by the EHS Department will be supplied and maintained and checked periodically for expired or missing items. Immediate medical assistance, if required, is available through the University Police (call 5-1111) or 911. It is strongly recommended that laboratory personnel maintain proficiency in First Aid, including CPR and Bloodborne Pathogen protocols.

4. Where medical consultations or examinations are provided, the examining physician shall be provided with the following information:

    a. The identity of the hazardous chemical(s) to which the employees may have been exposed.
    b. A description of the conditions under which the exposure occurred including quantitative exposure data, if available.
    c. A description of the signs and symptoms of exposure that the employee is experiencing, if any.

5. For examinations or consultations provided to employees, a written opinion from the examining physician shall be obtained by the Laboratory Supervisor and the Chemical Hygiene Officer. It shall include:

    a. Recommendations for further medical follow-up;
    b. Results of the examination and associated tests;
    c. Any medical condition revealed that places the employee at an increased risk of exposure to a hazardous substance found in the workplace; and,
    d. A statement that the employee has been informed of the results of the examination or consultation.

8.2 ACCIDENTS

1. Laboratory accidents that involve a personal injury that appears to require medical assistance should be immediately reported to the University Police (call 5-1111 or 911).

2. Personnel responding to any injury that appears to require emergency first aid shall notify the Laboratory Supervisor or Safety Officer at the first, safe opportunity.

3. An Incident Report form must be filed with the Department and the Chemical Hygiene Officer for any laboratory accident involving personal injury. A BSU Injury report must also be completed if any injury occurs for which medical attention beyond minor first aid is needed.

4. If a spill or incident represents a hazard to other building occupants, it should be reported immediately to them, the Chemical Hygiene Officer, and to the University Police.

5. Serious and reported accidents and near-accidents shall be investigated by the Department, Laboratory Supervisor, and the CHSO. Results will be communicated to the Department and will be recorded.

9.0 PERSONAL PROTECTIVE EQUIPMENT

The OSHA Laboratory Standard, and normal safety practices, require that before Personal Protective Equipment (PPE) is employed in laboratories that all efforts be made to first control the exposure of employees (and students) to contaminants or injury using engineering (i.e., ventilation, barriers, safety cabinets) or administrative controls (i.e., product substitution, proper housekeeping, work rotation, training).

The Laboratory Supervisor will be responsible for performing the necessary hazard assessments, specifying work practices and engineering controls where possible; and, when necessary, selecting additional personal protective equipment, acquiring approved equipment, maintaining availability, and establishing equipment cleaning and disposal procedures as defined in appropriate SOPs and the Job Hazard Assessment. Laboratory workers should be advised on the proper selection, use and limitations of personal protective equipment and be thoroughly trained in the use of such equipment, before they can use the equipment or be potentially exposed to any chemical hazards. Personal protective equipment, excluding safety glasses and shoes, should be removed when leaving work areas.

9.1 EYE PROTECTION

1. Appropriate eye protection should always be worn during laboratory work or potential exposure to hazardous chemicals

2. Before each use, eye and face protection equipment is to be inspected for damage, (i.e. cracks, severe scratches, debris). If deficiencies are noted, the equipment should be cleaned, repaired or replaced before use.

3. The BSU Eye Protection Policy applies to ALL persons: faculty, staff, students, and visitors. It is the responsibility of the faculty member or the area supervisor to enforce the Department protective eyewear policy. Failure to do so may subject an individual to personal liability.

9.2 GLOVES

1. Chemical resistant gloves shall be worn whenever the potential for hazardous skin contact exists. The safety data sheet (SDS) for the substance or glove selection charts should be referenced. Standard operating procedures should specify glove requirements, if any.

2. Suitable gloves must always be worn when working with hazardous substances. Choose gloves made of material known to be (or tested and found to be) resistant to permeation by the substance in use. In some cases, two gloves should be worn on each hand to ensure that no exposure will occur in the event of damage to, or compromise of, the outer glove.

3. Adequate quantities of gloves in the appropriate sizes and chemically resistant construction materials must be maintained for laboratory worker and student use.

4. Contaminated gloves shall be removed before touching surfaces outside the work area (i.e., doorknobs, faucet handles).

5. Before each use, gloves are to be inspected for damage and contamination, i.e., tears, punctures, discoloration. If deficiencies are noted, the gloves should be cleaned, repaired, or replaced before use.

6. Heat resistant gloves shall be used for handling hot objects. Asbestos containing gloves should not be used.

7. Abrasion resistant gloves (e.g. leather) should be worn for handling broken glass and other similar materials but should not be used to handle chemicals.

8. To prevent the unintentional spread of hazardous chemicals or biological, always remove gloves before handling objects such as doorknobs, phones, keyboards, pens, etc.

9.3 SHOES

1. No sandals or open-toed shoes shall be worn in the laboratory. Shoes worn should have non-skid soles and should have reasonable heel heights.

2. Safety shoes, toe guards or the equivalent should be worn if there is potential for injury from heavy objects. Safety shoes must meet the requirements of ANSI Z41 as adopted by OSHA.

3. Before each use, shoes should be inspected for damage, deterioration, contamination, (i.e., tears, punctures, discoloration). If deficiencies are noted, the shoes should be cleaned, repaired or replaced before use.

4. Any special shoe requirements or restrictions shall be specified in the Job Hazard Assessment or Standard Operating Procedures for the laboratory activity.

9.4 CLOTHING

1. Laboratory coats or aprons should be worn by laboratory employees and students whenever a reasonable risk of chemical exposure to skin or street clothing exists or when specified by SOPs. They should be kept in an appropriate clean storage area. Disposable laboratory coats are recommended when working with highly toxic materials such as select carcinogens, mutagens, or teratogens. Chemical resistance and permeability of the coats/aprons must be evaluated relative to the chemicals in use.

2. Fire-resistant (FR) lab coats should be worn whenever working with highly flammable or pyrophoric materials.

3. Clothing should be cleaned regularly. Clothing contaminated with hazardous materials must be either decontaminated before reuse or disposed of. Laboratory coats may be laundered commercially or on-site.

4. The commercial launderer of any contaminated work clothing shall be notified of any potentially contaminating substances.

5. Before each use, clothing is to be inspected for damage, deterioration, contamination, (i.e. tears, punctures, or discoloration). If deficiencies are noted, the clothing should be cleaned, repaired or replaced before use.

6. For some laboratory procedures or chemical usage, chemically resistant aprons or suits may be necessary based on the chemical characteristics and procedures involved.

7. Lab coats, gloves, and other chemical protective clothing must be removed before leaving the laboratory or studio work area.

9.5 HEARING PROTECTION

1. Hearing protection (noise attenuating ear muffs or plugs) are required whenever employees are exposed to 85 dBA or greater as an eight-hour time weighted average. If there is difficulty hearing a normal conversation at three (3) feet in the lab or work area, noise measurements should be taken.

2. Hearing protection is to be inspected before each use for proper fit and function, tears, and contamination. If deficiencies are noted, the hearing protector should be cleaned, repaired or replaced before use.

3. Refer to the *BSU Hearing Protection Program* for further information.

9.6 RESPIRATORS

All employees to be issued respirators for any reason must follow all the requirements set forth in the *BSU Respiratory Protection Program*. OSHA requirements exist for even the voluntary (not employer required) use of respirators in the workplace or laboratory. Refer to the *BSU Resipriatory Protection Program* for further information on the use of respirators and related fit-testing and medical evaluation requirements.

Respiratory hazards should be controlled at their point of generation by using engineering controls and good work practices. In keeping with this goal, the use of respirators as the primary means of protecting employees from airborne hazards is considered acceptable only in very specific situations and only with prior approval from the BSU Environmental Health and Safety Office. The routine use of respirators as a means of primary control is strongly discouraged.

Approval may be granted only for such situations as short-time temporary experiments where engineering controls are not feasible, and situations in which the use of respiratory protection is an added or supplemental control.

10.0 EMERGENCY EQUIPMENT

10.1 GENERAL

Emergency equipment for each laboratory should be located at visually apparent locations in the lab or as indicated on a floor plan for the laboratory, Department, or building. Each laboratory employee shall be familiar with the location, application and correct use, where applicable, of the following equipment.

1. Fire extinguishers

2. Fire alarms

3. Fire doors

4. Smoke detectors

5. Sprinkler or other fire suppression systems

6. Safety showers

7. Eye wash units

8. First aid kits

9. Spill Response Kits

10.2 SAFETY SHOWERS AND EYE WASHES

1. Safety showers and eye washes should be properly maintained and be easily accessible to the employees.

2. Inspections:

   a. Access should be checked daily by laboratory personnel.

   b. Eye wash units should be flushed and checked for adequate flow once each week by laboratory personnel who will run them until water is clear.

   c. Safety showers and eye wash function will also be flushed and tested by BSU laboratory personnel and EHS personnel during normal school terms. These units will be flushed and tested at other BSU Campus locations by EHS.

10.3 FIRE ALARMS

1. Access to fire alarms and their location must remain unobstructed.

2. Inspections of fire alarm and suppression systems will be conducted periodically by Facilities Planning and Maintenance or their contractors.

   a. Fire alarms should be conspicuously marked.

   b. Fire alarms will be tested by an outside testing agency.

   c. The inspections will be documented.

10.4 SMOKE OR HEAT DETECTORS

1. Should be installed and selected for the appropriate hazards per building codes, fire codes and fire insurer's requirements.

2. Inspections will be performed periodically by FPM or their contractors. The detection system should be tested to assure proper working order per manufacturer's and/or fire insurer's instructions.

3. Smoke alarms will be tested by an outside testing agency.

10.5 FIRST AID KITS

1. First aid kits will be available and maintained for treatment of minor injuries or for short term emergency treatment until medical assistance arrives.

2. The first aid kits will be kept adequately stocked and maintained.

3. First aid kits will be kept in an accessible and marked location in the laboratory or nearby as indicated in the laboratory layout.

4. Monthly inspections of the kit will be performed.

10.6 FIRE DOORS

1. Fire doors will be provided as required per building codes, fire codes and fire insurer's requirements.

2. Fire doors must not be blocked open and must be maintained and allowed to close properly.

3. Inspections will be conducted periodically by FPM.

10.7 FIRE SUPPRESSION SYSTEMS

1. The fire suppression system must be selected based on the hazards.

2. Inspections—periodically, by FPM or its contractors.
    a. All system components must be checked for physical condition.
    b. The system should be activated and checked as appropriate for the type of system.
    c. Fire suppression systems will be tested by an outside agency.
    d. The inspections should be documented.

10.8 EMERGENCY LIGHTING

1. Emergency lighting must be adequate to provide lighting for egress during an emergency or power failure.

2. Inspections--Annually by BSU FPM or contractors
    a. Emergency lighting must be activated to assure it is operational.
    b. Inspections should be documented.

10.9 CHEMICAL SPILL AND CONTAINMENT KITS

Each laboratory or Department area in which hazardous chemicals are used must maintain an appropriate spill control kit as supplied by the Department with consultation of the Chemical Hygiene Officer. Specific devices, neutralizers, or supplies may be needed for several specific chemicals that may be used in the laboratory including hydrofluoric acid, formaldehyde, mercury, etc. The location of the spill response equipment should be visually obvious or otherwise shown on the laboratory layout maintained for the laboratory. The necessary spill containment supplies will be identified by the BSU EHS Office in concert with the various Departments and laboratories.

11.0 EMERGENCY PROCEDURES

OSHA regulations at 29 CFR 1910, Subpart E, require all places of employment, including laboratories, whether free-standing or in a Department building, to have a written emergency action plan including evacuation plans. The laboratories must maintain a comprehensive safety program consistent with the guidelines outlined in the ACS publication, "*Safety in Academic Chemistry Laboratories*" and in accordance with applicable OSHA standards and regulations. Evacuation plans for the individual laboratories and/or the buildings in which they are housed, also showing the locations of emergency response equipment, should be posted in each laboratory.

Despite our commitment to safety, however, we recognize that accidents happen due to the very nature of the work undertaken in laboratories and support areas. Therefore, it is requisite that all personnel know what to do in the event of an emergency or accident. Personnel must be trained in what actions they should take in the event of a spill and, equally important, those actions that they should not take.

No emergency plan can include all the contingencies for every emergency. The most important component of emergency planning is prevention. Prevention measures include:

1. Planning - Investigating the hazardous aspects of experimentation and thinking about "worst case scenarios" can greatly reduce risk.

2. Employee training and facility inspection programs.

3. Engineering design. Using devices such as fume hoods for chemicals or interlocks for lasers will also reduce risk.

4. Administrative Controls. Adopting and using Standard Operating Procedures, enforcing the Eye Protection Policy in your lab, and maintaining a chemical inventory are examples of using administrative controls to prevent injury.

5. Using appropriate personal protective equipment.

If the injury requires more than a band-aid (as a rule), but is not life threatening, call the University Health Center at 285-8431. If the injury is potentially severe or life-threatening, call 285-1111 or 911. As noted earlier**,** the University has an internal policy for response and reporting of injuries and medical assistance. However, the priority is to obtain the emergency or medical response necessary.

The laboratory supervisor, safety office, principal investigator, or a designee, should meet the Emergency Personnel at the laboratory entrance and give them any relevant information regarding the emergency.

If medical attention is needed, you are expected to call for help. This help is available at all hours.

Employees and students must notify their immediate supervisor or instructor of all illnesses related to exposure to hazardous chemicals and hazards.

Obtain an accident report form from the Lab Supervisor, the Department, the CHSO, or the BSU EHS. Complete the form while including as many of the details of the accident as possible. Sign the form and return it to the Lab Supervisor and the EHS. This is an extremely important document because it serves to protect everyone involved.

If a **FIRE** occurs:

1. If a burning odor or smoke is present, pull a fire alarm to activate the fire alarm system.

2. If possible, shut off gas and pressurized air in your area or emergency stop button.

3. If you can help control the fire without personal danger and have received training, act with available fire extinguisher. If not, leave the area.

4. Never allow the fire to come between you and an exit.

5. Leave the building, checking as you leave to make sure everyone has left the immediate area. Close doors behind you to confine the fire.

6. Pull fire alarm to evacuate the building. Do not rely upon the alarm to alert the fire officials.

7. Once you have evacuated, Call 285-1111 to report location and the material burning if known. Answer all the questions that the dispatcher asks. Do not hang up until the dispatcher does first.

Meet the Emergency Personnel at the door and give them any relevant information.

Use common sense - a solvent fire in a beaker in a fume hood is easily extinguished by covering the beaker and depriving the fire of oxygen. Using a fire extinguisher on the same beaker may cause the solvent to spill, thus increasing the hazard!

If you are certain that you have extinguished the fire, call 285-1111 or 911 to report that the fire is out. If there is time, the fire truck response will be canceled, although fire safety officials will still come out to assess the damage and file a report.

You are expected to utilize good judgment - it may not be necessary to evacuate the building for a small incipient fire in the lab. If, however, there is any chance that the fire may endanger others or may cause serious damage, do not hesitate to pull the fire alarm. Never feel embarrassed about being over-cautious.

Immediately after a fire extinguisher has been used, call the BSU EHS Safety and Health and Fire Prevention Specialist 285-2815 to request that it be recharged or replaced.

If an **EMERGENCY** occurs:

The chemicals involved, quantities, flammability, toxicity, and several other factors will determine the appropriate response to a chemical spill or uncontrolled reaction. The *BSU Spill Preparedness and Response Plan* should be referenced for actions to be taken in the event of a spill or release of chemicals, radioactive materials, or etiologic agents.

11.1 HIGH HAZARD (MAJOR) EMERGENCY -

Chemical emergencies such as large spills, spills involving highly hazardous or flammable materials, releases of toxic or corrosive gases or substances should be treated as are other types of emergencies.

1. ISOLATE THE AREA and instruct non-responders to evacuate the laboratory area;
2. PULL THE FIRE ALARM AND EVACUATE THE BUILDING;
3. CALL UNIVERSITY POLICE AT 285-1111. Notify the dispatcher of the type and location of emergency; they will notify the appropriate emergency personnel.
4. If you do call 285-1111, be sure to meet or designate someone to meet the emergency personnel at the building entrance, stairwell, door, or the building loading dock. You can then give them any relevant information and direct them to the exact location of the emergency.
5. If possible, identify the materials involved and collect the relevant SDSs.
6. If there are injured victims, provide the minimum necessary first aid ONLY IF YOU ARE SURE THAT THERE IS NO DANGER TO YOURSELF. If aiding will endanger yourself, DO NOT attempt intervention; wait for emergency response personnel.

11.2 LOW HAZARD (MINOR) EMERGENCY -

If the emergency consists of only the following conditions, treat the emergency as low hazard.

1. Remove all ignition sources and obstacles from the area;
2. Retrieve the spill response kit;
3. Don the necessary protective apparel;
4. Isolate the area and have students and other persons relocate away from the incident
5. For a small spill, use an absorbent material or other materials from the spill response kit or other sources.
6. Use a treatment reagent that will neutralize the spill if available;
7. Surround the spill with the absorbent material to confine its area
8. Where blood or potentially infectious materials are involved, follow the *Universal Precautions* for blood-borne pathogen procedures.

9. Absorb the spilled chemical(s) with the absorbent material
10. The area should be decontaminated with soap and water after cleaning up. This should be followed by a prescribed disinfectant if potentially infectious agents are involved.
11. Residue should be placed in an appropriate container for subsequent treatment and waste characterization.
12. Contact the EHS Office for assistance if the spill or incident is beyond the training or capability of laboratory staff, or if the spill is of a nature or quantity where assistance is needed.

11.3 Building Evacuation Procedures:

Emergency response for all police, fire, and medical emergencies will be initiated by calling 285-1111 or 911.

Also refer to the BSU Emergency Response Guidelines prepared by the Crisis Management Team.

12.0 RECORD KEEPING

1. Accident /Incident records shall be retained by the Departments for five (5) years with copies forwarded to the Division of EHS.

2. Medical records shall be retained by the University for the duration of employment plus thirty years.

3. Industrial hygiene monitoring records, Safety Data Sheets (SDSs), sampling results, and other exposure records shall be maintained by the University for thirty years.

4. Laboratory inspection forms shall be maintained for at least 2 years.

5. Laboratory or Art safety training records must be maintained throughout the tenure of a student or faculty and for three (3) years beyond that time.

13.0 EMPLOYEE TRAINING

It will be the responsibility of the Laboratory Safety Officer, Supervisor, or Principal Investigator in charge of a laboratory to inform those employees, for whom they are responsible, of the potential hazards associated with the use of the specific chemicals and procedures performed within that laboratory. A training record must be signed to acknowledge awareness of the hazards associated with the specific laboratory. Training must include the following information:

1. The physical and health hazards of chemicals or biologicals within that specific laboratory;

2. The measures employees can take to protect themselves from these hazards, including work practices, engineering controls, and personal protective equipment; and,

3. The actions to be taken (or not taken) in the event of a spill or release of the chemical, biological, or radioactive material.

13.1 TRAINING

1. All laboratory employees must be trained on the hazards of the chemicals, radioactive materials and biological agents present in their work area.

2. The goal of the training program is to assure that all individuals at risk are adequately informed about the work in the laboratory, its risks, and what to do if an accident occurs.

3. This training shall be provided at the time of an employee's initial assignment to a work area where hazardous chemicals are present. It shall also be provided prior to assignments involving new exposure situations or working with new chemicals that present new exposure or safety hazards. The training shall be coordinated through the Laboratory Supervisor, or their designee, as appropriate. The CHSO/EHS Office may assist in such training or provide general laboratory safety training.

4. The training should specifically include:

    a. Handling hazardous chemicals or biological materials or infectious agents;
    b. Characteristics and hazards of the chemicals or materials being handled;
    c. Exposure signs and symptoms;
    d. Fire training--prevention and response;
    e. Emergency response and evacuation;
    f. Location and interpretation of SDS's;
    g. Engineering controls;
    h. First aid;
    i. Personal hygiene;
    j. Protective clothing;
    k. Chemical or infectious waste disposal;
    l. Contents and availability of the CHP;
    m. Review of PELs and action levels;
    n. Laboratory hazards specific to work area;
    o. Respirator protection and fit testing program;
    p. Identification and labeling of chemicals and wastes; and,
    q. SOPs for the chemicals or biologic materials
    r. The contents of the *OSHA Laboratory Standard*

5. Training will be documented with the following information:

    a. Trainer and/or media used,
    b. Content of Training,
    c. Attendees by signature,
    d. Date, and
    e. Location

14.0 WASTE MANAGEMENT AND DISPOSAL PROCEDURES

Ball State University is required to comply with Federal, State, and local regulations regarding the identification, labeling, accumulation, storage, packaging, transportation, and disposal of waste, spent, or unwanted chemicals. Due to the variety and quantity of materials handled, it is important

that all laboratories work closely with the BSU EHS Office to correctly identify, characterize, label, accumulate, and dispose of hazardous and non-hazardous chemicals and biologic wastes according to these requirements.

14.1 LABORATORY WASTE MANAGEMENT

The labels for laboratory wastes are essential, but only one component of the BSU *Laboratory Waste Management Plan*. The following is a summary, or checklist, of the major requirements of the EPA Laboratory Waste Management requirements as expressed in the BSU Plan.

With the exceptions noted below, the disposal of chemical wastes and byproducts down the drain to the sewer system is prohibited unless specifically approved by the BSU EHS Office and the Muncie Sanitary District.

Such practices can cause damage to the building drain piping, create hazards for service personnel, cause problems for the sewer lines and wastewater pumping stations, interfere with wastewater treatment facility operations, or pass through the treatment systems causing damage to the receiving waterways. Refer to the BSU document, ***Disposal of Laboratory Wastes: Requirements for Chemical Disposal to Sinks and Drains***.

A first and important step in proper waste management is to minimize or eliminate the types of wastes and volumes generated that require off-site disposal.

14.2 WASTE MINIMIZATION AND VOLUME REDUCTION PROCEDURES

A. General

1. Do not dispose of chemicals unnecessarily. If you have no further need of a reagent, solvent, preservative, or other material, determine whether your colleagues or other University Departments can use it.

2. Do not mix chemicals (e.g., halogenated solvents with non-halogenated solvents). Mixing of chemicals reduces the amount of materials that may be reused or redistributed and increases disposal costs. If possible, do not combine other chemicals with organic solvents. Acids, bases, heavy metals, carcinogens, oxidizers, cyanides, sulfides, pesticides, and <u>especially HALOGENATED ORGANIC SOLVENTS</u> (chloroform, methylene chloride, fluoride, etc.) should be collected in separate, labeled, and dated waste containers.

3. If possible recover, redistill, and reuse your <u>ORGANIC SOLVENTS.</u>

B. Non-Hazardous Waste

Certain chemicals may be disposed of as non-hazardous solid waste so long as they have not been mixed with other chemicals that may cause them to be listed or characteristic hazardous wastes. Non-hazardous and non-toxic wastes may be disposed with in regular solid waste containers, dumpsters, or roll-offs if they do not contain free liquids.

C. Drain Disposal

Treatment (e.g., neutralization) or drain disposal, even as described above, of any chemical waste must be performed in accordance with the BSU document, ***Disposal of Laboratory Wastes: Requirements for Chemical Disposal to Sinks and Drains***. Additional information on waste disposal may be obtained by calling the BSU Chemical Health and Safety Officer at 285-2807.

14.3 WASTE CHARACTERIZATION AND ACCUMULATION

The University does maintain on-site hazardous waste accumulation areas, so it is possible for the EHS Office to pick up wastes from laboratories between the scheduled waste vendor pickups and store them properly on campus in the interim. It is incumbent upon the individual Departments to accumulate and store their wastes, particularly hazardous wastes, safely and in accordance with federal, state, and local regulations until they are retrieved by the EHS Office. Contact the laboratory manager, or Chemical Health and Safety Officer in the EHS Office at 285-2807 for waste pickups.

14.4 OTHER WASTE MANAGEMENT GUIDES

The **BSU Waste Management Guide**, along with the ***Disposal of Laboratory Wastes: Requirements for Chemical Disposal to Sinks and Drains*** summarize the procedures for the identification, accumulation, handling, and disposal of hazardous and other waste materials on the BSU Campus. Any questions on these Guides or proper waste management should be directed to the BSU Chemical Health and Safety Officer at 285-2807.

15.0 FUME HOOD SAFETY AND VENTILATION

15.1 GENERAL GUIDELINES

1. General laboratory ventilation shall provide air flow into the laboratory from non-laboratory areas (negative pressure differential in the lab) and out to the exterior of the building.

2. Laboratory doors should remain closed, except for during egress and entrance.

3. Ball State Environmental Control should be notified if any deficiencies are noted in the heating, ventilation, or air conditioning systems serving the laboratory. Call Work Control at 285-5081.

15.2 HOOD USE

The laboratory fume hood is the major protective device available to laboratory workers. It is designed to capture chemicals that escape from their containers or apparatus and to remove them from the lab workers proximity and the laboratory environment before they can be inhaled. Chemical characteristics to be considered in requiring fume hood use are physical state, volatility, toxicity, flammability, eye and skin irritation, odor, and the potential for producing aerosols. A fume hood should be used if a proposed chemical procedure exhibits any one of these characteristics to a degree that:

1. Airborne concentrations might approach the action level (or permissible exposure limit);

2. Flammable vapors might approach one tenth of the lower explosion limit;

3. Materials of unknown toxicity are used or generated; or

4. The odor produced is annoying to laboratory occupants or adjacent units.

Procedures that can generally be carried out safely outside the fume hood include:

1. Water-based solutions of salts, dilute acids, bases, or other reagents,

2. Very low volatility liquids or solids,
3. Closed systems that do not allow significant escape to the laboratory environment, and

4. Extremely small quantities of otherwise problematic chemicals. The procedure itself must be evaluated for its potential to increase volatility or produce aerosols.

The hood sash should remain at the proper indicated sash height when it is in use (12-18 inches). When adjustments are needed to laboratory equipment or operations within the hood while chemical emissions are being produced, the hood sash should not be raised beyond the 80 feet per minute (fpm) indicator.

15.3 CHEMICAL FUME HOOD MAINTENANCE AND INSPECTIONS

The following are fundamental aspects of the BSU fume hood surveillance program:

1. Daily hood function inspections -- Daily (or "before each use") inspections by the Laboratory Safety Officer, faculty, or Principal Investigator should be conducted:

    a. Visually inspect the hood area for storage of materials and other visible blockages.

    b. Ensure that installed monitors and function switches and lights are operable and indicate the unit is functioning properly.

    c. If hood function indicating devices are not a part of your hood, or are not operational, place a 1 inch by 6-inch piece of soft tissue paper (e.g., KimWipe® or a ribbon), tinsel, or other light weight flow indicator at the hood opening and observe it for appropriate directional flow into the hood.

    d. If the hood is not operating properly, notify FPM Work Control 285-5081 for the necessary repairs. Label the subject fume hood as inoperable and do not allow its use. Contact the EHS Office to mark the unit as not usable pending repair.

2. Periodic hood function inspections

    The quality and quantity of ventilation is to be evaluated upon installation, annually, and whenever a change in local ventilation devices is made. These evaluations are the responsibility of EHS Office who should be contacted by the Department or Laboratory Manager if any hoods are found to be not working or of questionable performance.

    a. Inspections consist of measuring the face velocity of the hood and using a smoke stick to check its containment effectiveness visually. If the laboratory hood passes both the face velocity and smoke containment tests, then it is posted visually with

an updated certification date or label. If the hood does not pass the survey and the problem is so severe that it is unsafe for use, then it is labeled with a "DO NOT USE" sign. It is the responsibility of researchers and laboratory supervisors to notify the EHS Office if any hoods in their laboratory do not have an updated certification label.

b. If a hood fails inspection due to a problem that FPM, Environmental Control can correct (*e.g.,* a slipping fan belt, cracked duct work), then the Laboratory Supervisor or Department should submit a work order to Work Control to have it repaired. Work Control is to notify the BSU EHS Office when the repairs have been made, and the fume hood is then re-inspected. If a hood functions poorly due to incorrect use (*e.g.*, cluttered hoods) then the EHS Office will notify the Laboratory Supervisor and Department.

15.4 OTHER CONTAINMENT DEVICES

Biological Safety Cabinets

Biological Safety Cabinets (BSC), also known as tissue culture hoods or laminar flow hoods, are the primary means of containment for working safely with microorganisms. Cabinets are available that either exhaust to the outside or that recirculate HEPA filtered air to the laboratory. They are not to be used for working with volatile or hazardous chemicals unless they are specifically designed for that purpose and are properly vented. Generally, the only chemical work that should be done in a BSC is that which could be done safely on a bench top involving chemicals that will not damage the BSC or the HEPA filter. For proper cabinet selection and use see, the CDC publication, *Primary Containment for Biohazards*.

Glove Boxes or Gas Cabinets

Other containment devices, such as glove boxes or vented gas cabinets, may be required when it is necessary to provide an inert atmosphere for the chemical procedure taking place, when capture of any chemical emission is desirable, or when the standard laboratory fume hood does not provide adequate assurance that overexposure to a hazardous chemical will not occur. The presence of biological or radioactive materials may also mandate certain special containment devices. High strength barriers coupled with remote handling devices may be necessary for safe use of extremely shock sensitive or reactive chemicals.

16.0 WORK WITH PARTICULARLY HAZARDOUS MATERIALS

16.1 IDENTIFICATION OF PARTICULARLY HAZARDOUS SUBSTANCES

A. Identification and Classification of Particularly Hazardous Substances

There are some substances that pose such significant threats to human health that they are classified as **"Particularly Hazardous Substances"** (PHSs). The OSHA Laboratory Standard requires that special provisions be established to prevent the harmful exposure of researchers to PHSs. Three categories of *Particularly Hazardous Substances* are defined in the OSHA Lab Standard: Carcinogens, Reproductive Toxins, And Compounds with a High Degree of Acute Toxicity.

1. **Select Carcinogens**

Certain potent carcinogens are classified as "select carcinogens" and treated as PHSs. A select carcinogen is defined in the OSHA Lab Standard as a substance that meets one of the following criteria:

a. It is regulated by OSHA as a carcinogen
b. It is listed as "known to be a carcinogen" in the latest *Annual Report on Carcinogens* published by the National Toxicology Program (NTP)
c. It is listed under Group 1 ("carcinogenic to humans") by the *International Agency for Research on Cancer* (IARC)
d. It is listed under IARC Group 2A or 2B, ("probably carcinogenic to humans") or under the category "reasonably anticipated to be a carcinogen" by the NTP, *and* causes statistically significant tumor incidence in experimental animals after:

    i. inhalation exposure of 7 hours per day, 5 days per week, for a significant portion of a lifetime to dosages of less than 10 mg/m^3
    ii. repeated skin application of less than 300 mg/kg of body weight per week
    iii. oral dosages of less than 50 mg/kg of body weight per day

2. **Reproductive Toxins**

Reproductive toxins act during pregnancy and cause adverse effects on the fetus; these effects include embryo lethality (death of the fertilized egg, embryo or fetus), malformations (teratogenic effects), and postnatal functional defects. Examples of embryo toxins include thalidomide, and physical agents such as radiation. Embryo toxins have the greatest impact during the first trimester of pregnancy. Special caution is advised when working with all chemicals, especially those rapidly absorbed through the skin (*e.g.*, formamide, DMSO, *etc.*). Consultation with the laboratory supervisor and Occupational Health Services should be done before working with substances that are suspected to be reproductive toxins. As minimal precautions, the general procedures outlined below should be followed for work with such compounds.

3. **Compounds with a High Degree of Acute Toxicity**

Compounds that have a high degree of acute toxicity comprise a third category of particularly hazardous substances as defined by the OSHA Lab Standard. Acutely toxic agents include certain corrosive compounds, irritants, sensitizers (allergens), hepatotoxins, nephrotoxins, neurotoxins, agents that act on the hematopoietic systems, and agents which damage the lungs, skin, eyes, or mucous membranes.

In evaluating the hazards associated with work with toxic substances, it is important to note that several factors influence the response of individuals to exposure to a toxic compound. For example, people are rarely exposed to a single biologically active substance. With this point in mind, it is noteworthy that one toxin can influence the effect of a second. Several classic examples are the dramatically enhanced lung carcinogenicity of combined exposure to asbestos and tobacco smoke, and the potentiating activity of phorbol esters on skin carcinogenesis initiated by polycyclic hydrocarbons. There are insufficient data at present to identify which substances potentiate (or possibly even antagonize) the effects of others but is important for laboratory workers to be cognizant that such interactions can occur. This point always underscores the importance of maintaining good laboratory practices, and with all chemicals.

16.2 DESIGNATED AREAS

A key requirement of the *OSHA Laboratory Standard* is that all work with particularly hazardous substances be confined to designated areas. A designated area is defined as a laboratory, an area of a laboratory, or a device such as a laboratory hood that is posted with warning signs to ensure that all employees working in the area are informed of the hazardous substances in use there.

It is the responsibility of Laboratory Supervisors or Safety Officers to define the designated areas in their laboratories. These areas shall be posted with conspicuous signs.

16.3 GENERAL PROCEDURES FOR WORK WITH MODERATE-TO-HIGH CHRONIC TOXICITY OR HIGH ACUTE TOXICITY

The following general procedures should be followed in work with substances with **high acute toxicity—***i.e.* substances that can be fatal or cause serious damage to target organs as the result of a single exposure of short duration. These procedures should also be employed in laboratory operations using those **carcinogens and reproductive toxins** for which infrequent, small quantities do not constitute a significant hazard, but which can be dangerous to workers exposed to high concentrations or repeated small doses. A substance that is not known to cause cancer in humans, but which has shown statistically significant, but low, carcinogenic potency in animals, generally should also be handled according to the procedures outlined in this section. Work with more potent carcinogens and reproductive toxins requires the additional precautions described below.

1. Information

Before beginning a laboratory operation, each researcher should consult the appropriate literature for information about the toxic properties of the substances that will be used. The precautions and procedures described below should be followed if any of the substances to be used in significant quantities is known to have high acute or moderate chronic toxicity. If any of the substances being used is known to be highly toxic, it is desirable that there be at least two (2) people always present in the area. These procedures should also be followed if the toxicological properties of any of the substances being used or prepared are unknown. If any of the substances to be used or prepared are known to have high chronic toxicity (*e.g.*, compounds of certain heavy metals and strong carcinogens), then the precautions and procedures described below should be supplemented with the additional precautions outlined in this CHP.

2. Zero skin contact

Contact with the skin is a frequent mode of injury. Many toxic substances are absorbed through the skin with enough rapidity to produce systemic poisoning. *Avoid all skin contact with particularly hazardous substances* by using suitable protective apparel including the appropriate type of gloves or gauntlets (long gloves) and a suitable laboratory coat or apron which covers all exposed skin. Always wash your hands and arms with soap and water immediately after working with these materials. In the event of accidental skin contact, the affected areas should be flushed with water and medical attention should be obtained as soon as possible.

3. Restrict access to areas where particularly hazardous substances are in use

Those operations involving particularly hazardous substances in which there is the possibility of accidental release of harmful quantities of the toxic substance must be carried out in designated areas.

16.4 ADDITIONAL PROCEDURES FOR WORK WITH SUBSTANCES OF KNOWN HIGH CHRONIC TOXICITY

All the procedures and precautions described in the preceding section should be followed when working with substances known to have high chronic toxicity. In addition, when such substances are to be used in quantities more than a few milligrams to a few grams (depending on the hazard posed by the substance), the additional precautions described below should also be used. A substance that has caused cancer in humans or has shown high carcinogenic potency in test animals (but for which a regulatory standard has not been issued by OSHA) will generally require the use of these additional procedures. However, this determination will also depend on other factors, such as the physical form and the volatility of the substance, the kind and duration of exposure, and the amount of material to be used. Besides strong carcinogens, substances in the high chronic toxicity category include potent reproductive toxins and certain heavy metal compounds such as dimethylmercury and nickel carbonyl.

1. **Approvals**
   Permission must be obtained from your Department head, Laboratory Safety Officer, Principal Scientist or research supervisor prior to any work with substances of known high chronic toxicity. It is the supervisor's responsibility to approve all plans for experimental operations and waste disposal. For those chemicals that require prior approval, signed forms are required before conducting the project.

2. **Restrict access to areas where substances of high chronic toxicity are being used and stored**
   Any volatile substances having high chronic toxicity should be stored in a ventilated storage area in a secondary tray or container having enough capacity to contain the material should the primary container accidentally break. All containers of substances in this category should have labels that identify the contents and include a warning such as the following: ***WARNING! HIGH CHRONIC TOXICITY or CANCER SUSPECT AGENT***. Storage areas for substances in this category should be designated areas, and special signs should be posted if a special toxicity hazard exists. Except for materials that require refrigeration, substances of high chronic toxicity should be stored in areas maintained under negative pressure with respect to surrounding areas (*e.g.*, fume hoods).

3. **Medical Surveillance**
   If you anticipate being involved in continued experimentation with a substance of high chronic toxicity (*i.e.*, if you regularly use toxicologically significant quantities of such a substance three times a week), then a qualified physician should be consulted to determine whether it is advisable to establish a regular schedule of medical surveillance or biological monitoring.

17.0 RADIONUCLIDES

The Radiation Safety Committee and Radiation Safety Officer have strict policies and procedures for the handling, use and disposal of radioactive materials. These procedures shall be followed by anyone using radionuclides.

18.0 LABORATORY STANDARD OPERATING PROCEDURES (SOPs)

The development and adherence to Standard Operating Procedures (SOPs) is a significant requirement of the *OSHA Laboratory Standard*.

18.1 LABORATORY SPECIFIC SOPs (FOR DEPARTMENTAL DEVELOPMENT OF SOPs)

A laboratory-specific SOP is required to protect a laboratory worker in a commonly required and repeated laboratory procedure. Lab-specific SOPs should also be developed to indicate circumstances under which certain laboratory procedures, operations, or activities require prior approval from the Laboratory Supervisor before implementation (e.g., use of radioactive materials, bench top manipulation of volatile carcinogenic solvents without use of engineering controls, night or weekend work performed alone, reagent substitutions, etc.). The above chapters of this plan should be reviewed as part of the SOP development.

Laboratory specific Standard Operating Procedures should contain the following:

a. Process, Hazardous Chemical, or Hazard Class Identification
b. Describe Process, Hazardous Chemical or Hazard Class
c. Potential Hazards
d. Personal Protective Equipment
e. Engineering Controls
f. Special Handling and Storage Requirements
g. Spill and Accident Procedures
h. Decontamination Procedures
i. Waste Disposal Procedures
j. Material Safety Data Sheet Locations
k. Protocols

The completed laboratory-specific SOPs should be placed in common and known locations, along with other SOPs. Each laboratory is free to develop their own procedures, outlines, or SOP templates, but the above information should be included regardless of the format used by the Department or Laboratory.

19.0 REVIEW AND REVISION OF CHEMICAL HYGIENE PLAN

The BSU Chemical Hygiene Plan will be reviewed by the Environmental Health and Safety (EHS) Office and by the various Departments, Department Chairpersons, or Laboratory Safety Officers. Requests for changes to the document may be made at any time during the year. Any request for changes that are more than editorial in nature will be reviewed by the respective Departments and EHS Office, if appropriate. If the Department Chair or appointed Safety Officers agree that the requested change can be made, then an amendment to the CHP will be drafted. If the Department, or its Safety Committee, cannot find a means of accommodating the request, the individual will be notified. If the individual wants to pursue the requested modification further, the issues will be documented and presented to the BSU EHS Office for discussion.

LABORATORY SPECIFIC CHEMICAL HYGIENE PLAN INFORMATION

Department _____

Laboratory: Building _____ **Room #** _____

Laboratory Supervisor/Principal Investigator:

Name _____ **Phone** _____ **Email** _____

Laboratory Safety Manager (if different from the Supervisor/Principal Investigator):

Name _____**Phone** _____ **Email** _____

Ball State University
Emergency Information and Phone Numbers

For all emergencies, contact BSU Campus Police at 285-1111 or 911

Police Emergency	765-285-1111
Fire	765-285-1111
Ambulance / EMT	765-285-1111
Delaware County Emergency Management Agency	765-747-4888
University Health Center	765-285-8431
BSU Environmental Health and Safety Office	765-285-2807
Crisis Management Team Coordinator (after hours: 760-7791 or 778-0166)	765-285-8988
Facilities Planning & Management (Work Control)	765-285-5081

Location of *Chemical Spill Kit*: _____

Location of *First Aid Kit*: _____

Location of *Eyewash/Shower*: _____

Location of *Evacuation Route/Plan* (or attachment): _____

Location of SDSs: _____

The Emergency Information above should be included in this laboratory's CHP. Contact information, access restrictions, PPE requirements, and hazard warnings must appear on the door sign at each laboratory entrance.