

UNIVERSITY OF KANSAS
LAWRENCE CAMPUS

LABORATORY SAFETY
MANUAL

PART I

General Laboratory Safety Plan

November 2000 Revision

PART I

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*1) Laboratory Safety Plan Introduction

The purpose of this plan when implemented is to provide a safe laboratory (work or learning) environment for all individuals frequenting laboratories at the University of Kansas - Lawrence Campus.

This manual or plan, hereafter referred to as the University of Kansas Laboratory Safety Manual (LSM), has been designed, as a minimum, to meet the requirements established by federal and/or state regulations as applicable. Additionally, it is conceptually but not legally based upon the guidance that exposure to Hazardous Materials/radiations shall be kept "**As Low as Reasonably Achievable (ALARA)**". This plan covers general laboratory safety and the use of hazardous chemicals, hazardous organisms/biological agents, and machines or materials that emit ionizing radiation or laser beams (Radiation Generating Devices [RGDs.]).

For ease of use and efficiency, this Laboratory Safety Manual is divided into five parts. Part I consists of the safety requirements that apply in the use of all Hazardous Materials (HM) whether they be hazardous chemicals, biohazards or radioactive materials. Certain sections of Part I also apply to the use of Radiation Generating Devices. The Chemical Hygiene Plan consists of Part I and Part II. The Biosafety Plan consists of Part I and Part III plus the Bloodborne Pathogen Program and the Guidelines for Recombinant DNA use. The (Ionizing) Radiation Safety Plan consists of Part I and Part IV. This includes Radiation Generating Devices that produce ionizing radiation. The Laser Safety Plan includes selected portions of Part I and all of Part V.

This Manual addresses the standard operating procedures (SOPs) and engineered safety features required for safely using materials or radiation generating devices that are normally used in most laboratories. The manual also addresses the process by which **additional laboratory-specific safety plans (LSSPs)** will be developed when the hazardous materials and/or radiation generating devices pose higher levels of risks than those encountered in the average laboratory and by which the requirement for additional SOPs and/or engineered safety facilities/equipment will be identified and met. This provides a graded approach to safety in order not to burden all users with unnecessary requirements.

To accomplish this graded application of safety requirements, the types of hazards (described in the previous paragraph) and the **levels** of the hazards associated with each type will be identified for each laboratory through registration with the Environment, Health and Safety (EHS) Department. For each type of hazard (chemical, biohazard, radioactive materials, devices producing ionizing radiation, and devices producing laser beams), the magnitude of the risks associated with the hazard will be classified as Level I, II, III or IV. (increasing magnitude of risks). For Level III and IV activities, the Laboratory Supervisor is required to submit a proposed Laboratory-Specific Safety Plan(LSSP) to the EHS Department that addresses the additional SOPs, safety equipment and/or safety features beyond those in this Manual that are needed to establish a safe working environment. For Level III hazards, the proposed LSSP requires EHS approval before implementation. For Level IV hazards, the proposed

LSSP requires the approval of both ~~the~~ EHS and the appropriate subcommittee of the Laboratory Safety Committee before implementation. The content of the approved LSSP(s) becomes part of the University Safety Plan for that laboratory. It is at this level that training of users becomes specialized and specific rather than general. After an approved LSSP has been developed and EHS has verified by an appropriate inspection that all safety requirements in the approved LSSP have been addressed, EHS will provide a written Safety Authorization to the laboratory that permits the laboratory to implement its activities as specified in the LSSP and this Manual. Section 3.9 of Part I describes the process through which this graded approach will be implemented and maintained.

In general, other physical hazards are governed by the University Safety and Health Manual which is applicable to all students, employees, and visitors on campus.

Note 1: See 1.1.3 and 1.1.4 below for the identification of those sections of Part I that apply to Radiation Generating Devices.

Note 2: This Plan adopts the principle of "ALARA" from radiation safety regulations as a commitment in the use of all Hazardous Materials/radiations because it is the best expression of the goal of the overall safety program. It is the guideline for 'prudent practice' where specific written regulations do not cover a situation. The definition of ALARA given in the Glossary should be studied, understood and used as a qualitative guide to be applied at all times. (ALARA is a qualitative goal because a quantitative risk assessment is not possible or feasible in many cases. However, it is a commitment to avoid unnecessary exposure to Hazardous Materials.)

Note 3: It is recommended that first time users of this manual read the Glossary before proceeding to other parts of this manual. Definitions that are manual-specific are provided there. In some cases, exemptions are specified by the definition. The definition of "laboratory" is of special importance. Any person who is not sure whether his/her activities fall under the jurisdiction of this Laboratory Safety Manual; should contact the Environment, Health and Safety (EHS) Dept. for clarification.

1.1) Regulations

The regulatory mandate for a written safety plan arises from numerous regulations and standards that are associated several different federal and state agencies. The regulatory bases for each of the specific areas of this Laboratory Safety Manual are listed in this section.

1.1.1) Chemical Hygiene Plan (Part I + Part II of this Laboratory Safety Manual)

The University of Kansas Chemical Hygiene Plan must meet the requirements established by the Kansas Department of Human Resources-Division of Industrial Safety and Health (KDHR-ISH). This state agency requires public sector employers in Kansas who have laboratories to comply fully with the Federal Occupational Safety and Health Administration's (OSHA) Standard -- "Occupational Exposure to Hazardous Chemicals in Laboratories" (29 CFR 1910.1450). This regulation is also known as the OSHA Lab Standard. A copy of it may be found in Part I: APPENDIX 8.1.1. The KDHR-ISH directive for compliance with the OSHA Lab Standard (29 CFR 1910.1450) requires that the University develop and carry out the provisions of a written Chemical Hygiene Plan that has capabilities and components specified in section 1.2 below.

1.1.2. Biosafety Plan (Part I + Part III of this Laboratory Safety Manual + the Bloodborne Pathogen Program under Human Resources + the Recombinant DNA Guidelines of the Recombinant DNA Committee)

"Prudent Practice" as part of the regulatory framework requires that the capabilities and components specified in section 1.2 below be addressed in the Biosafety Plan. The National Research Council's "Biosafety in the Laboratory, Prudent Practices for the Handling and Disposal of Infectious Materials" and the CDC-NIH, "Biosafety in Microbiological and Biomedical Laboratories" are considered the prudent practice level of safety. The Bloodborne Pathogen Program is mandated by 29 CFR 1910.1030 and the national guidelines for work with Recombinant DNA are given in 51 FR 1695a.

Note: The Bloodborne Pathogen Program and the Recombinant DNA Guidelines were the only existing formal programs in Biosafety before this comprehensive program was designed. After this comprehensive program has been implemented, the intent is to rewrite those programs in the format of this Plan and incorporate them directly into the Plan. Until that revision takes place, these programs are independently administered.

¹1.1.3 (Ionizing) Radiation Safety Plan (Part I + Part IV of this Laboratory Safety Manual)

Kansas Regulations 28-35-133 through 363 under the Bureau of Air and Radiation Control, Kansas Department of Health and Environment specify that all work with ionizing radiation be covered under a license that requires the establishment of an adequate radiation safety program that is addressed by the capabilities and components specified in section 1.2 below. Not all parts of Part I are applicable to Radiation Generating Equipment. Sections or items of Part I marked with an * are applicable to all Radiation Generating Devices and those marked with a superscript I apply only to Radiation Generating Devices which produce ionizing radiation beams.

¹1.1.4 Laser Safety Plan (Selected sections of Part I + Part V of this Laboratory Safety Manual)

"Prudent Practice" as part of the regulatory framework requires that the capabilities and components specified in section 1.2 below be addressed in the Laser Safety Plan. ANSI Standard Z-136 provides the accepted basis for 'prudent practice' in the use of lasers. The applicable sections of Part I are marked either with an * or a superscript L.

1.1.5 Reserved (Non-Ionizing Radiation Safety Plan exclusive of lasers)

***1.2) Common Regulatory Requirements of the Safety Plans**

The Laboratory Safety Program, when implemented,:

*1.2.1) Shall be capable of protecting employees from health hazards associated with hazardous materials/radiations in the laboratory.

*1.2.2) Shall be capable of keeping employee chemical exposures below the OSHA permissible exposure limits specified in 29 CFR 1910 Subpart Z, radiation exposure below the limits specified in KR 28-35-135 through 363, and laser radiation exposure below the limits specified in ANSI-Z-136.

*1.2.2.1) Shall be capable of keeping ionizing radiation exposures "as low as reasonably achievable" (ALARA) and should consider ALARA as a guide in managing all other exposures to hazardous materials /radiations.

Note: Obviously, unnecessary exposure to hazardous materials/radiations is unacceptable.

*1.2.3) Shall be readily available to employees, employee representatives, and federal and state agencies.

*1.2.4) Shall include each of the following components and shall indicate specific measures the employer will take to protect laboratory employees, students, and/or visitors:

*1.2.4.1) The Standard Operating Procedures (See Glossary) relevant to safety and health considerations to be followed when laboratory work involves the use of Hazardous Materials/radiations.

*1.2.4.2) The criteria the employer will use to develop and implement control measures to reduce employee exposure. Includes engineered controls, facility design, administrative controls, use of personal protective equipment, and hygiene practices.

*1.2.4.3) The requirement that fume hoods, glove boxes and other protective equipment be functioning properly and the measures that will be taken to meet this requirement.

Note: This includes shielding and barrier requirements when either ionizing or laser radiations are involved

*1.2.4.4) The provisions for documented employee information and training.

*1.2.4.5) The circumstances under which a laboratory procedure shall require prior approval before implementation and the level at which approval shall be obtained.

*1.2.4.6) The provisions for medical consultations and examinations.

*1.2.4.7) Designation of personnel responsible for the implementation of the Chemical Hygiene Plan, Biosafety Plan, Radiation Safety Plan, and/or the Laser Safety Plan and the assignment of Chemical Hygiene Officer(s), Radiation Safety Officer(s), Biosafety Officer(s), and/or Laser Safety Officer(s) as appropriate.

*1.2.4.8) The special provisions for additional employee protection for work with "EHS Safety Authorization-Requiring Hazardous Materials", such as carcinogens, reproductive toxins, highly toxic substances, highly hazardous biological agents, and for work with most sources of ionizing radiation and certain classes of lasers. Protective provisions may include: designated or specially controlled areas, containment devices, shielding and barriers, waste removal, and decontamination procedures.

***1.3) Program Policy**

No faculty, staff, students, or visitors of the University of Kansas - Lawrence Campus shall engage in any laboratory activity or be present during such an activity that presents the risk of exposure to Hazardous Materials or Radiations without first having received the appropriate information and training as required by this program. This is necessary in order to protect the safety and health of University laboratory users/occupants/visitors and achieve the goals and requirements of the University's Safety and Health Policy. This includes "KU laboratory activities" performed off campus by KU personnel/students/visitors when such activities are not under the jurisdiction of another institution.

Note: Remember that Hazardous Materials include all biohazards.

***1.4) Program Application**

This program applies to all University of Kansas personnel (faculty and staff), students and visitors who are engaged in the laboratory use of hazardous materials or hazardous radiations or who occupy laboratories in which such use is carried out.

Note #1: This program, in general, does not apply to activities that are not associated with laboratories as defined in the Glossary. That is, with the exceptions given below, Facilities Operations, Student Housing, Administrative Offices, etc., are not subject to this manual. The safety requirements for the use of Hazardous Materials in settings other than "laboratories" are included in "The Employee's Safety and Health Manual." The requirements of that manual apply to all areas of the campus and to all personnel, students and visitors. However, any individuals who enter a laboratory as defined in the Glossary shall meet the requirements of an Authorized Occupant or Visitor as specified in this Laboratory Safety Manual (definitions in the Glossary). In addition, the possession and use by any KU personnel or, students or visitors of any radiation generating device or radioactive materials each as defined in the Glossary is subject to the provisions of the Laboratory Safety Manual. That is, no one on the Lawrence campus is exempt from this manual when these two types of hazards are involved.

Note #2: If a person feels that mutually exclusive procedures (conflicts) are mandated between and/or within the Laboratory Safety Manual and the Employee's Safety and Health Manual, he/she should contact the EHS staff for clarification or resolution of the perceived conflict. A unique condition or process could cause a particular mandated procedure not to be the safest procedure. The person shall then consult with the EHS staff for the establishment of an appropriate procedure that still meets regulatory requirements.

***1.5) Program Responsibilities**

The University is committed to safety. Responsibility for safety rests at all levels. General responsibilities at the higher administrative levels are described in the "Preface" of the Kansas University (Lawrence Campus) Safety Program. This section defines specific or more detailed responsibilities, as applicable, with respect to Laboratory Safety.

*1.5.1) Chairs, Unit Directors or Supervisors - (Chairpersons, Directors, or Supervisors of Academic, Research, or Support Units with laboratories as defined in the Glossary)

Chairs, Directors or Supervisors shall:

*1.5.1.1) Provide the unit resources necessary to develop, implement and maintain the unit safety program in compliance with the Kansas University Safety Program including this Laboratory Safety Manual.

*1.5.1.2) Be responsible for the over-all effectiveness of the unit safety program.

*1.5.1.3) Support and foster the development and maintenance of appropriate safety consciousness and attitudes in all individuals within the unit.

*1.5.1.4) Appoint a unit/departmental safety coordinator or accept the responsibilities of the Unit Safety Coordinator. See 1.5.3 and Glossary.

*1.5.2) Authorized Laboratory Supervisor (ALS) -

The Authorized Laboratory Supervisor shall:

*1.5.2.1) Provide the resources necessary to develop, implement and maintain the laboratory-specific safety program in compliance with the University Safety Program including this Laboratory Safety Manual.

Note: "Laboratory-specific safety program" refers to the safety program as carried out in all the laboratories and facilities for which the authorized laboratory supervisor is responsible.

*1.5.2.2) Be responsible for the over-all effectiveness of the laboratory-specific safety program.

*1.5.2.3) Support and foster the development and maintenance of appropriate safety consciousness and attitudes in all individuals within the laboratory.

*1.5.2.4) Appoint a Unit Safety Coordinator or accept the responsibilities of the Unit Safety Coordinator. See 1.5.3 and Glossary.

*1.5.3) Laboratory, Departmental or Unit Safety Coordinators

Note: In some cases, the Unit Safety Coordinator must have special qualifications and the nominee for Unit Safety Coordinator must be approved by the appropriate Safety Officer of EHS. In all cases, the Unit Safety Coordinator shall be an authorized user with respect to the area of safety in which the service will be given. See Glossary for definition and explanations.

The Unit Safety Coordinator shall:

*1.5.3.1) Assist the Laboratory/Unit/Departmental Supervisor in establishing and maintaining the Laboratory/Unit/Departmental laboratory safety program in compliance with the Kansas University Safety Program and this Laboratory Safety Manual.

*1.5.3.2) Monitor the effectiveness of the laboratory/unit/departmental safety program through reviews, audits and inspections.

Note: This includes identifying deficiencies and non-compliance, recommending remedial actions, and reporting findings to the Unit/Departmental Supervisor and, as needed, to EHS.

The Unit Safety Coordinator may:

*1.5.3.3) Be assigned additional responsibilities within the laboratory/unit/ departmental safety program by the laboratory/unit/departmental supervisor and as approved by the EHS when needed.

*1.5.4) Authorized Users (AU), Authorized Occupants (AO), and Laboratory Visitors (i.e., all laboratory occupants)

The Authorized Users, Authorized Occupants, and Laboratory Visitors shall:

*1.5.4.1) Comply with the applicable sections of the Kansas University Safety Program which includes this Laboratory Safety Manual and laboratory-specific Standard Operating Procedures (SOPs).

*1.5.4.2) Report unsafe conditions or actions to the Authorized Laboratory Supervisor or, if necessary, to EHS.

*1.5.5) Dept. of Environment, Health & Safety (EHS)

EHS shall:

1.5.5.1) Assist the university administration and the EHS Council and its committees in the development and maintenance of the laboratory safety program subject to the limits imposed by the university administration through allocation of resources and/or assigned responsibilities.

1.5.5.2) Assist in the development and maintenance of the training programs required within the Laboratory Safety Manual.

Note: Depending upon resources, legal requirements, and assigned responsibilities, EHS, in some cases, will provide the training and, in other cases, will assist units in establishing their own training programs.

1.5.5.3) Perform periodic and requested evaluations of the Laboratory Safety Program through appropriate reviews, audits and inspections and make recommendations for remedial actions and program revisions as needed at the appropriate level of administration.

1.5.5.4) Be responsible for documenting all changes and revisions to this Laboratory Safety Manual. Updated portions are to be archived and coded as to effective dates. New revisions are to be made available to the laboratories either electronically or through hard-copy.

1.5.5.5) Evaluate all proposed Laboratory-Specific Safety Plans for Level III and IV activities and provide recommendations concerning these to the Laboratory Supervisor and/or the appropriate subcommittees of the Laboratory Safety Committee as needed or required.

1.5.5.6) Provide the written Safety Authorizations implementing approved Laboratory-Specific Safety Plans.

*1.5.6) Laboratory Safety Committee

The Laboratory Safety Committee shall:

*1.5.6.1) With the assistance of EHS, develop and recommend to the EHS Council and provost a campus-wide laboratory safety program.

Note: Some sections of the Laboratory Safety Manual become part of state license or permit requirements and must be approved by the state before implementation or before a change in this manual is implemented.

*1.5.6.2) Periodically, but no less than annually, review the effectiveness of the Laboratory Safety Manual and Program and file a report with the EHS Council and PROVOST.

*1.5.6.3) Recommend remedial or corrective actions when deficiencies in the laboratory safety program or incidents of non-compliance with the Laboratory Safety Manual are identified by them or reported to them by EHS. (These recommendations shall be made at the appropriate level and in the appropriate sequence.)

*1.5.6.4) Evaluate and formally respond to laboratory safety questions addressed to the Laboratory Safety Committee by the EHS Council or the Provost.

*1.5.6.5) Be pro-active in investigating and evaluating laboratory safety on campus and making recommendations for improvements in the Laboratory Safety Manual.

1.5.6.6) Evaluate all proposed Laboratory-Specific Safety Plans for Level IV activities and provide recommendations concerning these to EHS and/or Laboratory Supervisor as needed or required and approve them when it is satisfied that safety has been appropriately addressed. Upon request by EHS, proposed LSSPs for Level III activities will also be evaluated.

2) Standard Operating Procedures in Laboratories with Hazardous Materials (HM)/Radiation Generating Devices (RGDs)

***2.1) Responsibilities for and under Standard Operating Procedure**

***2.1.1) Responsibilities of Laboratory Personnel/Students**

Laboratory Personnel/Students and other Occupants of Laboratories shall:

*2.1.1.1) Comply with the standard operating procedures identified or referenced in this chapter where Hazardous Materials are handled or stored or where Radiation Generating Devices are used.

Note: This means that all individuals frequenting a laboratory shall meet the qualifications of either an Authorized Occupant, a Visitor or an Authorized User for the Hazardous Materials/Radiation Generating Devices they will use. See Glossary for definitions. Hazardous Materials that meet the criteria for more than one type of hazard must be used as specified for all of the classes and categories of hazards involved. If there appear to be incompatible Standard Operating Procedures contact EHS for an evaluation and for recommendations.

Reminder: The word "shall" introduces a requirement for the identified type of individual (authorized occupant, authorized user, etc.) unless prior written approval from EHS and/or the Laboratory Safety Committee for an exception has been obtained. In some cases, medical conditions might require an exception. Alternative approaches to safety would be explored in such cases.

*2.1.2) Responsibilities of Unit Safety Coordinators (USC) and Authorized Laboratory Supervisors (ALS):

Authorized Laboratory Supervisors/Unit Safety Coordinators shall:

*2.1.2.1) Implement and follow, in their areas of responsibility, the Standard Operating Procedures (SOPs) identified in this chapter and the applicable hazard-specific Standard Operating Procedures of Parts II-V.

Note: This means that a laboratory supervisor shall be an Authorized Laboratory Supervisor if Hazardous Materials/radiations are used and the Unit Safety Coordinator shall be an Authorized User for each of the types of hazards for which the Unit Safety Coordinator has responsibilities .

*2.1.2.2) When/where necessary, develop and implement, in their areas of responsibility, more specific or stringent operating procedures than those specified in this manual and/or obtain required EHS Safety Authorizations and implement the conditions specified by those authorizations. (Section I-3.9 specifies when EHS Safety Authorizations are required.)

*2.1.2.3) Make available and properly maintain the facilities/equipment required for compliance with these procedures by the authorized users.

2.1.3) Responsibilities of Environment, Health and Safety Department

EHS shall:

2.1.3.1) Develop and recommend to the Laboratory Safety Committee general, campus-wide, standard operating procedures for inclusion in this Laboratory Safety Manual. Note: the appropriate EHS personnel work with their designated subcommittees of the Laboratory Safety Committee.

2.1.3.2) Review the existing Standard Operating Procedure on a routine basis and recommend changes to the appropriate subcommittees of the Laboratory Safety Committee as necessary and appropriate.

2.1.3.3) Review proposed Laboratory-Specific Safety Plans for Level III labs and either approve, approve with additional conditions or disapprove such proposed LSSPs.

2.1.3.4) Review proposed Laboratory-Specific Safety Plans for Level IV activities and forward with recommendations to the appropriate subcommittee of the Laboratory Safety Committee.

2.1.3.5) Provide assistance to Unit Safety Coordinators and Laboratory Supervisors in implementing these general, campus-wide, standard operating procedures in their respective areas of responsibility.

2.1.3.6) Provide assistance to Unit Safety Coordinators and Laboratory Supervisors in developing and implementing more laboratory-specific or stringent operating procedures in their areas of responsibility when/where necessary or in the preparation of required Laboratory-Specific Safety Plans and their implementation upon approval.

2.1.4) Responsibilities of the Laboratory Safety Committee (LSC):

The Laboratory Safety Committee:

2.1.4.1) Shall review and approve recommended general, campus-wide, standard operating procedures or changes for inclusion in this Laboratory Safety Manual. May also assist in the development of these Standard Operating Procedures.

2.1.4.2) May assist with the development, review, and/or approve more laboratory-specific or stringent operating procedures, as requested.

2.1.4.3) Shall review proposed Laboratory-Specific Safety Plans for Level IV labs and recommend either approval, approval with additional conditions or disapproval of such proposed LSSPs. (Provide such review of proposed LSSPs for Level III labs when EHS or a Laboratory Supervisor requests such review.)

Note: The Laboratory Safety Committee shall have four standing subcommittees-- Chemical Hygiene/Safety, Biosafety, Radiation Safety, and Laser Safety. When required under regulations, the subcommittees function as a committee on their own. For example, responsibilities assigned to the Radiation Safety Committee by regulations and KU license cannot be assumed by the committee at large. For those functions the subcommittee on Radiation Safety is the Radiation Safety Committee with independent authority. The function of the committee at large is to provide an integrated, comprehensive and efficient safety plan and to monitor its effectiveness.

***2.2) Universal Procurement Procedures for Hazardous Materials (HM)/Radiation Generating Devices (RGDs)**

The Authorized User shall:

2.2.1) Estimate the amount of each hazardous material (HM) required by carefully preplanning the work task or experiment.

*2.2.2) Select only those Hazardous Materials or Radiation Generating Devices for which the available ventilation/ containment/ shielding is adequate.

*2.2.3) Obtain approval at the required level before ordering Hazardous Materials or a Radiation Generating Device.

Note 1: Authorized Users shall always obtain approval from the Authorized Laboratory Supervisor (ALS) before ordering Hazardous Materials. In some cases the Authorized Laboratory Supervisor may grant standing approval for re-orders. Initial orders always require Authorized Laboratory Supervisor approval.

*Note 2: For some Hazardous Materials and all Radiation Generating Devices, prior approval by EHS and/or appropriate subcommittee is required for each order. Laboratory-Specific Safety Plans approved by the EHS Dept. and the appropriate subcommittee are required in some cases before the initial order. For example, see Chapter 3 of Part II for EHS Safety Authorization- Requiring Hazardous Chemicals, Chapter 3 of Part III for EHS Safety Authorization- Requiring Biohazards, Chapter 4 of Part IV for radioactive materials and Chapter 3 of Part V for Lasers. In such cases the Authorized User/Authorized Laboratory Supervisor shall comply with all conditions specified in the Laboratory-Specific Safety Plans in addition to this Laboratory Safety Manual. See 2.2.8 below.

2.2.4) Obtain and review appropriate hazard information (Material Safety Data Sheet, Safety Data Sheets, Standards-) prior to ordering new or unusual Hazardous Materials.

Reminder: Users must be Authorized Users for all materials that will be used before such materials arrive in the laboratory.

2.2.5) Order Hazardous Materials in smallest quantity possible.

The Authorized Laboratory Supervisor shall:

*2.2.6) Order the least Hazardous Materials/Radiation Generating Devices required for anticipated projects.

*2.2.7) Before ordering any Hazardous Materials or Radiation Generating Devices, prepare for the proper storage, location and use of the Hazardous Materials or Radiation Generating Device as applicable. (For example, design and location of storage facilities, shielding and location of Radiation Generating Devices, posting of appropriate warning signs, acquisition of necessary personal protective equipment, dissemination of proper handling information to all laboratory users/occupants/visitors and provision for and completion of required training.) See Chapter 3 (Hazard Control Measures) of this Part I for additional guidance.

*2.2.8) Before ordering any Hazardous Materials or Radiation Generating Devices, possesses the required approval or Laboratory-Specific Safety Plan for the Hazardous Materials/Radiation Generating Devices.

2.3) Hazardous Material (HM) Receipt and Distribution

The Authorized User shall:

2.3.1) Not accept any Hazardous Materials whose container is not properly labeled or is damaged.

2.3.2) Review and observe specific information (container label, Material Safety Data Sheet and/or Safety Data Sheets) on the safe handling and storage of the Hazardous Materials.

2.3.3) Place all Hazardous Material containers that are to be delivered by hand within a shock-resistant carrying container or bucket.

2.3.4) Verify that the load is stable and secure before transporting Hazardous Materials by cart.

2.3.5) In buildings, whenever possible, transport Hazardous Materials on freight-only elevators to avoid potential exposure to public.

2.3.6) Contact the EHS Department (864-4089) when Hazardous Materials need to be transported in a vehicle on campus.

2.4) Hazardous Materials (HM) Storage

The proper storage of Hazardous Materials is a complicated subject due to the diversity of individual physical properties of the numerous Hazardous Materials that may be present in the laboratory environment. Some general procedures for safe Hazardous Materials storage are listed below. They are not intended to be all inclusive, but serve as minimum safety procedures to follow when storing Hazardous Materials. It may be necessary to adopt more specific procedures for particular laboratory situations. Specific instructions on Hazardous Materials storage may be obtained from the Material Safety Data Sheet, container label, or by contacting the EHS Dept. (864-4089).

The Authorized User (AU) shall:

- 2.4.1) Verify that all containers are in good condition and properly labeled.
- 2.4.2) Store Hazardous Materials appropriately so that incompatible materials are separated.
 - 2.4.2.1) Segregate Hazardous Materials in storage by the appropriate hazard class.

EHS-recommended segregation schematic follows:

- a) Compressed gases (separate incompatible gases)
- b) Flammable and Combustible Liquids
- c) Flammable Solids, Water Reactive Chemicals, Spontaneously Combustible (Air) Reactive Chemicals
- d) Corrosives (Separate Acids from Bases)
- e) Oxidizers & Organic Peroxides
- f) Poisonous/Toxic Compounds
- g) Explosive Compounds
- h) Biohazards
- i) Radioactive Materials

2.4.3) Segregate/separate Hazardous Materials by physical means (walls, dikes, berms, secondary containers) if required. (Requirements will be established on a case-by-case basis.)

2.4.4) Secure all storage shelves and cabinets to prevent tipping.

2.4.5) Establish and maintain storage locations that are dry and adequately ventilated.

2.4.6) Store Hazardous Materials secured against unauthorized access when required by regulations.

Note: All radioactive materials and most other "EHS Safety Authorization-Requiring Hazardous Materials" [see Glossary] are subject to this requirement. When such storage is not provided, the room that contains the materials has to have an Authorized User present to prevent access to the materials whenever the room is not locked.

The Authorized User should:

2.4.7) Select the storage locations for easy and safe access.

2.4.8) Have adequate supplies of spill control/cleanup absorbents on hand.

***2.5) Universal Safety Practices/Conduct in Laboratories with Hazardous Materials (HM)/Radiation Generating Devices (RGDs)**

*The proper use of Hazardous Materials/Radiation Generating Device is also a complicated subject due to the diversity of hazards associated with the numerous Hazardous Materials and Radiation Generating Devices that may be used in the laboratory environment. Some general procedures for safe Hazardous Materials/Radiation Generating Device usage are provided in this section. They are not intended to be all inclusive, but serve as minimum safety procedures to be followed where Hazardous Materials/Radiation Generating Devices are used or handled. Specific safety instructions for using specific Hazardous Materials may be obtained from the Material Safety Data Sheet, container label, or by contacting EHS Dept. For Radiation Generating Devices, the manuals for the equipment are a good source of safety information in addition to the references given in sections 1.1.3 and 1.1.4 of this Part.

Note: The term "use" includes all handling of Hazardous Materials and any use, re-location or repair of Radiation Generating Devices.

***2.5.1) Restrictions Applicable to Visitors, Non-Laboratory Personnel and/or Non-Laboratory Authorized Occupants in Rooms with Hazardous Materials**

***2.5.1.1) Restrictions for Rooms posted with Level I or II Hazards (See 3.4.6 and Glossary.)**

Visitors may:

- a) Walk to an inner office (if there is one) by the closest route without touching anything in route.
- b) Enter the room and remain near the entrance until an Authorized User has been requested and established as an escort.

Visitors shall not:

- c) Touch or handle any items, furniture, or equipment in the room.

Authorized Users shall:

- d) Briefly inform the visitor of the nature of the hazards in the room, provide any special laboratory-specific instructions if needed, and supervise the visitor in such a fashion that exposure to Hazardous Materials is avoided if possible. Visitors are not allowed if the exposure is likely to be at a level greater than that permitted for the general public.

Authorized Occupants who are not laboratory personnel/students shall:

e) Not touch the surfaces of laboratory bench tops, hoods, safety cabinets, etc., or items in or on such furniture and equipment in Level I and II laboratories unless such contact is required to perform the necessary service and the Authorized Laboratory Supervisor has specifically cleared the equipment to be serviced as being free of contamination and has provided access to that equipment by removing all potentially contaminated materials and containers that may be in the way.

Note 1: In laboratories posted at Level I or II, the Authorized Laboratory Supervisor need not be present with the Authorized Occupant provided that the Authorized Laboratory Supervisor has certified to the supervisor of the Authorized Occupant that the service may be provided without risk of exposure to Hazardous Materials.

Reminder: Housekeeping activities in laboratories with Hazardous Materials are restricted to cleaning floors and removing normal uncontaminated trash. Office personnel also shall not touch items and surfaces of equipment/furniture in the laboratory.

f) Not touch or handle any containers clearly labeled as containing hazardous chemicals, hazardous biological agents, or radioactive materials.

Note: This restriction applies to all Authorized Occupants. Authorized Occupants shall not move or manipulate such containers and shall not be asked to do so by Authorized Users or the Authorized Laboratory Supervisor.

*2.5.1.2) Restrictions for Rooms posted with Level III and IV Hazards (See 3.4.6 and Glossary.)

Visitors shall:

- a) Knock on the door and wait for an escort and shall not enter the room until a qualified escort is available.

- b) Not touch or handle any items, furniture, or equipment in the room.

Authorized Laboratory Supervisors shall:

- c) Briefly inform the visitor of the nature of the hazards in the room, provide any special laboratory-specific instructions if needed, and supervise the visitor in such a fashion that exposure to Hazardous Materials is avoided if possible. Visitors are not allowed if the exposure is likely to be at a level greater than that permitted for the general public.

Authorized Occupants for Level I & II labs and not part of the laboratory staff shall:

- d) Not enter a laboratory posted as containing Level III or IV hazards unless accompanied by the Authorized Laboratory Supervisor (or EHS-Approved designee as posted) who is responsible for guiding the activity of the individual in such a fashion that contact with Hazardous Materials is avoided.

- e) Not touch any items in the laboratory or any surfaces associated with laboratory benches, storage cabinets, hoods, and other equipment in rooms posted as containing Level III or IV hazards unless the Authorized Laboratory Supervisor (or EHS-approved designee as posted) has certified the items or surfaces that need to be serviced as being free from contamination with Hazardous Materials and is present to supervise the individual so that other hazards will not be encountered by the individual.

Explanatory Note: For Level III or IV laboratories, there are no non-laboratory Authorized Occupants because unsupervised occupancy and/or activities by such individuals are prohibited. Furthermore, only individuals who have the training required for an Authorized User in Level I & II labs may perform supervised work in a Level III or IV lab. All individuals not assigned to such a lab must be under the direct supervision of the Authorized Laboratory Supervisor (or EHS-approved designee as posted) while in a level III or IV lab.

2.5.2) Restrictions Applicable to Individuals who are Authorized Occupants in Rooms with Hazardous Materials (All levels)

Authorized Occupants shall:

2.5.2.1) Not touch or handle any containers clearly labeled as containing hazardous chemicals, biohazards, or radioactive materials for which they have not been certified as an Authorized User.

2.5.2.2) Not touch or handle any equipment, containers, or other items that are in an area that has been marked and labeled as one in which Hazardous Materials are being used for which the Authorized Occupant has not been certified as an Authorized User.

Note: This means that no equipment or materials may ever be removed from such an area by the Authorized Occupant. The Authorized User for that area must decontaminate the materials/equipment, remove labels and markings and place them outside the area before an Authorized Occupant may have access to them.

Note: An example of an Authorized Occupant is an individual who is an Authorized User of hazardous chemicals but is not an Authorized User of Radioactive Materials. Such an Authorized Occupant may not handle radioactive materials and may not remove items from an area reserved for work with radioactive materials even if the item is unlabeled.

*2.5.3) General Procedures

Authorized Users and Authorized Occupants shall (unless “should” is introduced):

*2.5.3.1) Review and be familiar with applicable emergency procedures. See section 2.9 and posted laboratory-specific emergency procedures.

Note: For Hazardous Materials this includes emergency spill procedures. For Radiation Generating Devices this includes safe shut down procedures.

*2.5.3.2) Know the locations of available safety equipment and how to use such equipment.

*2.5.3.3) Not engage in behavior that compromises safety.

a) Not throw objects, run, push individuals, play practical jokes, or engage in any other "horseplay." Note: Sudden loud noises are also to be avoided.

2.5.3.4) Not eat, drink, smoke, chew gum, or apply cosmetics, or store these items in areas where Hazardous Materials are stored or used.

These items have been known to become contaminated from airborne Hazardous Materials or from contacting contaminated work surfaces, thus allowing the hazardous contaminant to be ingested, inhaled, or absorbed through the skin.

Note 1: No one, including authorized occupants or visitors, is permitted to introduce into the laboratory items that are meant to be ingested or applied to the body or the containers for such items. The only exception is the following: If access to a room that is not an authorized laboratory--for example, an office--is not available except through an authorized laboratory, items may be taken directly to such a room by the nearest and safest route. Such items may not be placed on any surface in the laboratory during that transfer through the laboratory.

Note 2: By habit, there should be no “hand to face or body” contact while working with Hazardous Materials.

Note 3: “Area” includes the whole room in which the Hazardous Materials are used.

Reminder: Smoking is not allowed in any university building.

Authorized Users and Authorized Occupants shall (unless “should” is introduced):

*2.5.3.5) Practice good housekeeping

Examples: Lab benches, desks, and other facilities should be clean, neat and uncluttered. Drawers and cabinets should be closed when not in use. Aisles and exits must be free of obstructions. Spilled materials and broken glassware must be carefully and promptly cleaned up. The floors must be kept free of materials that might cause slipping.

Note: Authorized Occupants, upon noticing spilled Hazardous Materials or contaminated broken glassware, should inform an authorized user about the spill and request a “clean up.” They shall not perform such clean up themselves. Authorized Occupants shall clean up non hazardous spills (water, for example) or uncontaminated broken objects.

*2.5.3.6) Dispose of all sharp objects ("sharps"), such as broken glassware and hypodermic needles, in an EHS-approved container. There are no exceptions to this requirement. Go to I-6.2.1.4 for detailed procedures for handling this type of waste.

Note: This applies to Authorized Occupants who have created uncontaminated sharp objects. Authorized Occupants should request Authorized Users to take care of the disposal of potentially contaminated sharps and shall not handle such items if they are potentially contaminated.:-

2.5.3.7) Practice good personal hygiene by always washing hands and face after handling Hazardous Materials or working in a room with Hazardous Materials and before leaving the area for eating, drinking, or smoking.

Authorized Users and Authorized Occupants shall (unless “should” is introduced):

2.5.3.8) Wear appropriate clothing and shoes at all times as follows:

a) Wear shoes that cover the entire foot.

Bare feet, sandals, and open-toed shoes are not permitted in labs where chemical, physical, biological, or radioactive material hazards are present.

b) Wear clothes that cover as much of the body area as possible.

Shorts worn without a protective full-length laboratory coat are prohibited. Women who prefer dresses to slacks or long pants are to wear a long laboratory coat for additional protection. See also section 3.6.

c) (Should) wear gloves when the assigned activity requires contact with potentially contaminated surfaces or items in rooms posted with Level I or II hazards and shall wear gloves for such activities in rooms posted with Level III or IV hazards.

Note: The restrictions given in 2.5.1 above specify that there shall be no contact with surfaces and items in any laboratory with Hazardous Materials if the assignment does not require it. Housekeeping is restricted to cleaning floors and emptying normal uncontaminated trash. Their assignment does not require contact with other items or furniture/equipment surfaces in the room. That is also true of general office personnel.

d) Wear appropriate eye and or face protection if the assigned activity might involve the creation of materials that might hit the face or eye and shall minimize the amount of bare skin that is exposed (long-sleeved shirts, etc.).

e) Wear any special safety apparel specified by the posting at the entrance of a laboratory. The Authorized Laboratory Supervisor shall instruct the Authorized Occupant in the proper use of the safety apparel.

Note: There may be laboratories in which Authorized Occupants are required to wear special safety apparel--lab coats, gloves, safety glasses, etc. The laboratory-specific SOPs will stipulate when this is required and such requirements must be posted at the entrance. (Such situations should be very rare at KU.)

2.5.3.9) Shall know the meaning of posted warning signs and labels and comply with applicable restrictions and procedures mandated by those signs and labels.

Authorized Users shall (unless “should” is introduced):

*2.5.3.10) Wear appropriate personal protective equipment/apparel (eye protection, hand protection, clothing, etc.) to protect from hazard of inadvertent contamination with Hazardous Materials or exposure to radiations. Go to section 3.6 for detailed requirements and procedures. All of section I-3.6 is part of this requirement.

Note: In some cases, laboratory-specific Standard Operating Procedures may require Authorized Occupants to use special Personal Protective Equipment.

a) Use dedicated laboratory coats under conditions when contamination with Hazardous Materials is likely. See I-3.6.4.2.

b) Use protective gloves as specified in I-3.6.4.1.

2.5.3.11) Perform procedures so that the creation of splashes or aerosols is prevented or, as a last resort, minimized.

Note 1: This means using special care and/or special procedures in the removal of screw caps, pouring liquids, homogenization, sonication, use of mixers, centrifugation, etc. The latter four may produce respirable aerosols in addition to larger droplets. This also includes the handling of bedding materials from animal cages.

Note 2: Where the potential for splashes or aerosols is substantial, special laboratory-specific engineered safeguards may be required. Fume hoods are generally required for chemicals. At Biosafety Level II, these may require a Biological Safety Cabinet. See III-3.4.2.

*2.5.3.12) Use the "buddy system" if at all possible.

Note: This means that occupants of laboratories should have someone within calling distance and preferably within sight.

2.5.3.13) Not intentionally smell, taste, or touch with bare hands, any Hazardous Materials.

Note: Authorized Occupants are never to touch containers with Hazardous Materials or surfaces bearing warning labels.

Authorized Users shall (unless “should” is introduced):

2.5.3.14) Keep containers closed at all times, except when filling/dispensing.

2.5.3.15) Not leave potentially Hazardous Materials or processes unattended.

Note: Overnight or weekend processes are covered under section 2.6.2.

*2.5.3.16) Use equipment only for its intended purpose.

*2.5.3.17) Know the hazards and follow applicable Standard Operating Procedure associated with the Hazardous Materials/Radiation Generating Devices being used as specified in Parts II, III, IV or V. Know and observe laboratory-specific Standard Operating Procedure and/or Laboratory-Specific Safety Plan conditions as applicable for the materials/Radiation Generating Devices.

*2.5.3.18) Be alert to unsafe conditions and actions and pursue correction of such unsafe conditions and actions. See 2.5.4 below.

Note: Someone else's accident can be as dangerous to you as any you might have.

*2.5.3.19) Think, act, and encourage safety until it becomes a habit.

*2.5.4) Reporting Unsafe Conditions and/or Actions

Introduction: It is the policy of the University that any individual on campus may request an inspection or evaluation by the EHS staff of conditions that they believe may constitute a health or safety hazard. However, when the conditions or actions constitute only a minor risk/hazard, individuals are to report to and work with the responsible laboratory supervisor in correcting the conditions or modifying the behaviors. If the conditions or actions create an imminent danger or a serious risk/hazard, EHS shall be notified immediately. If necessary, the chair of the Laboratory Safety Committee may also be notified. See Glossary for definitions of imminent danger and serious risks/hazards. Confidentiality, to the extent permitted by regulations and possible under the circumstances, will be maintained by EHS for the one notifying EHS of the unsafe condition/acts if requested to do so.

Any person who has identified an unsafe condition or act shall:

*2.5.4.1) Immediately report the unsafe condition or act to EHS at 4-4089 if imminent danger or a serious risk/hazard is involved. (Note: If it is actually an emergency, the emergency procedures shall be followed. If the person reporting to EHS and/or the Authorized Laboratory Supervisor has the expertise to take corrective actions, he/she should do so, especially if timely action might eliminate the hazard.)

*2.5.4.2) Take corrective action “as soon as it is reasonably achievable” if the condition is a minor risk/hazard and the condition or behavior can be safely corrected. Report it to the Authorized Laboratory Supervisor only if it is likely to occur again.

*2.5.4.3) Remind an individual performing an unsafe act or who is not following required Standard Operating Procedures of the correct procedure.

*2.5.4.4) Report continuing and uncorrected minor risks/hazards to the Authorized Laboratory Supervisor/Unit Safety Coordinator. If no corrections are made, ~~the~~ EHS should be informed.

Note of caution: All of the procedures specified in 2.5.4 should be carried out in the spirit of a mutual support and caring and not as adversaries.

***2.6) Specialized Safe Laboratory Practices in the Use of Hazardous Materials/Radiation Generating Devices**

Note: In this section, topics are listed. Authorized User is understood to be the subject of every imperative sentence. Shall is understood unless the procedure begins with a "Should."

***2.6.1) Working Arrangements**

Authorized Users (in undergraduate laboratories) shall:

*2.6.1.1) Not work with potentially hazardous laboratory operations in the undergraduate laboratories unless there is a qualified Teaching Assistant on duty in that laboratory.

Authorized Users (graduate, postdoctoral, and advanced undergraduate students) should:

*2.6.1.2) Notify at least one other person who will remain within sight or sound during the working period when Hazardous Materials/Radiation Generating Devices are used.

***2.6.2) Overnight Reactions/Experiments**

Authorized Users shall:

*2.6.2.1) Obtain Authorized Laboratory Supervisor approval of the arrangement before leaving an unattended process involving Hazardous Materials/Radiation Generating Devices.

*2.6.2.2) Take special care in checking water lines, power stirrers, electric heating sources, pumps, and condensers to insure that connections are tight, equipment is secure, flow rates are appropriate, moving parts are lubricated, etc., before the equipment is left unattended.

Note: Reactions left overnight or unattended are prime sources for fires, floods, and explosions.

*2.6.2.3) Fill out the appropriate form indicating information about the reaction or operation and how the responsible person can be contacted in case a problem arises during the night and attach the form in a prominent location near the apparatus/equipment.

Note: This form shall have the Authorized Laboratory Supervisor signature in order to accomplish the requirement of 2.6.2.1.

2.6.3) Pipetting

2.6.3.1) Never pipette by mouth. (Use the appropriate mechanical device.)

2.6.4) Reagent Addition

2.6.4.1) Always add reagents slowly; never "dump" them in.

Note: Be especially careful with a potentially exothermic reaction that fails to start. Further addition of reagents could result in an uncontrollable reaction.

2.6.4.2) Never add any solid to a liquid that is near its boiling point.

2.6.5) Spraying or Splattering of Hazardous Materials

2.6.5.1) Never point containers, such as flasks, test tubes, separatory funnels, etc, toward another person.

Note: This precaution applies to any apparatus that might spill or spray a corrosive or toxic material onto another individual.

*2.6.6) Glass and Sharp Objects (Included as a reminder. Go to 6.2.1.4 for disposal procedures.)

2.6.7) Frozen Stoppers and Stopcocks

2.6.7.1) Should lubricate all ground glass surfaces lightly with stopcock grease.

Note: In the event that a stopper, stopcock, or joint becomes frozen it usually can be loosened as follows: (1) Remove all liquids, dry the apparatus, and allow it to cool; (2) heat the outer joint quickly (20-30 sec.) and evenly (rotate it) in the flame of a burner; pull apart before inner joint warms. If the procedure fails, contact your lab supervisor.

2.6.8) Glass Tubing

The following precautions shall be taken when a glass tube, rod or thermometer is being inserted through the hole in the cork or rubber stopper:

2.6.8.1) Be certain that the hole in the stopper is not too small.

2.6.8.2) Always fire polish glass tubes.

2.6.8.3) Lubricate the glass and stopper with glycerin (glycerol), silicone oil or stopcock grease or other appropriate lubricant.

2.6.8.4) Protect your hand with a cloth towel, rag, or other appropriate hand protection.

2.6.8.5) Grasp the tubing near to the end being inserted

2.6.8.6) Twist the tube through the hole with firm, steady pressure but shall not force it.

2.6.9) Glassware (general)

2.6.9.1) Should check glassware carefully for flaws such as cracks or chips before assembly.

2.6.9.2) Clamp apparatus to a support rack firmly but without putting strain on any glassware.

Note: Apparatus should be clamped sufficiently far above the bench that a cold bath could be used to quickly moderate a reaction that has become too vigorous.

2.6.9.3) Check all glass joints, stoppers, hose connections, and the alignment of stirring motors before starting any reaction

2.6.10) Cold Traps and Cryogenic Hazards

Contact with cryogenic materials (e.g., dry ice and various liquefied gases) can cause severe burns. Even brief skin contact with liquid nitrogen (bp -195 °C) can cause tissue damage similar to thermal burns, while prolonged contact can cause blood clots that have potentially serious consequences.

2.6.10.1) Wear goggles (or preferably a face shield) and gloves when handling dry ice, cold baths, or cryogenic liquids such as liquid nitrogen.

2.6.10.2) Work in a well ventilated area.

2.6.10.3) Not lower your head into a dry ice chest because of the danger of asphyxiation.

2.6.10.4) Tape the outside of, or enclose in a metal container, any Dewars used for cold traps or to transport liquefied gases in order to avoid hazards from implosions,.

2.6.10.5) Not use liquid nitrogen to cool vessels on a vacuum line open to the atmosphere.

Note: Oxygen can condense from the atmosphere within the vessel. If the line is then closed, an extreme pressure buildup can occur when the liquid nitrogen coolant evaporates or the cold trap is removed.

2.6.10.6) Not use liquid nitrogen to cool a flammable material in air.

Note: Atmospheric oxygen can condense to produce an explosion hazard.

2.6.10.7) Use clean Dewars for liquid nitrogen.

2.6.10.8) Not attempt transfer of liquefied gases from one container to another the first time without supervision.

2.6.11) Compressed Gas Cylinders

2.6.11.1) Secure compressed gas cylinders by approved straps or chains to a sturdy object such as lab bench, wall, or inside a cylinder cabinet.

2.6.11.2) Not move cylinders without the cylinder cap in place in order to protect the valve stem from being accidentally broken.

2.6.11.3) Keep the main cylinder valve closed and any reduction valve bled when a cylinder is not in use.

2.6.11.4) Not force valves.

2.6.11.5) Never bleed a cylinder completely empty, but leave a slight positive pressure to keep out contaminants.

2.6.11.6) Not put oil or grease on the high-pressure side of the regulator on an oxygen cylinder. This may cause an explosion.

2.6.11.7) Not modify or repair regulators unless qualified (trained) to do so.

2.6.11.8) Transport cylinders into or out of laboratory rooms by means of an appropriate cylinder cart. (The use of a cart does not preclude the need to have the cylinder cap in place.)

2.6.12) Refrigerators

2.6.12.1) Store Flammables/Combustibles only in refrigerators equipped with externally mounted thermostats to minimize the possibility of explosions. (Preferred for the storage of any Hazardous Materials)

2.6.12.2) Verify that all containers of Hazardous Materials stored in these units are tightly sealed.

2.6.12.3) Label each container with the name of the compound or source of the material being stored, the name of the experimenter, and the date.

2.6.12.4) Not store food or beverages for consumption in refrigerators being used to store Hazardous Materials of any type.

*2.6.13) Other Commercial Laboratory Equipment

*2.6.13.1) (Should) follow the safety instructions, if any, included in the vendor's manual. If such instructions appear to be in conflict with Standard Operating Procedures specified in this manual, EHS should be consulted.

(Authorized Laboratory Supervisors may promote such instructions to "shall" in laboratory-specific Standard Operating Procedures. Laboratory-Specific Safety Plans may do so as well.)

*2.6.14) Hazard Information and Communication

*2.6.14.1) Follow the practices and instructions given in section 3.4 of chapter 3.
(Inventories, labeling and signs are addressed.)

*2.6.15) Hazard Control Equipment

2.6.15.1) Follow the practices and instructions given in chapter 3.

Section 3.5 addresses engineering controls--ventilation, hoods, biological safety cabinets, etc.

Section 3.6 addresses personal protective equipment/apparel--clothing, respirators, movable shields, etc.

Section 3.7 addresses safety equipment -- storage, showers, etc.

*2.6.16) Safety Inspections

2.6.16.1) Follow the requirements specified in section 3.8 of Chapter 3.

2.7) References to Hazard-Specific Safety Procedures and Requirements

EXPLANATORY NOTE: This section directs the authorized users to other parts of this manual based upon the specific type of hazards that are present in the laboratory. The previous sections specify procedures that are applicable to the handling of all types of Hazardous Materials/Radiation Generating Devices.

Authorized Users shall, as applicable:

2.7.1) Flammable/Combustible Liquids and Gases (See Glossary for definition.)

2.7.1.1) Follow all requirements and procedures specified in Part II-Section 2.4, in addition to those of this Part I.

2.7.2) Corrosives (See Glossary for definition.)

2.7.2.1) Follow all requirements and procedures specified in Part II-Section 2.5, in addition to those of this Part I.

2.7.3) Reactives (See Glossary for definitions.)

2.7.3.1) Follow all requirements and procedures specified in Part II-Section 2.6, in addition to those of this Part I.

2.7.4) Explosive Compounds (See Glossary for definition.)

2.7.4.1) Follow all requirements and procedures specified in Part II-Section 2.7, in addition to those of this Part I.

2.7.5) Particularly Toxic Chemicals (See Glossary for Definitions.)

2.7.5.1) Follow all requirements and procedures specified in Part II-Section 2.8, in addition to those of this Part I.

2.7.6) Biohazards (See Glossary.)

2.7.6.1) Follow all requirements and procedures specified in Part III in addition to those of this Part I.

Note: Part III covers the additional safety requirements for the use of hazardous organisms/biological agents at Level I and II. These address primarily decontamination, disinfection and sterilization procedures.

2.7.7) EHS Safety Authorization-Requiring Hazardous Chemicals (See Glossary for definition.)

The chemicals included in this category are identified in Part II - Chapter 3, Section 3.9.3.1 and Section 3.9.3.2.

2.7.7.1) Follow all conditions, requirements and procedures specified in Part I-Section 3.9.

Special Note: Authorized Occupants must have the training specified for Authorized Occupants in Part I: Chapter 4.

2.7.8) EHS Safety Authorization-Requiring Biohazards

All Biohazards requiring Level III or Level IV safety provisions are in this category. Lists of Biohazards Level III or IV safety provisions are found in references listed in Part III-Section 3.7.1.

2.7.8.1) Follow all requirements and procedures specified in Part I- Section 3.9.

Special Note: Authorized Occupants must have the training specified for Authorized Occupants in Part I: Chapter 4.

2.7.9) Radioactive Materials (See Glossary for definition.)

2.7.9.1) Follow all conditions, requirements and procedures specified in Part IV.

Note: The use of any radioactive materials requires an EHS Safety Authorization in the form of a Radiation Safety Permit.

Special Note: Authorized Occupants shall follow the procedures specified in this chapter for Authorized Occupants.

2.7.10) Radiation Generating Devices that Produce Ionizing Radiation

2.7.10.1) Follow all applicable requirements and procedures in Part IV (with special emphasis on Chapter 1 and 7) and the applicable portions of Part I identified with an * or a superscript I.

Note: The use of any radiation generating device requires an EHS Safety Authorization in the form of a Radiation Safety Permit.

Special Note: Authorized Occupants must have the training specified for Authorized Occupants in Part I: Chapter 4.

2.7.11) Lasers

2.7.11.1) Follow all requirements and procedures specified in Part V and applicable portions of Part I (identified with an * or a superscript L).

Note: The use of any Class 2, Class 3a, Class 3b or Class 4 laser/laser system requires an EHS Safety Authorization.

Special Note: Authorized Occupants must have the training specified for Authorized Occupants in Part I: Chapter 4.

***2.8) Laboratory-Specific Standard Operating Procedures**

Even though each laboratory supervisor and laboratory person is responsible for complying with the minimum Standard Operating Procedures previously identified in this chapter and category specific Standard Operating Procedures in Parts II - V, they shall also develop and implement more specific or stringent laboratory standard operating procedures where/when necessary.

The Authorized Laboratory Supervisor shall:

*2.8.1) Develop written laboratory-specific Standard Operating Procedures when necessary.

Note: It is recommended that they be kept with the laboratory's copy of this KU Laboratory Safety Manual. Any Authorized User-developed Standard Operating Procedures must be reviewed and approved by the Authorized Laboratory Supervisor.

EHS recommends the following:

*2.8.2) SOP Format

Laboratory-specific Standard Operating Procedures shall provide the following minimum information:

*2.8.2.1) SOP Title

*2.8.2.2) Building, Department, Lab, & Room #

*2.8.2.3) Authorized Laboratory Supervisor

*2.8.2.4) Process Identification

*2.8.2.5) Hazard Assessment

*2.8.2.6) Hazard Controls

*2.8.2.7) Emergency Procedures

*2.8.2.8) Experimental Methodology

*2.8.2.9) Signature of Preparer of the Standard Operating Procedures & Date of Issue.

*2.8.2.10) Lab Supervisor Signature & Date

*2.8.3) See Part I - Appendix 8.2.1, for a blank copy of the recommended form for documenting laboratory-specific Standard Operating Procedures.

*2.8.4) Laboratory-specific Standard Operating Procedures should be kept in section 7.2 of Chapter 7, Record Keeping), of this manual.

***2.9) Emergency Procedures**

During the course of normal laboratory operations there is always the potential for an emergency situation to arise. Emergencies can be the result of Hazardous Materials spills/releases, malfunctioning equipment, fire, and/or personal injury/need for medical assistance. In the event of an emergency, the appropriate action must be implemented. This may include evacuation of the facility if necessary. Internal communication is very important because it is essential that all employees know how to act and react during an emergency. It is necessary that written emergency action procedures be developed and that all employees be trained and participate in drills. All accidents, regardless of severity, must be reported and investigated.

***2.9.1) Responsibilities of the Authorized Laboratory Supervisor/Departmental Safety Coordinator/Department Chair**

The Authorized Laboratory Supervisor, Unit Safety Coordinator or Dept. Chair shall:

*2.9.1.1) Develop and post laboratory-specific or department-specific emergency procedures. EHS shall provide assistance as requested. This shall be based upon the pre-planning described in 2.9.4 below.

*2.9.1.2) Appropriately train all laboratory users/occupants in these procedures.

*2.9.1.3) Perform sufficient drills to acquaint all laboratory users/occupants with the procedures to be followed. (Records shall be kept of drills including an evaluation of performance and follow-up remedial actions when indicated.)

*2.9.1.4) Report accidents to EHS and, if injuries that require treatment are involved, to Human Resources, and conduct appropriate investigations.

Note: Serious work-related injuries must be treated at Lawrence Memorial Hospital. If emergency treatment is required, go to LMH Emergency Room. If it is not an emergency, call the LMH Occupational Health Clinic at 749-6467 to schedule an appointment. A 1101-A accident report must be sent to KU Human Resources.

*2.9.2) Responsibilities of Authorized Users, Authorized Occupants, and other Personnel/Students

Authorized Users, Authorized Occupants, and all other Department Personnel/Students shall:

*2.9.2.1) Be trained in the applicable emergency procedures.

*2.9.2.2) Participate in drills when those are initiated.

*2.9.2.3) Follow the emergency procedures during drills and during actual emergencies.

*2.9.3) General Emergency Procedures

All individuals shall follow the basic requirements of this section. (If an action has already been effectively taken, repetition is not required. Ensuring that all affected individuals are notified and take action is a cooperative venture.)

Occupants shall:

*2.9.3.1) Notify other individuals in the lab of the emergency situation.

If necessary, alert facility/building occupants by activating building alarm system. Contact Kansas University Police Department (911) and inform of situation/need for emergency assistance.

*2.9.3.2) Evacuate the laboratory, closing doors behind you (verify the evacuation of all occupants).

Take any quick, obvious and low risk actions that would minimize the consequences of the emergency.

If building alarm is activated, leave building/facility through the nearest, safe emergency exit. Do not use elevators! Provide assistance to those who may need it.

*2.9.3.3) Assemble outside the lab in the designated safe area. (All individuals to remain in the assembly area until released.)

If evacuating to the outside, assemble at a safe location upwind from the facility. Check to make sure all personnel, students and visitors are accounted for. Keep everyone together, and do not allow re-entry into facility until it has been cleared by KUPD. Segregate any individuals who may be contaminated with Hazardous Materials.

*2.9.3.4) Report to Emergency Services Field Command. Person who reported incident or who has knowledge about the emergency should immediately report to the Emergency Services Field Command Post. Initially this would be the first responding KUPD officer identified.

*2.9.4) Emergency Preplanning and Preparation

Laboratory supervisors and Hazardous Materials/Radiation Generating Device users must prepare for potential laboratory emergencies by proper preplanning and preparation. The following factors are to be considered:

Authorized Laboratory Supervisors shall:

*2.9.4.1) Review the nature of the activities/operations to be conducted in order to identify potential hazards (i.e. know the hazardous properties of the materials/Radiation Generating Devices being used and quantities present in the lab).

*2.9.4.2) Identify locations where these emergencies could arise.

*2.9.4.3) Be familiar with the locations of emergency equipment, supplies, building alarms, and evacuation routes.

*2.9.4.4) Make available appropriate emergency equipment/supplies in the lab (or nearby) before initiating Hazardous Materials/Radiation Generating Device activities/operations. These include:

a) Safety Showers and Eyewashes See section 3.7.2 & 3.7.3

b) Fire Extinguishers and Fire Blanket See section 3.7.4.

c) First Aid Kit See section 3.7.5.

d) Spill Control/Cleanup Kit See section 3.7.7.

*2.9.5) Medical Emergencies See also 2.9.1.4 above.

*2.9.5.1) Serious Injury/Emergency Medical Assistance

Personnel, students or visitors shall:

a) Contact KUPD (911) immediately and identify need for emergency medical assistance. Provide information as asked by the Dispatcher.

b) Assist injured person only if properly trained to administer first aid.

Otherwise, keep injured person still and calm. Keep unnecessary individuals away. Do not move the injured person unless it is necessary to prevent his/her exposure to further harm. However, individuals shall not endanger themselves.

c) Protect themselves and others from any injured person's blood/body fluids and from any hazards that may have caused the injury.

d) Notify individuals in adjacent areas of any potential hazards.

Authorized Laboratory Supervisor shall:

e) Complete the appropriate accident/injury reports, conduct an accident investigation, and initiate corrective action(s).

*2.9.5.2) Minor Injury/Non-Emergency Medical Assistance See also 2.9.1.4 above.

Personnel, students, or visitors may:

a) Handle minor injuries by self-treatment. (However administer first aid only if properly trained to do so. Otherwise, contact KUPD(911) for emergency medical assistance.)

Personnel, students, or visitors shall:

b) Protect themselves and others from the injured person's blood/body fluids and from any hazards that may have caused the injury.

Personnel, students, or visitors should:

c) Seek proper medical attention.

[Note 1]: Students should go to Watkins Health Center. If it is closed, Students should go to the Lawrence Memorial Hospital Emergency Room.

[Note 2]; University employees must go to Lawrence Memorial Hospital for on-the-job injuries requiring medical treatment.

Authorized Laboratory Supervisors shall:

d) Complete the appropriate accident/ injury reports, conduct an accident investigation, and initiate corrective action(s).

*2.9.6) Fire Emergencies

Fires are a possible emergency in the laboratory setting. In the event of a fire:

Laboratory users/occupants shall:

- *2.9.6.1) Assist any person in immediate danger to safety, but only if it can be accomplished without risk to themselves.
- *2.9.6.2) Activate the building alarm system so that other individuals in the facility/building can begin evacuation.
- *2.9.6.3) Contact KUPD (911) to report the fire.
- *2.9.6.4) If the fire is small, use a nearby extinguisher to control and extinguish it, but only if trained in using fire extinguishers. If the initial extinguishing attempt does not succeed, evacuate the area. (Do not go after more extinguishers or back into the fire area.)
- *2.9.6.5) Not attempt to fight fires that are large, are out of control, or may be in the presence of a toxic atmosphere.
- *2.9.6.6) Evacuate the area or building immediately. Close doors behind you as you leave. Do not use elevators!
- *2.9.6.7) Evacuate a building immediately if the facility alarm is sounding.
- *2.9.6.8) Assemble at a pre-determined meeting area. Supervisor is responsible for taking roll and accounting for all laboratory users/occupants/visitors.
- *2.9.6.9) Not re-enter the building without permission of KUPD.
- *2.9.6.10) Report all fires to the KU Police Department so that the appropriate investigations may be made, if necessary.

2.9.7) Hazardous Material Spills/Releases

Spills/releases of Hazardous Materials are also a possible emergency in the laboratory environment. The proper response action is dependent upon the hazard and quantity of material spilled/released. All spills need to be reported to your supervisor immediately.

2.9.7.1) Emergency Hazardous Materials Spills/Release

a) Emergency Hazardous Materials spills/releases are those that are of sufficient hazard to require a response from KUPD, EHS, and the Lawrence Fire Department. A Hazardous Materials spill/release is considered to be an emergency spill/release whenever it:

- Causes personal injury or exposure requiring medical attention.
- Causes a fire hazard.
- Requires the need for special personal protective equipment.
- Contaminates a public area or causes airborne contamination that requires laboratory or building evacuation.
- Cannot be controlled or cleaned up by authorized users.
- Requires prolonged or overnight cleanup.
- Involves an unknown substance.
- Enters the land, water, or air.

b) Emergency Spill/Release Response Procedures:

Personnel, students, or visitors shall:

- Contact KUPD (911) [and EHS at 4-4089, if possible] immediately and identify need for emergency spill assistance. Provide information as asked by the Dispatcher.
- If the spill presents an immediate danger, evacuate the spill area, warn others nearby of the hazard and keep individuals out.
- Protect themselves first. Assist injured individuals only if it can be accomplished without risk to themselves.
- Send someone down to meet the responding agencies.
- If the spill presents a danger to other building occupants, activate the building alarm and evacuate.
- Not operate electrical switches except to de-energize if flammable vapors are present. Turn off or remove heat sources if safe to do so.
- If the spilled substance is an unknown, limit actions to self-protection, KUPD notification(911), isolation of the spill, evacuation and to securing the area.
- Try to control the spread or the volume of the spilled material by absorbents or containment if the spill does not present immediate personal danger.

2.9.7.2) Minor Hazardous Material Spills/Releases

a) Minor Hazardous Material spills/releases are those that do not meet the definition of an emergency spill as described previously and can usually be handled by properly trained and equipped. The following procedures should be used for minor spills/releases:

Authorized Users shall:

- Attend to any individuals who may have been contaminated. If person requires medical attention this is an Emergency Spill.
- Notify persons in immediate area of the spill and evacuate all nonessential individuals.
- Control the spread of the spilled material by absorbents or containment.
- If the spilled material is flammable, turn off ignition sources.
- Avoid skin contact and breathing vapors, mists, fumes, or particles from spilled materials.
- Leave on or establish exhaust ventilation, if safe to do so.
- Contact EHS for assistance and disposal of spilled materials.

The following steps shall ONLY be performed by qualified and appropriately trained individuals.

- Secure appropriate spill cleanup supplies. EHS has positioned small spill kits in every chemical stockroom.
- Don appropriate personal protective equipment.
- Use a neutralizing agent/absorbent mixture on corrosive liquids.
- Other liquids should be absorbed with an appropriate, non-reactive material such as vermiculite, clay, dry sand, paper towels, other spill absorbents. EHS recommends 3M Powersorb Universal Sorbent that is available from Fisher Scientific.
- Collect spilled material and used cleanup supplies into an appropriate container and contact EHS for proper disposal.
- Collect spilled solids in a container for reuse, or disposal by EHS. Be Careful! Sweeping can cause airborne particulates that can be inhaled. If spilled solids are highly toxic, it would be better to clean them up using a HEPA vacuum. Contact EHS for assistance.
- Mop or wipe any contaminated surfaces before reusing.

2.9.7.3) Hazardous Chemical Spills

Follow previous instructions in Part I - Section 2.9.7.1 & 2.9.7.2. Contact EHS (864-4089) for further information or assistance for procedures in handling special types of Hazardous Chemical spills/releases.

2.9.7.4) Biohazard Spills/Releases

Handle biohazard spills/releases in accordance with the procedures in Part III. Contact EHS (864-4089) for further information or assistance.

2.9.7.5) Radioactive Spills/Releases

Handle radioactive spills/releases in accordance with the procedures referenced in Part IV. Contact EHS - Radiation Safety Services (864-4089) for further information or assistance.

3) Hazard Communication and Control Measures

Hazard control is defined as measures, practices, or procedures utilized to remove, prevent, or reduce employee exposure to real or potential safety, health and/or environmental hazards. Hazard control can become a complicated subject due to the diversity of potential hazards that may be present in the laboratory environment.

This Chapter identifies the minimum control measures that shall be implemented and followed in the laboratory environment at the University of Kansas - Lawrence Campus in order to protect university personnel/students/visitors from potential hazards associated with Hazardous Materials (HM) and Radiation Generating Devices. Reminder: "laboratory environment" includes off campus locations involving KU personnel/students/visitors when such location is not under the jurisdiction of another institution.

*3.1) General Hazard Control

There are three general types of hazard control:

*3.1.1) Engineering Controls (See Glossary for definition.)

The Authorized Laboratory Supervisor (ALS) or Authorized User (AU), as appropriate, shall:

3.1.1.1) Initially, eliminate the hazards associated with the use of Hazardous Materials (HM)/radiations or reduce them through the use of engineering controls to an acceptable level keeping the concept of "As Low As Reasonably Achievable" (ALARA) in mind. These are accomplished by:

- a) Evaluating for and using the least hazardous equipment, Hazardous Materials, or process needed to perform the required task.
- b) Physically isolating the operator or process when appropriate.
- c) Providing the appropriate local and general exhaust ventilation.
- d) Providing appropriate shielding.
- e) Contact EHS Dept for assistance (4-4089).

*3.1.2) Administrative Controls

Administrative controls are procedural measures implemented to reduce or eliminate hazards when engineering controls are insufficient or not feasible.

The Authorized Laboratory Supervisor shall:

3.1.2.1) Establish and enforce standard laboratory practices, procedures, work methodologies, etc., with the general philosophical goal of keeping exposures to Hazardous Materials and/or radiations "As Low As Reasonably Achievable" (See Chapter 2 of this Part for universal Standard Operating Procedures.).

3.1.2.2) Assess and identify all hazards associated with the Hazardous Materials and/or hazardous radiations used in the laboratory and communicate the nature of those laboratory hazards, as appropriate, to visitors, authorized occupants and authorized users. (See Sections 3.3 & 3.4 of this Part.)

3.1.2.3) Provide laboratory users with adequate information and documented training to safely work with Hazardous Materials (HM)/Radiation Generating Devices. (See Chapter 4, Information & Training.)

3.1.2.4) Perform laboratory inspections and provide maintenance on a routine basis (See Section 3.8 of this Part.).

3.1.2.5) Perform prior review and approval of particularly hazardous operations, procedures, or activities and obtain additional approval and/or establish approved Laboratory-Specific Safety Plans when required. (See section 3.9 of this Part.)

*3.1.3) Personal Protective/Safety Equipment.

When engineering and administrative controls are not sufficient, or have not yet been implemented, Authorized Users may have to rely upon personal protective/safety equipment to protect them from hazards present. These may include:

3.1.3.1) Personal Protective Equipment

*a) Eye/Face/Hearing Protection (section 3.6.3 & 3.6.6 of this Part)

b) Hand/Body Protection (section 3.6.4 of this Part)

c) Foot Protection (section 3.6.5 of this Part)

d) Respiratory Protection (section 3.6.7 of this Part)

3.1.3.2) Safety Equipment

*a) Safety Shields/Containment (section 3.7.1 of this Part)

Note: Includes radiation shielding when necessary.

b) Safety Showers/Eyewash Fountains (sections 3.7.2 & 3.7.3 of this Part)

c) Fire Extinguisher (section 3.7.4 of this Part)

d) First Aid Kits (section 3.7.5 of this Part)

e) Storage Cabinets (section 3.7.6 of this Part)

f) Spill Kits (section 3.7.7 of this Part)

***3.2) Hazard Control Responsibilities**

Authorized Users shall:

*3.2.1) Comply with the hazard control measures identified in this chapter.

Authorized Laboratory Supervisors shall:

*3.2.2) Implement the hazard control measures identified in this chapter and require all personnel/students/visitors in their laboratories to follow them.

*3.2.3) Develop and implement more stringent hazard control measures in laboratories when/where necessary.

*3.2.4) Never transfer Hazardous Materials or RGDs that require Laboratory-Specific Safety Plans(LSSP) to another individual unless authorized to do so by EHS. (Such Hazardous Materials or RGDs must be under the responsibility of an authorized laboratory supervisor with an appropriate LSSP at all times. Such RGDs shall not be re-located without prior approval from EHS.)

Unit Safety Coordinators (USC) shall:

*3.2.5) Implement the hazard control measures identified in this chapter and in associated Laboratory-Specific Safety Plans or laboratory-specific Standard Operating Procedures and monitor compliance in their assigned areas of responsibility.

*3.2.6) Provide assistance to laboratory supervisors in implementing these hazard control measures; and in developing and implementing more stringent hazard control measures when/where necessary.

*3.2.7) Perform safety audits and inspections as specified in 3.8 of this chapter.

EHS shall:

3.2.8) Provide assistance to laboratories in the development and selection of appropriate hazard control measures.

3.2.9) Perform special safety audits and inspections as specified in 3.8.

3.2.10) Provide the Laboratory Safety Committee an annual evaluation (report) of the effectiveness of the laboratory safety program and recommendations for changes, if any, that need to be made to strengthen the program.

The Laboratory Safety Committee, through its subcommittees, shall:

3.2.11) Evaluate the effectiveness of the laboratory safety program at least on an annual basis and submit its reports with associated recommendations to the EHS Council.

3.2.12) Act on any report submitted to it by EHS.

3.2.13) Investigate any substantive problems reported to it. (The normal sequence for addressing problems is as follows: the Authorized Laboratory Supervisor, the Departmental Safety Officer, the chair or director of the unit in which the Authorized Laboratory Supervisor is located, EHS and then the Laboratory Safety Committee)

***3.3) Hazard Assessment and Registration**

This administrative control measure requires the assessment, identification and communication of hazards so that personnel/students/visitors (Visitors, Authorized Occupants or Authorized Users) can be properly informed of hazards present in the laboratory.

The Authorized Laboratory Supervisors (ALS)/Dept. Safety Coordinators (USC) shall:

*3.3.1) Assess their laboratory in order to identify hazards that may be present at least on an annual basis.

*3.3.2) Use the "Lab Hazard Registration/Safety Authorization Application (LHRSAA) Form" provided in Part I - Chapter 8.3.1 to conduct and document this required assessment. Additional assessments are usually required when the work requires a Laboratory-Specific Safety Plan. See Part II - Section 3.9, Part III - Section 3.7, Part IV - Section 5, Part IV - Section 7 and Part V- Section 3.9 for situations in which Laboratory-Specific Safety Plans (LSSPs) are required. The procedures for establishing required LSSPs is given in this Part, Section 3.9.

*3.3.3) Keep a photocopy of the completed LHRSAA form in the laboratory's copy of the Laboratory Safety Manual at Section 7.1.3 of Chapter 7, Part I or with the laboratory-specific Standard Operating Procedures..

*3.3.4) Provide a copy of the LHRSAA form to EHS for entry into the university- wide database and for developing the appropriate Laboratory Entrance Posting.

*3.3.5) Update the LHRSAA form immediately if/when laboratory hazards change and, forward the new/updated information to EHS promptly, and submit and obtain approval of proposed amendments to existing Laboratory-Specific Safety Plans before initiating use involving significant changes in materials/equipment requiring Laboratory-Specific Safety Plans.

*3.3.6) Communicate to Authorized Occupants and Authorized Users the content and laboratory location of the LHRSA form and Laboratory-Specific Safety Plans, if the latter are needed. The LHRSA form and the Laboratory-Specific Safety Plans become a part of their information and training.

Note: Some of this information may need to be shared with Visitors as well. See section 4.4 of this Part. All individuals entering an authorized laboratory belong to one of the three classifications.

*3.3.7) Immediately inform Authorized Occupants and Authorized Users of any changes/updates in the Hazard Registration form (or Laboratory-Specific Safety Plans and laboratory-specific Standard Operating Procedures).

*3.3.8) Maintain and keep records of training, inventories, laboratory-specific Standard Operating Procedures, Laboratory-Specific Safety Plans, and safety evaluations (surveys, contamination monitoring results, exposure levels, audit and inspection reports) See 3.4 below.

*3.3.9) Verify that the items of 3.3.8) above are organized and readily available to individuals with a "right to know."

Note: To the extent that it is practical, it is recommended that such documents be inserted as additional sections in this Laboratory Safety Manual. If choices need to be made, the inclusion of the laboratory-specific Standard Operating Procedures and Laboratory-Specific Safety Plans in this manual is preferred.

***3.4) Hazard Communication Information**

The administrative control measures identified in this section require that information concerning the Hazardous Materials/Radiation Generating Devices present and used in laboratories at the University of Kansas - Lawrence Campus be available and properly communicated to all individuals frequenting the laboratories. Such individuals must be informed of the potential risks associated with Hazardous Materials/Radiation Generating Devices in their work area and must be aware of how to protect their own safety and health.

3.4.1) Inventory of Hazardous Materials

The Authorized Laboratory Supervisor/Unit Safety Coordinator shall:

3.4.1.1) Develop and maintain a current inventory of all Hazardous Materials present in the laboratory as specified in Part II - Section 3.4.1 for hazardous chemicals, Part III - Section 3.3 for Biohazards and Part IV for radioactive materials.

3.4.1.2) Keep the Hazardous Materials inventory list as current as required in the referenced sections of 3.4.1.1.

3.4.1.3) Make the laboratory Hazardous Materials inventory list(s) readily accessible to all occupants (Visitors, Authorized Occupants & Authorized Users) of the laboratory.

3.4.1.4) Submit inventories to EHS as required in the referenced sections of 3.4.1.1.

*3.4.2) Registration and Location of Radiation Generating Devices

The Authorized Laboratory Supervisor(ALS)/Dept. Safety Coordinator (USC) shall:

3.4.2.1) Provide to EHS in the proposed Laboratory-Specific Safety Plan all of the information necessary to register Radiation Generating Devices with the state as required. See Part IV and Part V.

3.4.2.2) Never re-locate, dismantle, discard or transfer responsibility for Radiation Generating Devices until authorized to do so by EHS.

*3.4.3) Safety Information

The Authorized Laboratory Supervisor/Unit Safety Coordinator shall:

3.4.3.1) Obtain or develop safety information for all Hazardous Materials present in the laboratory and then maintain this information as specified in Part II - Section 3.4.2 for hazardous chemicals, Part III - Section 3.3.2 for hazardous biological agents, Part IV for radioactive materials and Radiation Generating Devices, and Part V for lasers.

Note: For hazardous chemicals, the information is contained in the Material Safety Data Sheets. Safety Data sheets for radioactive materials and biohazards and exposure data for Radiation Generating Devices have to be developed. Call EHS Dept. (4-4089) for help as needed.

3.4.3.2) Keep the required safety information as current as required in the referenced sections of 3.4.3.1.

3.4.3.3) Make the safety information readily accessible to all occupants (Visitors, Authorized Occupants & Authorized Users) of the laboratory.

3.4.4) Labeling (General)

Authorized Users shall:

3.4.4.1) Maintain original labels on original containers of Hazardous Materials as received from vendors if possible until emptied and decontaminated.

3.4.4.2) Replace labels with equivalent information when original labels no longer are legible for reasons not under the control of the user.

3.4.4.3) Deface or remove and destroy labels from thoroughly decontaminated containers before such containers are discarded in trash.

3.4.4.4) In general, label all secondary containers with Hazardous Materials and Hazardous Material-contaminated articles.

Note: Items in a clearly labeled, marked, defined and reserved work area--preferably in a secondary tray--need not all be labeled if Standard Operating Procedures clearly specify that items from such an area may never be removed except by the Authorized User with the reservation for that area. Contaminated items shall be labeled by the Authorized Users before removal from the area. All containers placed into storage shall be labeled or clearly marked. (Marking in lieu of labeling is acceptable only for containers to be used for short periods of time after which they are decontaminated and returned to clean stock. Such markings must be maintained in a legible form until decontamination is accomplished by the responsible Authorized User.) In some cases, labeling of a tray containing test tubes or vials may be a surrogate for individual labeling if all Authorized Users understand that removal from such a tray or area is not permitted without labeling unless the removal is for the purpose of a process, such as centrifugation or measurement in an instrument, that remains under the control of the Authorized Users for the duration of the process or measurement. (Authorized Occupants are never to remove items from an area marked and set aside for materials for which they are not an Authorized User.)

Note: Creation of an “orphan” container of Hazardous Materials or Hazardous Material-contaminated object without identification of type and quantity of Hazardous Material is considered serious non-compliance with this Laboratory Safety Manual. An “orphan” container or object is one for which the link between the person responsible for the container/object and the container/object itself has been lost and/or information concerning the content of the container/object has been lost.

3.4.4.5) Dispose of any Hazardous Material-contaminated container/object as hazardous waste according to the procedures applicable to the type of Hazardous Materials. See Chapters 6 of this Part, Part II, and Part III and the Radiation Safety Service-approved directions (radioactive waste) as applicable. If in doubt, contact EHS.

3.4.4.6) Follow the specific container labeling Standard Operating Procedures of Part II: 3.4.3, Part III: 3.3.3, and Part IV: 13.3.2 as applicable.

*3.4.5) Hazard Warning/Safety Equipment Signage

Appropriate warning signs are to be displayed inside the laboratory in areas that present a hazard to individuals. Warning Signage shall conform to requirements of applicable OSHA regulations, Kansas Regulations 28-35-133 through 363, or ANSI Z-136, as appropriate. For general information about appropriate hazard warning signage see Part I - Appendix 8.3. For hazardous chemicals warning signage see Part II - Section 3.4.4. For hazardous biological agents see Part III - Section 3.3.4. For radioactive materials see Part IV - Section 13.3.2. For lasers see Part V.

The Authorized Laboratory Supervisors shall:

3.4.5.1) Identify and appropriately post, label or tag any/all hazards in the laboratory.

Note: Any sign or label which comes attached to a commercial RGD shall not be removed, shall be maintained in a legible condition and shall be readily visible.

3.4.5.2) Post the appropriate signs in the laboratory to identify the location of various types of safety equipment, such as:

- a) Safety Showers & Eyewashes
- b) Fire Extinguisher & Fire Blankets
- c) First Aid Kits
- d) Spill Control Kits
- e) Personal Protective Equipment

3.4.5.3) Contact EHS for assistance in identifying and obtaining the appropriate hazard warning/safety equipment signage.

The Authorized Users (AU) shall:

3.4.5.4) Post the appropriate hazard warning signs or tags before initiating any operation or activity that may present a hazard.

*3.4.6) Laboratory Entrance Posting

The entrance to each laboratory must be posted with certain hazard and emergency information so that all individuals (lab or non-lab) can be properly warned before entering, and know who to contact in the event of an emergency or question about the laboratory.

Based upon the levels and types of hazards present in a laboratory, all laboratories on the Lawrence campus also will be assigned a "Hazard Class" that shall be posted on the entrances to the laboratory. (See sections 1 and 3.9 of this Part.) Procedures and requirements are based upon that hazard class. After the hazard controls needed for the laboratory have been established based upon the completed LHRSA form and the requirements of this chapter and its referenced sections, each laboratory will be placed into one of four classes--Level I, Level II, Level III or Level IV. In some cases, laboratories that have a combination of hazards, each of which would be at some lower level, may be placed at a higher overall level. All Level III Laboratories require EHS-approved Laboratory-Specific Plans (LSSPs) and all Level IV Laboratories require EHS/Laboratory Safety Committee-approved LSSPs. Because of regulations, some Level I and Level II labs may also require approved Laboratory-Specific Safety Plans--for example, if radioactive materials are used. See section 3.9 and its references. (Hazard Classes are addressed for each category in Parts II, III, IV and V.)

Note: The proper Laboratory Entrance Posting (LEP) will be developed and provided by EHS after receipt of the LHRSA form. The Laboratory Entrance Posting information will be based upon that provided by the lab supervisor on the Hazard Registration form.

The Authorized Laboratory Supervisor (ALS) shall:

3.4.6.1) Post the entrance to the laboratory with the proper hazard warnings, emergency contact information and overall hazard class.

3.4.6.2) Include in the emergency information the name(s) and phone number(s) of the lab supervisor or other responsible party(ies) to be contacted in the event of an emergency or question about the lab.

Note: There shall be at least two individuals listed on the Laboratory Entrance Posting who can provide information necessary when an emergency occurs. Two lab supervisors who are well acquainted with each other's work may decide to be the "second" person listed on the other's Laboratory Entrance Posting.

3.4.6.3) Establish and maintain Hazard Warning information that identifies the presence of the following:

- a) Physical Hazards
- b) Chemical Hazards
- c) Biohazards
- d) Radiation Hazards

-- For Ionizing Radiation see posting requirements in Part IV-Section 13.3.2 and Guidance Document (GD-3.2).

-- For Lasers, see Part V.

-- Contact EHS-Radiation Safety Service(4-4089) for assistance.

Note: An example of a Laboratory Entrance Posting may be found in Chapter 8.3.3.

3.4.6.4) Keep a photocopy of the current Laboratory Entrance Posting in the Laboratory's Laboratory Safety Program manual at section 7.1.4 of Chapter 7, Part I.

***3.5) Engineering Controls**

As stated earlier in section 3.1.1, initially, the hazards associated with the use of Hazardous Materials/Radiation Generating Devices shall be reduced or eliminated as much as possible through the implementation of engineering controls.

***3.5.1) Process Modifications/Substitutions**

The Authorized Laboratory Supervisors and Authorized Users shall:

3.5.1.1) Examine each laboratory activity for the possibility of substituting less hazardous equipment, Hazardous Materials or processes for the existing ones.

3.5.1.2) Where feasible, make process modifications/substitutions to reduce or eliminate the hazards of existing processes.

***3.5.2) Physical Isolation/Containment**

The Authorized Laboratory Supervisor and Authorized Users shall:

3.5.2.2) Make every effort to physically isolate the person from the hazard through appropriate barriers, shields or containment as appropriate..

3.5.3) Exhaust Ventilation

Any laboratory activity that has the potential to generate airborne emissions (fumes, vapors, gases, mists, dusts, smoke, particulates, etc.) must be conducted under the appropriate exhaust ventilation. There are two types of exhaust ventilation: General and Local.

General exhaust ventilation is that usually associated with the normal building temperature control and fresh air supply (HVAC) system. Air is exhausted from rooms and returned to the building air handler for mixing with a certain small percentage of fresh incoming air. With these systems, any airborne contaminants in the laboratory can be picked up and spread throughout an entire facility. General exhaust ventilation is not to be relied upon for contaminant removal.

Local exhaust ventilation is used at the point of contaminant generation to immediately capture and remove the airborne contaminants to the exterior of the facility. Examples of local exhaust ventilation are: Capture Hoods, Canopy Hoods, and Enclosure Hoods. The most common type of local exhaust found in the laboratory environment is the laboratory fume hood which is an enclosure hood.

3.5.4) Laboratory Fume Hoods

The laboratory fume hood is an engineering control that provides physical isolation and containment of the laboratory process or activity and local exhaust ventilation. It is designed to prevent the escape of chemical emissions from chemicals and their reactions into the general laboratory environment. It is not intended to be used as a means to provide general laboratory exhaust ventilation.

3.5.4.1) Criteria for Use

The Authorized User(AU) shall use a properly functioning hood for any chemical procedure that has the potential of creating:

- a) Airborne concentrations of one or more chemicals approaching the corresponding Permissible Exposure Limit (PEL) or of radioactive materials that might approach a Derived Air Concentration (DAC).
- b) Flammable vapors approaching 10% of the lower explosion limit.
- c) EHS Safety Authorization-Requiring Hazardous Chemicals or materials of unknown toxicity. See Glossary for EHS Safety Authorization-Requiring Hazardous Chemicals and sections 3.9 of Part I and II..
- d) Fumes, vapors, gases, dusts, mists, or odors that are potentially a nuisance or irritation to other individuals. (Dusts of high toxicity shall only be used in a glove box or equivalent. See Part I: Section 3.5.6.)

3.5.4.2) Procedures Not Requiring a Fume Hood

The Authorized Users may generally conduct the following procedures safely outside the fume hood:

- a) Operations with aqueous solutions of salts, dilute acids, bases, other reagents.
- b) Operations with liquids or solids that have very low volatility.

Note: Lower Explosion Limit must be below 10%.

- c) Operations with closed systems that do not allow significant emissions to escape into the laboratory environment.
- d) Operations with extremely small quantities of hazardous chemicals that do not release enough emissions to be a health hazard.

3.5.4.3) Fume Hood Work Practices

Authorized Users shall adhere to the following minimum work practices for the maintenance of proper exhaust ventilation when using laboratory fume hoods. More stringent practices may be necessary in some circumstances.

Authorized Users shall:

- a) Confirm adequate hood ventilation performance prior to beginning work inside of hood. (Check for airflow into and through the hood.)
- b) Use only materials for which the fume hood has been designed and for which its current exhaust flow rate is capable of providing protection.
- c) Keep all apparatuses at least 6 inches back from the hood face (front). Apparatus should be raised 2-3 inches off of the surface with blocks to allow proper airflow under the object.
- d) Not put their head in the hood when contaminants are present.
- e) Not use the hood as a routine waste disposal mechanism for evaporation of volatile materials.
- f) Not store chemicals or apparatus in the hood unless they are part of an ongoing process that must be set up in the hood because of hazardous emissions. Hazardous Materials should be stored in appropriate (ventilated, if necessary) safety storage cabinets.
- g) Minimize the quantity of Hazardous Materials and apparatuses present in the hood and not allow them to block baffles or prevent exhaust flow.
- h) Keep the hood sash closed at all times, except when manipulating or making adjustments to activities inside.
- i) Keep the hood sash as low as practical when working inside. The sash is designed to be used as a limited safety shield. Recommended sash working height is >12 inches and <18 inches.
- j) Leave the hood "on" if there are hazardous substances in the hood that present concern about airborne emission. Shut the system off if there is no need to have contents under ventilation.

- k) Minimize foot traffic past the face of the hood when in use to prevent cross-draft turbulence that can affect hood face velocity and prevent proper contaminant capture.
- l) Use an appropriate barricade or safety shield if there is the chance of an explosion, eruption, or exposure to hazardous radiations.
- m) Not place electrical receptacles or other spark sources inside the hood when flammable liquids or gases are present. No permanent electrical receptacles are permitted inside a laboratory fume hood.
- n) Keep laboratory doors and windows closed.
- o) Not position air movement devices so they interfere with the hood's performance and shall not block air supply vents in the room.
- p) Not remove the hood sash, panels or baffles except when necessary for apparatus set-up. Replace all parts and confirm adequate hood performance before beginning operations.

3.5.4.4) Radioisotope Hoods

Authorized Radiation Users, in addition to the work practices for laboratory hoods identified above, shall:

- a) Conduct the use of radioisotopes in a hood in accordance with Part IV of this manual.
- b) (Should) not use a radioisotope hood as a general purpose laboratory hood.
- c) (Should) not use radioisotopes in a general purpose laboratory hood without approval by Radiation Safety.

3.5.4.5) Perchloric Acid Fume Hoods

Where perchloric acid is heated above ambient temperatures, vapors may condense within the fume hood exhaust system and form explosive perchlorates. In such instances, specially designed perchloric acid fume hood exhaust systems must be in place and utilized. These systems will have dedicated exhausts, a water wash-down system, and may only be used for perchloric acid digestions.

Authorized Users shall:

- a) Not use or heat perchloric acid in a fume hood designed for other purposes.
- b) Conduct perchloric acid digestions in a proper perchloric acid fume hood system.
- c) Identify perchloric acid fume hoods with large warning signs.
- d) Not use a perchloric acid fume hood as a general laboratory fume hood.
- e) Wash down perchloric acid fume hood systems after each use.
- f) (Should) remove the hood baffle regularly (after wash-down) for inspection and cleaning. Flush away any deposits.
- g) Use the lowest quantity of perchloric acid possible for the required process..
- h) (Should) not use spark-producing apparatus inside a perchloric acid hood.
- i) (Should) apply only inorganic coatings and lubricants to apparatuses used within the hood.
- j) (Should) label all active and inactive perchloric fans and duct-work with an appropriate caution sticker.
- k) Contact EHS for assistance in testing for residual perchlorates prior to system disassembly or for any other assistance.

3.5.4.6) Laboratory Fume Hood Performance Criteria

The Authorized Laboratory Supervisor shall:

- a) Maintain all laboratory fume hoods so that a minimum average face velocity of 100 linear feet per minute (100 lfpm) is achieved at the normal sash working height (usually in the range of 12"-18" open).
- b) Require that all new hoods have a continuous airflow monitoring device capable of confirming adequate hood airflow. This must be either a pressure gauge, airflow velocity monitor, and/or calibrated alarm device.
- c) (Should) provide all existing hoods with a continuous airflow monitoring device capable of confirming adequate hood airflow added as soon as possible. Existing hoods without such a device should at least have a strip of ribbon or tissue taped to the bottom of the sash so that fan operation and airflow into the hood can at least be qualitatively verified during use.

3.5.4.7) Laboratory Fume Hood Inspection/Certification

The Unit Safety Coordinator/Authorized Laboratory Supervisor shall:

- a) Verify that all laboratory fume hoods have been properly inspected after installation or modification, and annually thereafter.
- b) Contact EHS for assistance in conducting annual Fume Hood Inspections and Certifications. These must consist of a Visual Inspection, Smoke Trace Test, Average Face Velocity Tests, and Written Certification.

3.5.5) Biological Safety Cabinets

These are specially designed, ventilated, safety enclosures used when working with biological organisms that present a hazard. This device is not a laboratory fume hood.

Authorized Users shall:

3.5.5.1) Use Biological Safety cabinets in accordance with the procedures specified in III-3.4.2.

3.5.5.2) (Should) not use hazardous chemicals in these devices.

3.5.5.3) Inspect the biological safety cabinet prior to each use in order to confirm adequate cabinet ventilation performance.

The Authorized Laboratory Supervisor (ALS) shall:

3.5.5.4) Require the inspection and certification of Biological Safety Cabinets on an annual basis in accordance with the manufacturer's requirements.

3.5.6) Gloveboxes/Containment Devices

Authorized Users shall:

3.5.6.1) Operate all gloveboxes/containment devices in a manner so that hazardous substances do not enter the laboratory environment and pose a hazard to personnel/students/visitors.

3.5.6.2) Check that the exhaust air from gloveboxes/containment devices is passed through the appropriate scrubbers, filters, or other treatment devices prior to release into the regular exhaust system. (This includes maintenance of these.)

3.5.6.3) Inspect the gloveboxes/containment devices prior to and during each use to confirm adequate ventilation performance.

The Authorized Laboratory Supervisor shall:

3.5.6.4) Verify that all gloveboxes/containment devices are inspected and certified on an annual basis in accordance with the manufacturer's requirements.

3.6) Personal Protective Equipment (PPE)

***3.6.1) General**

Personal Protective Equipment (PPE) is personal apparel that provides some degree of protection from safety hazards. This equipment may include, but is not limited to the following:

Head Protection - Hard Hat, Hair/Head Cover/Hood

* Eye and Face Protection - Safety Glasses, Goggles, Face Shields

Hand and Body Protection - Gloves, Lab Coats, Aprons, Body Coveralls

Foot Protection - Safety Shoes, Boots, Pullovers, Toe/Tarsal Guards

Hearing Protection - Earplugs, Earmuffs

Respiratory Protection - Air Purifying or Air Supplying Respirators

The Authorized Laboratory Supervisor shall:

3.6.1.1) Provide the necessary Personal Protective Equipment within his/her lab(s) and require that it is properly used/worn through appropriate training; establish laboratory-specific Standard Operating Procedures that are enforced.

3.6.1.2) Provide Personal Protective Equipment, if required, at no expense to laboratory personnel who are defined as "employees of the University" and non-laboratory personnel who may be "visitors" of the laboratory.

3.6.1.3) Provide Personal Protective Equipment, if required, other than lab coats, safety glasses, and/or safety goggles, at no expense to individuals who are defined as KU students.

Note: Students may be required to purchase their own lab coats, safety glasses, and/or safety goggles.

Authorized Student Users shall:

3.6.1.4) Purchase and wear Personal Protective Equipment that conforms with the design requirements specified throughout this section 3.6.

Authorized Users shall:

3.6.1.5) Select and wear Personal Protective Equipment in accordance with the hazards present and as specified in the laboratory-specific Standard Operating Procedures and/or applicable Laboratory-Specific Safety Plans.

3.6.1.6) Check, before using, that the protective apparel is compatible with the required degree of protection for the Hazardous Materials/radiations being used.

3.6.1.7) Wear the required minimum safety apparel specified in section 2.5.3.8.

3.6.2) Head Protection

Head protection is required where there is reasonable probability that injury could result without it.

Authorized Users shall:

3.6.2.1) Wear protective helmets (Hard Hats) when working in areas where there is the potential for head injury from falling objects.

3.6.2.2) (Should) wear Hair Covers/Hoods, when applicable, to protect hair from contamination by Hazardous Materials, prevent it from getting in the way, or becoming entangled in moving equipment.

3.6.2.3) Verify that any Personal Protective Equipment designated for head protection meets the design requirements of ANSI Z89.1-1986.

*3.6.3) Eye and Face Protection

State of Kansas law (K.S.A.72-5207[B]) requires that every student, teacher, and visitor in all schools, colleges, and universities shall wear appropriate eye/face protective devices when conducting any activity that presents a hazard to the eyes or face. See also section 2.5.3.8.D of Chapter 2.

Authorized Users shall:

3.6.3.1) Wear approved safety glasses whenever there is the potential for flying fragments, objects, chips, particles, dusts, etc.

3.6.3.2) Wear approved safety goggles whenever there is the potential for chemical splashes, irritating mists, liquids, etc.

3.6.3.3) Wear approved face shields whenever there is the potential for hot sparks, molten metals, high temperatures, or chemical splash to face. Face shields should not be used as a substitute for eye protection but should be used in conjunction with either safety glasses or goggles.

*3.6.3.4) Use eye protective devices that provide the appropriate protection from optical radiation (be filtered) as necessary.

*3.6.3.5) Verify, before use, that all eye/face protective devices conform to the requirements of ANSI Z87.1-1989 and/or ANSI Z136 as appropriate.

3.6.4) Hand and Body Protection

Skin contact is a potential source of exposure to Hazardous Materials. Therefore, necessary precautions must be taken to protect the skin when working with Hazardous Materials that can cause significant exposure through skin contact or absorption. Appropriate hand and body protection should be selected to meet the needs of the specific laboratory work environment.

Authorized Users shall:

3.6.4.1) Wear gloves whenever there is the potential for hand contact with Hazardous Materials, thermal hazards, or physical hazards.

a) Select gloves based upon the evaluation of the performance characteristics of the hand protection relative to the tasks to be performed, conditions present, duration of use, and the hazards/potential hazards identified.

b) Wash reusable gloves appropriately before removal and inspect them periodically for wear and effectiveness.

c) Remove disposable gloves immediately after use and dispose of them appropriately.

d) Remove gloves before leaving the Hazardous Materials use area in order to prevent contamination. Contaminated gloves shall not be worn outside of the laboratory environment.

e) Remove potentially contaminated gloves in such a fashion that no bare skin touches the outside surface of the gloves.

3.6.4.2) Wear lab coats whenever there is the potential for body/clothes contact with Hazardous Materials.

a) (Should) launder lab coats frequently. (However, any Personal Protective Equipment contaminated with Hazardous Materials shall not be sent to commercial cleaners until decontaminated to a level that presents no hazard.)

b) Remove lab coats immediately if contaminated with Hazardous Materials at such level that penetration through the lab coat is likely or when contaminated with radioactive materials that could expose the body areas beneath the coat to unacceptable doses of radiation.

c) Remove lab coats before leaving the hazardous material use area in order to prevent the spread of contamination. Contaminated lab coats are not be worn outside of the laboratory environment.

3.6.4.3) Wear other, greater chemically protective clothing (sleeves, aprons, body coveralls, etc.) if the hazards of the chemicals being used warrant it. Consult the Material Safety Data Sheet or EHS for further assistance.

3.6.5) Foot Protection - Safety Shoes, Boots, Pullovers, Toe/Tarsal Guards

The requirement and need for safety shoes and/or other foot protection in the laboratory environment is a judgmental process and can only be made after careful hazard assessment of the laboratory operations being conducted.

Authorized Users and Authorized Occupants shall:

3.6.5.1) Wear the appropriate footwear at all times in laboratories where exposure of the feet to Hazardous Materials is probable. Note: Authorized Occupants and/or Visitors are included in this requirement if such individuals walk where the exposure is probable.

a) Wear non-perforated shoes as a minimum when the potential for contamination exists. See c) below and 3.6.5.2. (section 2.5.3.8).

b) Not be in bare feet in labs where Hazardous Materials are present. Open-toed shoes and sandals shall not be worn when a reasonable potential for contamination is present.

Note: In areas of a laboratory where contamination is not likely, such shoes and sandals are not prohibited but it is better not to use them in laboratories at all for the highest protection. Safety coverings over shoes or sandals might be adequate under some circumstances when the potential for contamination exists.

c) Wear chemically protective booties, pullovers, etc., when necessary and should select them in accordance with the hazard presented.

3.6.5.2) Wear the appropriate protective footwear (safety shoes) when working in areas where there is a danger of foot injuries due to falling or rolling objects, objects piercing the sole, or where the feet are exposed to electrical hazards.

a) Verify, before using, that safety shoes conform with the requirements of ANSI Z41-1991.

3.6.6) Hearing Protection

Noise levels in most laboratories are usually not excessive, but there are laboratory facilities or activities in which noise can reach levels for which hearing protection should be provided or in which the laboratory users/occupants should participate in a hearing conservation program. Excess noise levels should be reported to EHS for proper noise hazard assessment.

Authorized Laboratory Supervisors should:

3.6.6.1) Make hearing protection available to laboratory users/occupants who may be or are exposed to noise levels above 85 decibels, no matter what the length of exposure time, in order to prevent temporary hearing loss.

Authorized Users and Authorized Occupants shall:

3.6.6.2) Participate in the University's Hearing Conservation Program when they are exposed to noise levels at or greater than 85 decibels over an eight-hour time-weighted average.

Note: The Authorized Laboratory Supervisor shall provide the appropriate hearing protection to be worn at all times if the noise exposure is above this level.

3.6.7) Respiratory Protection

In laboratory environments where airborne contaminants are present, it may be necessary to use respirators to keep personnel/students/visitors exposures below permissible exposure limits.

Engineering and administrative controls are to be initially implemented to eliminate as far as feasible any potential airborne contaminants (dusts, fogs, fumes, mists, gases, smokes, sprays, or vapors). If, after these actions, respiratory hazards will still be present or produced, then the Authorized Laboratory Supervisor shall select and provide the appropriate, approved respiratory protection equipment.

Respirators fall into three general classifications:

Air-Purifying	Air-Supplying	Combination Air-Purify/Air-Supplying
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The selection of a respirator for any given situation requires consideration of the following factors:

- Nature of the hazard
- Extent of the hazard
- Work Requirements and Conditions
- Characteristics and Limitations of Available Respirators.

Only those respirators carrying an MSHA/NIOSH certification as "approved respirators" are acceptable for protection of laboratory users/occupants from exposures at or above a PEL.

Single-strap, paper-filter, comfort masks are not MSHA/NIOSH approved and do not provide protection against hazardous levels (\geq PEL) of dusts, mists, fumes, vapors or other contaminants. They provide minimal, if any, protection against nuisance dust and non-toxic particles only.

Laboratory users/occupants are not to be issued, required to wear, or use an approved respirator without the following conditions being met:

The Authorized Laboratory Supervisor shall:

3.6.7.1) Have a written respiratory protection plan approved by EHS as part of the laboratory-specific Standard Operating Procedures when respiratory protection is required.

3.6.7.2) Perform a hazard assessment and contact EHS to assist in selecting the proper, "approved" respiratory protection.

Each Authorized User or Authorized Occupant requiring respiratory protection shall:

3.6.7.3) Undergo examination by a licensed physician to determine that they are physically and physiologically capable of wearing and working with a respirator prior to being assigned to an operation requiring such approved respiratory protection

a) Undergo, as a minimum, a routine physical and a pulmonary function test.

3.6.7.4) Be fit tested by EHS to assure that the respirator assigned to them provides a tight seal.

a) Not have facial hair that interferes with an approved respirator's seal.

b) Not wear normal corrective lenses (glasses) with full-face respirators because the earpieces interfere with the face piece seal. Special corrective lenses, especially for full-face respirators, should be purchased.

Authorized Users, Authorized Occupants, and Authorized Laboratory Supervisor requiring respiratory protection shall:

3.6.7.5) Be trained in the proper selection, use, limitations, and maintenance of respirators. Note: This includes testing for a seal, checking for saturation or out-of-date filters, checking for type of protection.

a) Contact EHS to arrange for this training.

3.6.7.6) Perform routine inspection, maintenance, cleaning, and storage of their respirator if it is of the reusable type.

a) Notify the Authorized Laboratory Supervisor of identified problems and not use defective respirators until repaired and retested or replaced by the Authorized Laboratory Supervisor.

3.6.7.7) Contact EHS for assistance with any of the above.

***3.7) Safety Equipment**

These are specialty devices or equipment that are used to enhance the protection of personal safety. Some are used in a proactive manner and others in reactive manner because of an emergency.

The laboratory supervisor shall provide required safety equipment, check that such equipment is properly functioning or adequate, and enforce the use of such equipment by the Authorized User in his/her laboratory.

Note: This requirement does not address who has to provide the funds for purchases and maintenance and does not address who performs the installation and maintenance.

***3.7.1) Safety Shields/Containment**

The Authorized Laboratory Supervisor (ALS) should verify that:

3.7.1.1) Fume hoods are equipped with drawn sashes, gloveboxes, face shields or other protective barriers whenever laboratory activities using chemicals with a high potential for sudden splattering (i.e., those involving concentrated acids, bases, oxidizing or reducing agents) are undertaken.

3.7.1.2) Specialty safety shields, barriers, or containment are used whenever laboratory activities using chemicals with a potential for severe reaction or explosion are undertaken.

*3.7.1.3) Radiation shielding or beam blocking devices are adequate and properly functioning.

3.7.2) Safety Showers

The Authorized Laboratory Supervisor shall verify that:

3.7.2.1) An easily accessible, drench/deluge-type safety shower is available within 100 feet, or 10 seconds travel time, of each laboratory storing or using hazardous chemicals.

3.7.2.2) Laboratories routinely storing or using significant quantities of hazardous chemicals have a drench/deluge-type safety shower inside the laboratory.

Note: The meaning of "significant quantities" will be established in consultation with EHS at the time the Hazard Registration form is evaluated or a proposed Laboratory-Specific Safety Plan is processed.

3.7.2.3) All safety showers conform with the requirements of ANSI Z358.1-1990.

3.7.3) Eyewash Fountains

The Authorized Laboratory Supervisor shall:

3.7.3.1) Provide and maintain an eyewash fountain inside each laboratory where hazardous chemicals are stored or used.

3.7.3.2) Require that eyewash fountains comply with the requirements of ANSI Z358.1-1990.

*3.7.4) Fire Extinguisher

The Authorized Laboratory Supervisor shall:

3.7.4.1) Require that each laboratory has at least one (1) portable fire extinguisher that has been selected in accordance with the fire hazard(s) present in the laboratory. Selection criteria follow:

- a) Class A extinguishers are intended to be used on fires involving ordinary combustibles such as paper, wood, plastics, textiles, etc.
- b) Class B extinguishers are intended to be used on fires involving flammable liquids such as paints, solvents, petroleum fuels, etc.
- c) Class C extinguishers are intended to be used on electrical fires from wiring, electrical powered equipment, or on Class A or B fires in near proximity to electrical equipment.
- d) Class D extinguishers are used on combustible metals such as aluminum, magnesium, potassium, sodium, titanium, etc.
- e) It is recommended that this one minimum extinguisher be a portable dry-powder type with a rating of at least 2A:10B:C. The lab may also need other types (CO₂, Class D, etc.) of extinguisher depending on the hazards present.

3.7.4.2) Contact Facilities Operations to obtain fire extinguisher.

Laboratory personnel/students shall:

3.7.4.3) Not be asked to put out fires and shall not use portable fire extinguisher unless they have been properly trained.

*3.7.5) First Aid Kits

The Authorized Laboratory Supervisor should:

3.7.5.1) Obtain and maintain a properly stocked first aid kit in each laboratory.

Laboratory users/occupants:

3.7.5.2) Are not asked to render first aid and shall not render first aid unless they have been properly trained.

3.7.6) Storage Cabinets

Facilities for storage of Hazardous Materials in the laboratory must be selected with as much care as any other safety equipment. Many materials may be stored on ordinary shelves or cabinets, with only common sense safety provisions being necessary. (See I- 2.4.) However, some of these Hazardous Materials must be stored in special cabinets specifically designed to handle their dangerous properties. In other cases, there are restrictions on their use that require extra security precautions to prevent unauthorized access. Hazardous materials requiring special storage cabinets include: flammable materials, corrosive materials, EHS Safety Authorization-Requiring Hazardous Materials (toxics, carcinogens, mutagens, etc.), reactives, explosives, drugs/controlled substances, biohazards, and radioactive materials.

3.7.6.1) Flammable Material Storage Cabinets

Flammable/Combustible materials are among the most commonly employed chemicals in the laboratory and represent one of the most significant hazards because of their ignitability characteristics. The purpose of a flammable material storage cabinet is to postpone the involvement in a fire of the materials stored within the cabinet long enough to allow persons in the immediate area to evacuate the area, or in some cases extinguish the fire. Flammable material storage cabinets protect the flammable materials from people and potential accidents, not the other way around.

The Authorized Laboratory Supervisor (ALS) shall require that:

- a) All cabinets used to store flammable materials meet the design and construction requirements of NFPA 30.
- b) All cabinets used to store flammable materials are certified as capable of meeting the 10 minute fire test specified in NFPA 251.
- c) Flammable materials storage cabinet doors remain closed at all times, except when removing or returning containers.
- d) Individual flammable materials storage cabinets are limited to a total maximum volume not to exceed 60 gallons of flammable/combustible materials.
- e) The doors of flammable materials storage cabinets are conspicuously labeled with the following: "Flammable--Keep Fire Away"
- f) Flammable materials storage cabinets are not vented without approval by EHS.

3.7.6.2) Corrosive Materials Storage Cabinets

Certain corrosive materials may also require special storage cabinets because of their potential to generate hazardous vapors or fumes. Generally it is acids that pose a problem, but some bases may also generate problem vapors or fumes. Some cabinets present under a fume hood are specially constructed and vented and can be used for storing corrosive materials.

The Authorized Laboratory Supervisor shall require that:

- a) Cabinets used to store corrosives have finishes capable of providing protection from corrosive fumes or vapors.
- b) Acids and bases are not stored in the same cabinet, unless the cabinet has been constructed with separate, isolated compartments so that vapors or fumes from the two cannot mix.

The Authorized Laboratory Supervisor should require that:

- c) Corrosive materials storage cabinets under fume hoods are ventilated by a connection to the fume hood plenum. Stand-alone cabinets should be ventilated by an appropriate exhaust ventilation duct.

3.7.6.3) Radioactive Materials Storage Cabinets

Since all radioactive materials are chemicals, the requirements for storage of chemicals as specified above may need to be considered. There is one additional legal requirement that is best addressed at the storage level and, if the material emits radiations that penetrate the storage container, shielding may need to be included in the storage cabinet or refrigerator. The legal requirement is that radioactive materials must be secured against unauthorized use. High fines have been assessed for failure to do so. IF the storage facilities cannot be locked against unauthorized access, a room with radioactive materials must be locked whenever no authorized user is present to prevent unauthorized access.

The Authorized Laboratory Supervisor shall:

- a) Provide and use storage facilities that are appropriately shielded for the areas surrounding the storage facilities. Contact the Radiation Safety Office for help in evaluating shielding requirements. This is usually part of obtaining a permit (Laboratory-Specific Safety Plan). See IV-5.

The Authorized Laboratory Supervisor should:

- b) Provide securable storage facilities.
- c) Provide storage facilities designed for ease of decontamination.

3.7.6.4) Security Storage Cabinets

There are certain materials that need to be stored in secure cabinets in order to prevent unauthorized access, misuse, or potential theft.

The Authorized Laboratory Supervisor shall require that:

- a) Items such as reactives, explosives, EHS Safety Authorization-Requiring Hazardous Materials and biohazards are stored in substantially constructed cabinets that are suitable for the materials. For EHS Safety Authorization-Requiring Hazardous Materials, cabinets designed for providing security against unauthorized access are required.
- b) The storage of controlled substances or drugs is in accordance with applicable federal and state regulations.

3.7.7) Spill Control Kits

It is inevitable that laboratories using Hazardous Materials will experience at one time or another a spill or release. Therefore it is prudent that each laboratory be prepared and have the appropriate spill control/cleanup supplies on hand in the lab to address potential Hazardous Materials releases.

The Authorized Laboratory Supervisor should:

- 3.7.7.1) Consult EHS for information concerning the appropriate types and quantities of spill control materials that should be present.

***3.8) Laboratory Inspections/Reviews**

In order to provide laboratory facilities that are free from recognized safety hazards and are properly maintained/operated, they must be inspected on a routine basis. This may consist of quick, informal, self-reviews by laboratory users/occupants on a daily basis; documented safety inspections by lab supervisors or units on a periodic basis; random inspections by the University Lab Safety Committee or EHS Dept.; or formal compliance inspections by regulatory agencies.

***3.8.1) Required Laboratory Inspections**

3.8.1.1) Inspections by Laboratory Users/Occupants

The Authorized Users shall:

- a) Conduct daily inspections of their work areas to identify potential safety hazards.

This may be a quick, informal review of activities to be conducted and should be evaluated for compliance with the Laboratory Safety Manual Standard Operating Procedures identified in Chapter 2 and any lab-specific Standard Operating Procedures.

- b) Conduct documented surveys/inspections as required by laboratory-specific Standard Operating Procedures or Laboratory-Specific Safety Plans.

3.8.1.2) Inspections by Lab Supervisors

The Authorized Laboratory Supervisor, at least once each academic term (Fall, Spring and Summer) and whenever significant changes in conditions occur or are identified, shall:

- a) Assess and document laboratory hazards using the LHRSA form.
- b) Assess laboratory safety practices using the Laboratory Safety Inspection (LSI) checklist. See Part I - Appendix 8.3.4.
- c) Verify that appropriate inspections of all reusable Personal Protective Equipment are performed and that equipment is functioning. This may be documented on the Laboratory Safety Inspection Checklist.
- d) Verify that all safety equipment identified in section 3.7 above has been appropriately inspected for proper functioning and that such equipment remains available. This may be documented on the Laboratory Safety Inspection Checklist.

e) Verify that local exhaust ventilation devices (fume hoods, biosafety cabinets, gloveboxes, containment devices) have received annual inspections/certifications as required in 3.5.4.7(b), 3.5.5.3, and 3.5.6.4.

3.8.1.3) Inspections by Unit/Departmental Safety Coordinator (USC)

The Unit Safety Coordinator shall:

a) As a minimum, annually inspect/review each lab within his/her jurisdiction for compliance with this laboratory safety manual, lab-specific Standard Operating Procedures and/or applicable Laboratory-Specific Safety Plans.

b) Inspect/review a laboratory when there is reason to believe that the laboratory is not in compliance with the requirements of this Laboratory Safety Manual, lab-specific Standard Operating Procedures and/or Laboratory-Specific Safety Plans.

The Unit Safety Coordinator should:

c) Perform brief inspections on a periodic basis at a frequency determined by the nature of the hazards present in the laboratory and the history of safety performance within the laboratory.

d) Document the inspection using either the Laboratory Safety Inspection or other special check lists.

3.8.1.4) Inspections by EHS Dept. or Laboratory Safety Committee (LSC)

EHS/Laboratory Safety Committee may:

a) Perform random laboratory inspections/reviews to monitor compliance with this laboratory safety manual, or in response to requests for assistance. Such inspections/reviews shall not be performed without first notifying the appropriate Laboratory Supervisor or the Unit Safety Coordinator.

b) Perform unannounced laboratory inspections in response to complaints or emergencies. Every attempt will be made to notify the Laboratory Supervisor or Unit Safety Coordinator upon arrival prior to initiating such an investigation.

Note: Announced and unannounced inspections by the Radiation Safety Service of laboratories with radioactive materials are mandated and "shall" occur.

EHS shall:

- c) Recommend appropriate remedial action to the Authorized Laboratory Supervisor when non-compliance with this Laboratory Safety Manual, laboratory-specific Standard Operating Procedures or Laboratory-Specific Safety Plans occur. See 3.8.3 below.
- d) Report to the Laboratory Safety Committee any substantive deficiencies in compliance with the requirements of this Laboratory Safety Manual by any individual or unit when appropriate remedial or corrective action cannot be negotiated with the Authorized Laboratory Supervisor. The report shall contain EHS recommendations for corrective action. See 3.8.3 for detailed procedures involving non-compliance.
- e) Withdraw "Authorized Laboratory" status when it is the professional judgment of EHS that conditions warrant such action because of an immediate and imminent threat to health or safety. (EHS shall be prepared to justify such action to the Laboratory Safety Committee.)

3.8.1.5) Inspections by Regulatory Agencies

The University of Kansas does not control the inspections performed by regulatory agencies. The University of Kansas must cooperate with such inspections and make records, laboratories, and personnel/students/visitors available to the authorized agencies during an inspection.

The EHS Dept., Laboratory Safety Committee, Authorized Laboratory Supervisor, Authorized Users, and Authorized Occupants shall:

- a) Provide records as requested by such agencies.
- b) Make laboratories and facilities available for inspection as needed.
- c) Be available for interviews as needed.

*3.8.2) Hazard-Specific Inspections

3.8.2.1) Chemical — No hazard specific inspection required at this time.

3.8.2.2) Biosafety — No hazard specific inspection required at this time.

3.8.2.3) Ionizing Radiation See Part IV

3.8.2.4) Laser See Part V.

3.8.3) Deficiencies, Violations, Corrective Actions and Disciplinary Procedures

3.8.3.1) Corrective Actions for an Isolated Occurrence of Non-compliance

Authorized Users shall:

- a) Immediately discontinue a practice identified as in non-compliance with this Laboratory Safety Manual and implement one that is in compliance.
- b) Not carry out laboratory procedures with equipment or facilities that are not in compliance with the requirements of the Laboratory Safety Manual unless a temporary written waiver of the requirement has been granted by EHS together with a time limit for re-establishing compliance with the Laboratory Safety Manual.

Note 1: Such waivers will be granted only for “minor non-compliance” conditions when immediate corrections are not feasible and may include special administrative procedures for retaining equivalent safety.

Note 2: Reporting requirements are specified in section I-2.5.4.

Authorized Laboratory Supervisors shall:

- c) Enforce the requirements of the Laboratory Safety Manual in their laboratory and implement corrective actions immediately if feasible when non-compliance has been identified.
- d) Contact EHS at 4-4089 if it is not feasible to take corrective actions immediately and request an evaluation by them for the actions that should be taken -- e.g, cessation of procedures that are in non-compliance or continued work under a waiver granted by EHS. See b) above.
- e) Stop all affected procedures immediately when serious non-compliance and/or imminent danger exists whether identified by themselves or EHS.

f) Follow directives given by EHS for correcting noncompliant conditions and actions. These include the following Laboratory Safety Manual mandated procedures:

1) Not resume work after a “stop work” order until the appropriate corrections have been made, **including** a written evaluation of the causes that produced the “imminent danger” and a protocol designed to prevent recurrence of the condition have been submitted to and approved by the Laboratory Safety Committee and EHS.

Note: If, based upon the judgment of EHS, the informal process specified in the note under j) below is justified, work may be resumed upon authorization by EHS with concurrence of the Laboratory Safety Committee before the written approval has been issued by the Committee.

2) File a written report with EHS within one week of an identified “serious violation” that addresses the causes and the steps that will be taken to prevent recurrence of such violation.

g) (May) appeal to the appropriate subcommittee of the Laboratory Safety Committee for relief from requirements placed upon them by EHS subsequent to identification of non-compliance if it is believed the requirements are not reasonable, not appropriate, and not based upon the requirements of this Laboratory Safety Manual and applicable federal, state and local regulations.

Note: Compliance with EHS directives is required until a written evaluation and resolution of the contested requirements has been received from the Committee by the Authorized Laboratory Supervisor. Compliance with Committee directives is mandatory unless overruled by the Provost in a written directive to the Committee.

The EHS staff shall:

h) Recommend corrective actions (based only upon safety and regulatory requirements) to Authorized Users and the Authorized Laboratory Supervisor whenever non-compliance items have been identified by them.

Note: Non-compliance items may have been identified during inspections, as a result of a report, or during the performance of routine services.

i) Issue a “Stop Work” order if “imminent danger” may result from the non-compliance. Such an order may be verbal or written.

j) Submit a written report of the incident involving “imminent danger” including proposed corrective actions to the Supervisor with copies to the Chair of the Department involved and the Laboratory Safety Committee. The report shall include the report specified in f.1) above.

Note: Phone conferences, electronic notifications, or on-site conferences may be used to implement corrective actions on a more timely basis if it is judged expedient to do so. If any of these procedures are adopted, documentation of such conferences and notifications including the recommendations adopted shall be maintained by EHS. The reports specified in this section and f.1) above shall be filed within one week of the incident. The report shall include the documentation specified in this note.

k) Submit a report of EHS-approved resolution for “serious non-compliance” to the Authorized Laboratory Supervisor and the Chair of the involved Department.

l) Document incidents of “minor non-compliance,” including the date, in the standard forms used by EHS in inspections.

The appropriate subcommittee of the Laboratory Safety Committee shall:

m) Evaluate, make appropriate recommendations, and establish appropriate requirements as needed when any report or request is submitted to it by a user, laboratory supervisor or EHS concerning issues of non-compliance.

n) (May) request a meeting of the full committee if it is deemed expedient to obtain its recommendations.

3.8.3.2) Corrective Actions for Repeated and/or High Frequencies of Non-compliance

Note 1: In this section, a “Non-compliance index” of weighted levels of Non-compliance is introduced for the establishment of “action” levels. See section 3.8.3.3 for definitions.

Note 2: The Radiation Safety Plan has its own standard of Non-compliance action levels. Therefore, Part I: Sections 3.8.3.2 - 3.8.3.3 do not apply for radiation safety Non-compliance. See Part IV: Section 11.8 for the equivalent requirements for radiation safety.

Note 3: The requirements specified in the University’s Employee Safety & Health Manual are included in the assessment of Non-compliance in the laboratory.

The weighting factors are as follows:

Minor Non-compliance incident/promptly corrected	0.125
Minor Non-compliance incident	0.25
Serious Non-compliance incident/promptly corrected	0.25
Serious Non-compliance incident	0.5
Imminent Danger Incident/immediately corrected	1.0
Imminent Danger Incident	2.0

EHS shall:

- a) Direct the Authorized Laboratory Supervisor to file a written protocol that must include changes in the Laboratory-specific Standard Operating Procedures that are designed to reduce and control the frequency of Non-compliance whenever the Non-compliance index for the previous 12 months reaches a value of one (1.00) or higher.
- b) Submit a written approval (including additional requirements if deemed necessary by EHS) of the submitted protocol to the Authorized Laboratory Supervisor, the Chair of the Department and the Chair of the appropriate Laboratory Safety subcommittee. See also section 3.8.1.4.e.
- c) Request a meeting that includes, as a minimum, the appropriate Laboratory Safety subcommittee, the appropriate EHS Safety Officer, and the involved Authorized Laboratory Supervisor when the Non-compliance index exceeds two (2.00) for the past 24 months. See f. and g. below for the subcommittee’s responsibility associated with this meeting.

The Chair of the appropriate Laboratory Safety Committee shall:

- d) Arrange for a meeting of the subcommittee when requested to do so by EHS.
- e) Include additional individuals in the meeting as needed.

This may be based upon the recommendation of the EHS or the judgment of the Chair of the subcommittee. This could include involved Authorized Users, Authorized Occupants and/or the Chair of the involved Department.

The appropriate subcommittee of the Laboratory Safety Committee shall:

- f) Make binding recommendations for the procedures to be followed and/or restrictions to be imposed for the purpose of reducing and controlling the frequency of noncompliant incidents and for restoring a safe environment in the laboratory based upon the deliberations at that meeting between committee members, the EHS Safety Officer and the other individuals present at the meeting.
- g) These recommendations shall include the specific provisions for how the laboratory will be monitored for compliance, the length of time for special monitoring, and how the Non-compliance index will be used to flag additional actions.

Authorized Users and Authorized Laboratory Supervisors shall:

- h) Follow the directives of EHS and/or appropriate Laboratory Safety subcommittee.

Note: If an appeal has been filed for action at a higher level, compliance with directives is required until the appeal has been acted upon and directives based upon the appeal have been submitted in writing to both EHS and the Authorized Laboratory Supervisor.

3.8.3.3) Classification of Levels of Non-compliance

The following are the definitions for the various levels of Non-compliance.

a) Imminent Danger Non-compliance

Any situation in the laboratory that could reasonably be expected to cause death, serious injury or illness, or significant risk to the environment.

b) Serious Non-compliance

Any situation in the laboratory in which the non-compliance creates a condition where the capability to protect an individual(s) from safety and health hazards is compromised, or in which the capability of keeping exposures below applicable exposure limits has been compromised.

c) Minor Non-compliance

Any Non-compliance situation not included under imminent danger or serious Non-compliance.

3.8.3.4) Disciplinary Actions

Introductory note: Sections 3.8.3.1 and 3.8.3.2 are not disciplinary actions. They are designed to provide a safe environment on campus and, to the extent possible, will be carried out in the spirit of mutual cooperation. This section addresses procedures to be followed when mutual cooperation has not been achieved and deliberate non-compliance or apparent negligence has been identified.

Authorized Laboratory Supervisors shall:

a) Initiate disciplinary procedures in accordance with the applicable handbook or code (student, staff, faculty) and in keeping with established university grievance procedures against any individual in a laboratory who deliberately refuses to conform with the requirements of the Laboratory Safety Manual or who is negligent in observing safety requirements.

EHS shall:

b) Report in writing to the appropriate subcommittee and the chair of the department or unit any incident involving deliberate non-compliance with the Kansas University Safety Program and related federal, state and/or local regulations and/or negligence in observing safety requirements. This report shall include documentation of the evidence supporting the assessment of deliberate non-compliance or negligence.

c) In any situation of imminent danger or serious non-compliance that may result in safety and health hazards if the laboratory continues to be used, close the laboratory to the individual(s) who has (have) not complied until such time of resolution of the disciplinary action or correction of the identified non-compliance, whichever occurs first.

Note: The manner in which differences of opinion between the Authorized Laboratory Supervisors and EHS concerning the meaning and/or applicability of specific portions of the Kansas University Safety Program are to be resolved has already been addressed in 3.8.3.1 and 2 of this manual. If an individual refuses to follow the requirements of those sections, deliberate non-compliance is involved.

The appropriate subcommittee of the Laboratory Safety Committee shall:

c) Initiate hearings involving the alleged “deliberate non-compliance” or “negligence” in keeping with applicable university handbooks, codes and/or grievance procedures.

***3.9) Prior Hazard Registration and Procedure for Obtaining EHS Safety Authorizations for Level III and IV Laboratories**

Explanatory Note: All laboratories will be identified for the types of hazards that are present – chemical hazards, biohazards, ionizing radiation hazards, and/or laser hazards. For each of these the magnitude of the hazard will be assigned as Level I, II, III or IV (increasing hazard with increasing number).

Laboratories at Levels III and IV will be subject to additional laboratory-specific safety requirements specified in an EHS-approved **Laboratory-Specific Safety Plan (LSSP)** at Level III and an EHS and Laboratory Safety Committee-approved LSSP at Level IV. (See Section I of this Part for the rationale for this procedure.) This section provides the procedures by which types and levels of hazards in each laboratory will be assigned and the procedures that will initiate the process by which additional EHS and, if needed, Laboratory Safety Committee-approved LSSPs for Level III and IV laboratories may be established.

***3.9.1) Responsibilities of Authorized Users**

Authorized Users shall:

3.9.1.1) Obtain prior approval from their laboratory supervisor before procuring or using any Hazardous Materials/Radiation Generating Devices in accordance with all parts of this Manual and this section (I-3.9).

***3.9.2 Responsibilities of Authorized Laboratory Supervisors**

Authorized Laboratory Supervisor shall:

3.9.2.1) Submit a completed copy of the **LHRSAA** form (a copy of this form is given in Part I - Appendix 8.3.1) upon implementation of this University Safety Plan and thereafter an updated registration prior to any change in the mission of the laboratory that would either change the type of hazards present or the Level of the hazards.

Criteria that place a laboratory at Level III or IV are given in the LHRSAA form and are repeated for chemicals in Part II-Section 3.9, for biohazards in Part III-Section 3.7, for radioactive materials and/or radiation generating devices in Part IV-Section 7, and for lasers in Part V-Section 3.9. (Note: This registration provides the required initial notification to EHS of the hazards present in the laboratory and initiates the process by which the necessary Laboratory-Specific Safety Plans LSSPs will be established for Level III and IV laboratories. During the implementation of the University Safety Plan, a grace period will be given for Level III and IV labs until the written LSSPs can be created and appropriately approved unless existing conditions require immediate action.)

3.9.2.2) Upon notification by EHS of its receipt of the initial completed LHRSA form, (may) initiate Level I and II activities identified in the LHRSA except for the use of materials or equipment that emit ionizing radiation. (The latter require LSSPs even at Levels I and II. Under our radioactive materials license, the LSSPs are called “permits.” See Part IV if such use is planned.)

An updated LHRSA shall be submitted when a new type of hazard is introduced into the laboratory even if it is at Level I or II. For example, a laboratory that initially has been using chemicals but no biohazards shall not introduce biohazards into the laboratory unless registration with EHS has been accomplished.

Note: Upon receiving the LHRSA form, the EHS Department will propose an overall hazard level for the laboratory when many different types of hazards are present in the laboratory. This will be done in consultation with the Authorized Laboratory Supervisor. If the EHS Department and the Authorized Laboratory Supervisor cannot agree on the hazard level, the Laboratory Safety Committee will review the hazard levels in that laboratory and its recommendations are final.

3.9.2.3) Submit all safety information requested by EHS staff (who will request the information using appropriate forms) for all activities that are planned at Levels III and IV. The process by which the necessary Laboratory-Specific Safety Plans (LSSPs) are to be developed is described below in section 3.9.3 below.

3.9.2.4) Obtain hazardous materials (HM) or radiation generating devices (RGDs) requiring Level III or IV LSSPs only after receiving notification from EHS that the LSSPs have been appropriately approved. Note: Remember that this applies at Level I and II as well for the use of radioactive materials or machines that generate ionizing radiation.

3.9.2.5) Begin use of Level III or IV HM/RGDs **only** after receiving the written **Safety Authorization** from EHS. Note: The Safety Authorization will be granted only after EHS has inspected the facility and has verified that all safety requirements specified by the approved LSSPs have been met. This includes verification that the Laboratory Supervisor has been appropriately trained. See 3.9.3.8 below.

3.9.2.6) Permit laboratory personnel, students, or visitors to use such materials/equipment only after they have received documented safety training required by this Plan which includes training in the procedures and conditions specified in all applicable LSSPs.

3.9.3) Procedures for Obtaining an EHS Safety Authorization for Activities at Level III and IV.

Prospective Supervisors are encouraged to discuss plans with EHS very early in the planning stages—even prior to completing the LHRSA form that initiates the process.

3.9.3.1) The Laboratory Supervisor shall complete and submit an updated LHRSA form to EHS, 140 Burt Hall, whenever plans for a change in the type and/or Level of activities at Level III or IV are being made.

3.9.3.2) Upon receipt of the LHRSA, the EHS shall provide the forms to the Laboratory Supervisor that will provide instructions concerning the types of safety information (engineered controls, facilities, SOPs) to be addressed in the proposed Laboratory-Specific Safety Plans (LSSP(s)).

3.9.3.3) The Laboratory Supervisor shall complete and submit one copy of proposed Level III LSSP(s) to EHS and six copies of proposed Level IV LSSPs.

3.9.3.4) The EHS Department /Laboratory Safety Committee shall review the proposed LSSP(s) for adequacy in safety at the level of activities requested. This evaluation will be based upon the proposed safety facilities/equipment and appropriate Standard Operating Procedures (SOPs) taking into account any applicable federal, state and local regulations and the requirements of this Manual.

3.9.3.5) If deficiencies in the proposed LSSP(s) are identified by the EHS Dept. /Laboratory Safety Committee, EHS and the Laboratory Supervisor shall plan appropriate changes that will then be resubmitted by the Laboratory Supervisor for approval by the EHS Department /Laboratory Safety Committee.

Note: Some requirements may not be negotiable. In that case, they become EHS/Laboratory Safety Committee specified conditions in the LSSP.

Note: Wherever “the EHS Department/Laboratory Safety Committee” appears in these steps, it is to be understood that only the EHS needs to review Level III LSSPs. Both EHS and the appropriate subcommittee of the University Laboratory Safety Committee are involved when the LSSP is for a Level IV laboratory. A Laboratory Supervisor has the option of requesting a review by the appropriate Laboratory Safety subcommittee if disagreements with EHS concerning requirements cannot be resolved for proposed Level III LSSPs.

3.9.3.6) Upon approval of the proposed LSSP(s), EHS shall notify the Laboratory Supervisor of that approval.

3.9.3.7) Upon receiving approval of the LSSP(s), the Laboratory Supervisor shall prepare the laboratory to meet all conditions specified in the approved LSSP and then request an inspection by EHS.

Note #1: Hazardous Materials shall not be procured until the EHS approves the facility. In the case of Radiation Generating Devices, the procurement and installation of the devices shall be accomplished in collaboration with the appropriate EHS personnel and shall not be energized until EHS issues the Safety Authorization described in 3.9.3.8 below.

Note #2: No individual may use such HM/RGDs until he/she has satisfactorily documented all required training. This includes the Laboratory Supervisor and all other potential users. The Laboratory Supervisor is urged to address these issues in consultation with EHS as soon as plans for a Level III or IV laboratory are anticipated.

3.9.3.8) When all the conditions of the approved LSSP(s) have been met as verified by EHS, it shall issue a written Safety Authorization to the Laboratory Supervisor that references all documents associated with the approved LSSP(s).

Note: For LSSPs involving radioactive materials/ionizing radiation generating devices substitute “permit” for Safety Authorization.

3.9.3.9) Upon receiving the Safety Authorization from EHS, the Laboratory Supervisor may initiate use of the materials/equipment under the conditions of the applicable LSSPs and this Manual.

Note #1: All LSSPs will automatically contain a commitment to contact the EHS and notify them of the procurement of Level III or IV materials.

Note #2: All LSSPs must establish designated areas in the lab for use of Level III and IV materials (e.g., a hood, lab bench, or glove box) and identify their presence by appropriate signs and postings.

4) Information & Training

Federal and State Regulations and "Prudent Practice" require the University to provide all employees, students and visitors with information concerning hazards (Hazardous Materials, hazardous radiations, hazardous equipment) present in their environment (area of occupancy) and sufficient training to enable them to perform their tasks safely and to protect themselves.

*4.1) Responsibilities

*4.1.1) Responsibilities of Laboratory Supervisors

Authorized Laboratory Supervisors shall:

4.1.1.1) Provide, with documentation, all users of Hazardous Materials/Radiation Generating Devices in their respective areas with the minimum required information and initial and refresher training described in this chapter and applicable referenced sections to other parts of this manual.

4.1.1.2) Provide, with documentation, all occupants of areas in which Hazardous Materials/Radiation Generating Devices are used by others with the information and initial and refresher training described in this chapter.

4.1.1.3) Provide visitors with appropriate information concerning the hazards in the laboratory and provide supervision by an authorized user while they are in the laboratory.

Reminder: Where the term "Authorized User" or "Authorized Occupant" occurs in this manual it is understood that the individual referred to has had documented training that addresses the procedures introduced by "Authorized Users or Authorized Occupants shall or should."

*4.1.2) Responsibilities of Prospective Users of Hazardous Materials (HM) or Radiation Generating Devices (RGDs)

Prospective Users of Hazardous Materials/Radiation Generating Devices shall:

4.1.2.1) Not undertake any laboratory activities without first being informed and trained as described in this chapter and referenced sections and having obtained certification of that training by the person or office designated to have that authority as specified in this chapter.

Authorized Users shall:

4.1.2.2) Participate in all required safety training at the frequency described in section 4.6 of this Chapter.

Note: A previously authorized user who has not completed documented refresher training within sixty (60) days after the expiration date of the previous training is no longer an authorized user with respect to the activities for which the training has not been completed and may no longer perform the related activities.

4.1.2.3) Familiarize themselves with the required information as identified in section 4.2 of this Chapter.

4.1.2.4) Be trained in, understand and follow the conditions and procedures as specified in section 4.5 of this Chapter.

*4.1.3) Responsibilities of Prospective Unsupervised Occupants of Laboratories with Hazardous Materials/Radiation Generating Devices

Prospective Occupants of Laboratories with Hazardous Materials/Radiation Generating Devices shall:

4.1.3.1) Be informed of the content and location of the materials listed in 4.2 and trained (certified) as an "Authorized Occupant" as described in 4.3 before pursuing unsupervised residence in such a laboratory. Until such training has been accomplished, individuals may only be supervised visitors in such a laboratory.

NOTE: An authorized occupant who has not completed the documented refresher training before the expiration date of the previous training no longer has the privilege of unsupervised access to any laboratory with Hazardous Materials/Radiation Generating Devices.

Authorized Occupants shall:

4.1.3.2) Participate in all required safety training at the frequency described in section 4.6 of this Chapter.

*4.1.4) Responsibilities of the Unit Safety Coordinator (USC)

The Unit Safety Coordinator shall:

4.1.4.1) Coordinate general information and training sessions within his/her unit.

Note: If there are separate Unit Safety Coordinators, e.g., Departmental Radiation Safety Coordinator, Chemical Hygiene Safety Coordinator, etc., the responsibility is restricted to the requirements for that type of activity.

4.1.4.2) Monitor compliance training requirements of users and occupants as specified in this chapter and referenced sections of other parts of this manual.

4.1.5) Responsibilities of the Environment Health and Safety Department (EHS)

EHS shall: (through its respective safety officers)

4.1.5.1) Provide assistance to Unit Safety Coordinators and Laboratory Supervisors in developing and conducting required information and training of users.

*4.2) Required Information

Explanatory Note: It is expected that Authorized Users will have a solid understanding of the information relevant to their areas of authorized use as listed in this section and of where they may find copies for laboratory-specific information and/or requirements as needed. Authorized Occupants are expected to be aware of the types of information available in these documents and where they may be found. "Informed" has these two distinct meanings in this section.

4.2.1) Information for Authorized Users and Authorized Occupants in **all** labs.

All Authorized Users and Authorized Occupants in all labs shall be informed of:

4.2.1.1) The contents of the LHRSA Form.

4.2.2) Information for Authorized Users (AU) of Hazardous Chemicals and for Authorized Occupants in Rooms with Hazardous Chemicals

As a minimum, all Authorized Users and Authorized Occupants in rooms with hazardous chemicals shall be informed of:

4.2.2.1) The contents of the OSHA Laboratory Chemical Hygiene Standard (29 CFR 1910.1450) and its appendices. See Part I-Appendix 8.1.1

Note: The Authorized Laboratory Supervisor or Unit Safety Coordinator shall make this Standard available to all users.

4.2.2.2) The location and availability of the University of Kansas Chemical Hygiene Plan (Part I + Part II of this Laboratory Safety Manual) including laboratory-specific Safety Operating Procedures and applicable Laboratory-Specific Safety Plans.

4.2.2.3) The permissible exposure limits for OSHA regulated substances (29 CFR 1910 Subpart Z) or recommended exposure limits for other hazardous chemicals that have no OSHA limits. See Part II - Section 5.4.

4.2.2.4) Signs and symptoms associated with exposures to hazardous chemicals used in the laboratory.

4.2.2.5) The location and availability of known reference material (including Material Safety Data Sheets) on the hazards and safety practices associated with hazardous chemicals found in the laboratory.

*4.2.3) Information for Authorized Users (AU) of Biohazards and for Authorized Occupants in Rooms with Biohazards

As a minimum, all Authorized Users and Authorized Occupants in rooms with biohazards shall be informed of:

4.2.3.1) The contents of the CDC "Biosafety in Microbiological and Biomedical Laboratories" 4th ed. and/or the NRC "Biosafety in the Laboratory, Prudent Practices for the Handling and Disposal of Infectious Materials."

Note: The Authorized Laboratory Supervisor or Unit Safety Coordinator shall make this book available to all users and occupants. This could be in the departmental or division library.

4.2.3.2) The location and availability of the University of Kansas Laboratory Biosafety Plan (Part I & III of this Laboratory Safety Manual), the CDC manual referenced in 4.2.3.1 for Level III & IV labs, recombinant DNA guidelines, if applicable, and the Bloodborne Pathogen Program, if applicable) including laboratory-specific Safety Operating Procedures and Laboratory-Specific Safety Plans.

4.2.3.3) Signs and symptoms associated with exposures to hazardous biological agents used in the laboratory.

4.2.3.4) The location and availability of known reference materials (including Safety Data Sheets) on the hazards and safety practices associated with Biohazards found in the laboratory.

*4.2.4) Information for Authorized Users (AU) of Radioactive Materials/RGDs (producing ionizing radiations) and Authorized Occupants of rooms with such materials/equipment.

As a minimum, all Authorized Users and Authorized Occupants shall be informed of:

4.2.4.1) The contents of "Radiation Safety in the Use of Radioactive Materials" by Benjamin Friesen and its appendices.

Note: The Authorized Laboratory Supervisor or Unit Safety Coordinator shall make this book available to all users and occupants. This could be in the departmental or division library.

4.2.4.2) The location and availability of the University of Kansas Laboratory Radiation Safety Plan (Part I & Part IV of this Laboratory Safety Manual).

4.2.4.3) Federal and State radiation exposure limits including the License-mandated ALARA limits.

4.2.4.4) Effects of low level exposures to ionizing radiation. (See chapter IV of the text specified in 4.2.4.1 above for Authorized Users and Part IV of this manual for Authorized Occupants.)

4.2.4.5) The location and availability of applicable Safety Data Sheets and Permits (Laboratory-Specific Safety Plans) that address hazards and safety practices associated with sources of ionizing radiation (materials or equipment) found in the laboratory.

*4.2.5) Information for Authorized Users (AU) of Lasers and Authorized Occupants of rooms in which lasers are being used.

As a minimum, all Authorized Users and Authorized Occupants shall be informed of:

4.2.5.1) The contents of ANSI Z-136.

Note: The Authorized Laboratory Supervisor or Unit Safety Coordinator shall make this reference available to all users and occupants. This could be in the departmental or division library.

4.2.5.2) The location and availability of the University of Kansas Laboratory Laser Safety Plan (Part I and Part V of this Laboratory Safety Manual) and laboratory- specific Safety Operating Procedures and any applicable Laboratory-Specific Safety Plans..

4.2.5.3) Exposure limits specified in ANSI Z-136.

4.2.5.4) Effects of exposures to laser beams. (See Part V.)

***4.3) Required Training for Authorized Occupants**

As a minimum, Authorized Occupant training shall include:

4.3.1) A brief overview of the types of adverse health effects that may occur with exposure to Hazardous Materials/Radiations.

4.3.2) Sources of more specific information for specific types of exposures.

Note: Section 4.2 above provides references to such sources. The Authorized Occupant shall know where those sources can be found and what type of information is in those sources. Authorized Occupants are not required to master the content of those sources.

4.3.3) How to obtain guidance in safety practices from the Material Safety Data Sheet or Safety Data Sheets and information on specific hazards associated with the Hazardous Materials addressed by the Material Safety Data Sheet or Safety Data Sheet..

4.3.4) Safety procedures required for adequate safety in performing assigned activities in rooms with Hazardous Materials/Radiation Generating Devices.

Note: See Part I: Section 2.5 for applicable Safety Operating Procedures.

***4.4) Required Training for "Visitors"**

4.4.1) Required training for visitors in any laboratory

As a minimum, visitor training shall include:

4.4.1.1) General nature of hazards in the laboratory--chemical, biological, physical, and/or types of radiation sources.

4.4.1.2) Instructions to avoid contact with all laboratory bench surfaces, storage cabinets, fume hoods, biological cabinets, etc., and all containers in the laboratory.

4.4.1.3) Instructions necessary for avoiding exposure to Hazardous Materials/Radiations.

Reminder: Visitors are not permitted if exposures to Hazardous Materials or Radiations at levels greater than those permitted for the general public cannot be avoided through the supervision of the visitor by a qualified escort. See section I-2.5.1.

4.4.2) Additional training requirements for Visitors in Level III and IV Laboratories

4.4.2.1) Information on the nature of the hazards that cause the laboratory to be classified at the III or IV level including a brief explanation of biological risks associated with exposure.

***4.5) Required Training for Authorized Users**

4.5.1) Required Training for all Users (Authorized Users) of Hazardous Chemicals

As a minimum, Authorized User training shall include:

- 4.5.1.1) Methods and observations that may be used to detect the presence or release of hazardous chemicals.
- 4.5.1.2) The physical and health hazards associated with chemicals in the work area.
- 4.5.1.3) Measures the chemical users can take to protect themselves from these hazards.
- 4.5.1.4) The content of Part I and Part II of this manual.
- 4.5.1.5) Any other laboratory-specific chemical hygiene requirements.

4.5.2) Required Training for all Users of "EHS Safety Authorization-Requiring Hazardous Chemicals"

In addition, Authorized User training shall include:

- 4.5.2.1) The requirements of section 3.9 and 4.3 of Part II, as well as, any training specifically required by an approved Laboratory-Specific Safety Plan .

4.5.3) Required Training for all Users (Authorized Users) of Biohazards

As a minimum, Authorized User training shall include:

- 4.5.3.1) Methods and observations, if available, to detect the presence or release of biohazards.
- 4.5.3.2) The physical and health hazards associated with biohazards in the work area.
- 4.5.3.3) Measures the users can take to protect themselves from these hazards.
- 4.5.3.4) The content of Part I and Part III of this manual.
- 4.5.3.5) Any other laboratory-specific safety requirements. (For example, these might include immunizations.)

4.5.4) Required Training for all Users of “EHS Safety Authorization-Requiring Biohazards” (Biosafety levels 3 & 4 of the CDC classification).

In addition, Authorized User training shall include:

4.5.4.1) The requirements of section 4.1 of Part III.

*4.5.5) Required Training for all Users (Authorized Users) of Sources (Radioactive Materials or Equipment) of Ionizing Radiation

As a minimum, Authorized User training shall include:

4.5.5.1) Methods available to detect the presence radioactive materials or radiation fields.

4.5.5.2) The physical and health hazards associated with exposure to radiation in the work area.

4.5.5.3) Measures the users can take to protect themselves from these hazards.

4.5.5.4) The content of Part I and Part IV of this manual, and of applicable state regulations.

4.5.5.5) The skills and knowledge specified in Chapter 12 of Part IV for the applicable level of training.

4.5.5.6) Any other laboratory-specific safety requirements as specified in the applicable Laboratory-Specific Safety Plan.

*4.5.6) Required Training for all Users (Authorized Users) of Class II, III, or IV Lasers

As a minimum, Authorized User training shall include:

4.5.6.1) Methods and observations that are available to detect the presence hazardous laser beams.

4.5.6.2) The hazards associated with exposure to laser beams in the work area.

4.5.6.3) Measures the users can and shall take to protect themselves from these hazards.

4.5.6.4) The content of Part I and Part V of this manual.

Although there are some sections of Part I that are not applicable to laser users, there are sections of almost every chapter that are applicable. Sections of Part I applicable to Radiation Generating Devices are marked with an * or ^L.

4.5.6.5) Any other laboratory-specific safety requirements.

4.5.7) On-going Training Procedures

The Authorized Laboratory Supervisors/Unit Safety Coordinators should:

4.5.7.1) Observe the working behavior of Authorized Users and Authorized Occupants on an "on-going" basis, reinforce instances of correct safety behaviors, and correct unsafe behaviors (including demonstrations of correct behavior, if appropriate).

***4.6) Information & Training Frequency**

Users of Hazardous Materials/Radiations shall:

*4.6.1) Be provided with the required information and training at the time of their initial assignment to work with Hazardous Materials/Radiation Generating Devices. This means prior to undertaking any laboratory activity involving these Hazardous Materials/Radiation Generating Devices.

*4.6.2) Be provided with the required information and training prior to assignments involving potential new exposure situations.

*4.6.3) Undergo annual refresher training that covers the required information and training identified in this Chapter.

Authorized Occupants of Rooms with Hazardous Materials/Radiation Generating Devices shall:

4.6.4) Be provided with the required information and training at the time of their initial assignment to a work area where Hazardous Materials/Radiation Generating Devices are present. This means prior to undertaking any unsupervised activity in such an area.

4.6.5) Undergo annual refresher training that covers the required information and training identified in this chapter.

Visitors to Rooms with Hazardous Materials/Radiation Generating Devices shall:

4.6.6) Be provided the information specified in 4.4.1 above at the time of the visit unless written documentation is available to demonstrate that the information has been provided within the year prior to the date of the visit.

***4.7) Information & Training Documentation**

Authorized Laboratory Supervisors (ALS) shall:

*4.7.1) Provide users and "occupants" in their respective areas with the minimum required information and documented training as described in sections 4.2 - 4.5, and at the frequency identified in section 4.6 of this Chapter.

*4.7.2) Maintain documentation concerning Information and Training for users of hazardous chemicals, hazardous biological agents and lasers that includes the following:

4.7.2.1) User Name and position title.

4.7.2.2) Department, Building, Room #, Campus Phone.

4.7.2.3) Laboratory Supervisor's name and campus phone.

4.7.2.4) Description of information/training, date, and provider name.

4.7.2.5) Trainee's signature acknowledging the receipt of the required information and completion of the required training together with the date

4.7.2.6) For the initial training, results of an exam with a satisfactory score. The content of the exam should be documented. For refresher training a "sign off" version of documentation is sufficient unless the Laboratory-Specific Safety Plans or laboratory-specific Standard Operating Procedures specify otherwise. Documentation of continuing radiation safety training is covered in Part IV.

Note: See Part I - Appendix 8.4.1 for a blank copy of the recommended form for documenting Authorized User information and training for these categories.

4.7.3) Submit documentation of training for Category F Authorized Radiation Users to the Radiation Safety Service as specified in Chapter 12, Part IV.

4.7.4) Submit documentation of the "laboratory skills" training for other categories of training for Authorized Radiation Users that has been provided as authorized by the Radiation Safety Service. See Chapter 12 of Part IV for forms to be used for this documentation.

Note: Documentation of required "self study" or "classroom" training and/or lab skills training provided by the Radiation Safety Service is documented and recorded by them.

The Radiation Safety Service of the EHS Department shall:

4.7.5) Maintain the documentation for the information and training provided to Authorized Radiation Users and Authorized Occupants of rooms with radiation sources..

***4.8) Information & Training Resources**

Prospective supervisors and users of Hazardous Materials/Radiations shall:

*4.8.1) Contact EHS (864-4089) for assistance in providing the required information and training.

***5) Exposure Assessment/Medical Surveillance**

***5.1) Exposure Assessments**

A laboratory person's exposure to Hazardous Materials/Radiations must be assessed through proper monitoring or dose reconstruction procedures if overexposure has occurred, or if there is a reason to believe that it has occurred or might occur. In some cases, continuous monitoring is required while occupying a designated area or room.

***5.1.1) Initial Monitoring**

Authorized Laboratory Supervisors shall contact EHS to initiate appropriate exposure monitoring when:

5.1.1.1) A laboratory person exhibits signs or symptoms of overexposure to a chemical, biohazard or radiations used in the lab.

5.1.1.2) A person will be working with a hazardous material/radiation for which there is a regulatory standard that requires specific exposure monitoring.

a) See Chapter 11 of Part IV for monitoring required for users of sources of ionizing radiation.

5.1.1.3) There is reason to believe that the person's level of exposure to a hazardous chemical, biohazard or laser beam has exceeded or will exceed an OSHA Action Level or OSHA Permissible Exposure Level or some other applicable standard such as ANSI Z-136. Note: Any acute exposure deemed to be an emergency should be treated as an emergency and the procedures of section 2.9 shall be followed.

EHS shall:

5.1.1.4) Make recommendations for corrective actions or alternative procedures if initial monitoring indicates a problem and obtain medical consultation if needed.

Each Authorized Laboratory Supervisor shall:

5.1.1.5) Follow the recommended corrective actions.

5.1.2) Periodic Monitoring

EHS may:

5.1.2.1) Require or conduct additional monitoring to establish effectiveness of the corrective actions and periodically thereafter if required by a particular regulatory standard.

Note: Required ongoing contamination monitoring and exposure monitoring for Authorized Radiation Users is covered under 5.1.1.2 a) above.

*5.1.3) Notification of Exposure Monitoring Results

EHS shall:

5.1.3.1) Notify the laboratory person and supervisor in writing of the outcome of any exposure monitoring for hazardous chemicals or the results of dose reconstructions for other hazards within 15 days of the receipt of those results.

5.1.3.2) Provide an annual radiation exposure report for any individual participating in the Personnel Dosimetry Program under the Radiation Safety Plan.

***5.2) Medical Surveillance**

Any person who regularly and frequently handles toxicologically significant quantities of chemicals or biohazards or works where hazardous laser beams are present should notify EHS so that a determination can be made as to whether the person should consult a qualified physician about undergoing routine medical surveillance.

***5.2.1) Medical Consultation & Examinations**

Authorized Laboratory Supervisors should:

5.2.1.1) Advise prospective laboratory users/occupants/visitors concerning medical or physical conditions that might place them at higher risk from the hazards known to be present in the laboratory and offer the opportunity to discuss what reasonable accommodations, if any, can be made. This may require consultation with EHS, medical authorities, and legal counsel in some cases. If information about the medical condition of the laboratory users/occupants/visitors is needed, such request should only occur after the University has made its offer of employment, whether the offer is conditional or not upon passing of any required medical examination. Examples of conditions that might require evaluation include physical disabilities, known allergies, pregnancy, or chronic medical conditions.

Authorized Laboratory Supervisors shall:

5.2.1.1) Provide an opportunity for all laboratory users/occupants who work with Hazardous Materials/Radiations to receive appropriate medical consultation, including any follow-up examinations that the examining physician determines to be necessary, whenever:

- a) A laboratory person develops signs or symptoms associated with a hazardous material/radiation to which the person may have been exposed in the laboratory.
- b) Exposure assessment monitoring reveals an exposure level above the applicable action level or permissible exposure level.
- c) A spill, leak, explosion, or other event takes place in the laboratory that results in the likelihood of a hazardous exposure.

5.2.1.2) Arrange for all medical consultations and examinations to be:

- a) Performed by or under the direct supervision of a licensed physician.
- b) Provided at no cost to the laboratory person, without loss of pay, and at a reasonable time and place.
- c) Reported to EHS and the Unit Safety Coordinator.

*5.2.2) Information to Physician

The exposed person and the Authorized Laboratory Supervisor shall:

5.2.2.1) Provide the following information to the examining physician:

- a) Identity of the hazardous chemical(s), biological agents, and/or radiations to which the person may have been exposed.
- b) Description of the conditions under which the exposure occurred, including quantitative exposure data if available.
- c) Description of the signs and symptoms of exposure that the person is experiencing.

*5.2.3) Physician's Written Opinion

The Authorized Laboratory Supervisor shall:

5.2.3.1) Obtain from the examining physician a written opinion that includes the following:

- a) Any recommendation for further medical follow-up.
- b) The results of the medical examination and any associated tests.
- c) Any medical condition that may be revealed in the course of the examination that may place the person at increased risk as a result of exposure to a hazardous chemical found in the laboratory.

d) A statement that the person has been informed by the physician of the consultation/examination results and is aware of any medical condition that may require further examination or treatment.

Note: The written opinion shall not reveal specific findings of diagnoses unrelated to laboratory exposure.

e) Forward a copy of the written opinion to EHS and the Unit Safety Coordinator.

***5.3) Medical Emergencies/Assistance**

*5.3.1) Medical emergencies/assistance shall be handled in accordance with procedures identified in section 2.9.5 of Chapter 2 of this manual. See also 2.9.1.4 for non-emergency medical situations.

*5.3.2) Contact KU Police (911).

6) Laboratory Hazardous Materials Waste Management

6.1) Introduction

Hazardous materials must be disposed of properly to protect human health, safety and the environment. Many materials being used at the University present some type of hazard (biological, chemical, physical, or radiation) and specific disposal procedures are required. Therefore, all materials being used by a laboratory or laboratory-related unit shall be disposed in accordance with the University of Kansas Hazardous Materials Waste Management Program.

6.1.1) Waste Management Program Policy

The waste management procedures contained within this chapter and the referenced sections of Part II, III, and IV of this manual are an integral part of the University's Environmental Health & Safety Management Program. They have been instituted so that the University's educational mission may be conducted safely and so that its commitment towards providing a safer, more healthful environment for all employees, students, and visitors can be realized.

These procedures have been established for the proper management of the collection and disposal of Hazardous Materials generated by the University. Adherence to these procedures is necessary in order to reduce environmental hazards and contribute to the enhanced safety of the total educational and working environments; and to facilitate University compliance with all applicable Federal, State and local laws and regulations governing the disposal of Hazardous Materials waste.

All faculty, staff, and students shall be aware of their responsibilities as identified in this manual and comply with its requirements. Failure to do so shall be a violation of University Policy, sanctionable through established disciplinary procedures, and may be a violation of State and/or Federal laws punishable by fines and/or imprisonment.

6.1.2) Waste Management Program Responsibilities

6.1.2.1) Responsibilities of Users of Hazardous Materials

Authorized Users shall:

- a) Comply with all requirements set forth in this chapter and, as applicable, with procedures given in sections of other Parts of this Laboratory Safety Manual as referenced in this chapter.
- b) Keep the generation of waste with the philosophy of “As low as reasonably achievable” as a goal.

Note: Only Authorized Users may handle Hazardous Materials and are, therefore, the only ones who can generate materials waste.

6.1.2.2) Responsibilities of Supervisors:

Authorized Laboratory Supervisors (ALS) shall:

- a) Provide the space, storage facilities, and containers for their laboratories as needed to meet the requirements of this waste management program.
- b) Require that all Authorized Users in their laboratories know and follow the requirements of this program.

Reminder: All Authorized Laboratory Supervisors must also be Authorized Users.

6.1.2.3) Responsibilities of Environment Health and Safety (EHS)

EHS shall:

- a) Administer this campus laboratory waste management program.
- b) Develop, update, and maintain this written program, ensuring that it is made available to all campus units.
- c) Provide training concerning this program, as requested.

- d) Collect unwanted, spent, used, excess or surplus hazardous chemicals or radioactive materials from users and see that they are properly reused or disposed.
- e) Provide assistance to Authorized Laboratory Supervisors in establishing procedures for managing the disposal of hazardous biological agents.
- f) Require that the procedures for the disposal of Hazardous Materials (wastes) comply with all applicable local, state and federal regulations.

6.1.3) Waste Management Program Philosophy

The philosophy of this program is based upon the concepts of the Waste Management Hierarchy developed by the United States Environmental Protection Agency. This hierarchy provides a framework for systematic thinking about solutions to waste management. The hierarchy is a series of decision-making steps to be used sequentially in decreasing order of desirability. The first step is the most favorable option, while the last step is the least favorable. The following principles of the EPA Waste Management Hierarchy have been incorporated into the KU Hazardous Materials Waste Management Program.

Authorized Users shall:

- 6.1.3.1) Attempt to keep the generation of waste Hazardous Materials at a level “As low as reasonably achievable” (ALARA).
- 6.1.3.2) Minimize the proportion of unavoidable Hazardous Materials waste.
- 6.1.3.3) Separate and concentrate Hazardous Materials waste streams to make further management activities more feasible and economical.
- 6.1.3.4) Reuse Hazardous Materials waste within the laboratory in accordance with applicable federal, state and local regulations, if feasible.
- 6.1.3.5) Recycle or reclaim Hazardous Materials of value either in the lab or through the services of EHS, if feasible.

6.1.3.6) Maintain unavoidable and non-reclaimable Hazardous Materials wastes in a form amenable to treatment (e.g. incineration, neutralization, detoxification, etc.) by EHS permitted waste disposal contractors.

Note: If this is not possible, contact EHS on what steps are to be taken with respect to the potential waste before the material is generated or used. Laboratory- specific procedures will then have to be created.

6.1.3.7) In the lab where allowed by regulations, treat waste to reduce the volume and degree of hazard. Check with EHS.

6.1.3.8) Manage remaining Hazardous Materials wastes and treatment residues by secure disposal methods.

6.2) Hazardous Materials Identification

The following procedures are to be used in the identification of a spent, used, unwanted, waste, or surplus Hazardous Materials in order to determine whether it should be collected by the user for special disposal. It is recommended that users of Hazardous Materials contact EHS prior to performing experimentation, research, or work in order to determine whether or not the materials being used need to be collected for special disposal.

6.2.1) Non-Hazardous Materials

Although every material should be evaluated as to its potential reuse, redistribution, recycling or reclamation, the following substances, when in excess, spent, used, considered waste, or no longer wanted, are not considered hazardous and DO NOT need to be collected for special disposal.

Authorized Users and Authorized Occupants should:

6.2.1.1) When feasible, recycle or reuse Normal Solid Waste: paper, cardboard, plastics, metals, dirt, sand, food, etc., free of any hazardous components or residue. If not feasible, they may be disposed of into normal trash baskets or dumpsters.

Authorized Users shall:

6.2.1.2) Not place empty potentially contaminated Hazardous Materials Containers (metal, plastic, or glass) into normal trash baskets.

6.2.1.3) Reuse or recycle containers when feasible or, if not, dispose of them as follows:

a) Rinse or otherwise clean container until it is free of any hazardous material residue. Note: Obviously, the cleaning procedure shall not generate more hazardous waste than is already present! See I-6.2.2.

b) Remove (or, if this is not possible, thoroughly deface) all labels before containers are reused, recycled, or disposed.

c) Remove all lids of containers before disposal into a dumpster.

Reminder: Such disposal is permissible only if the containers are clean.

d) Collect empty containers (metal, plastic, or glass) smaller than 2.5 liters in size into an appropriate temporary holding/collection vessel (box, bucket, etc., but not normal trash basket).

Note: EHS recommends that glass containers 1 liter or smaller in size be collected into a glass disposal box (see "Non-Contaminated Sharps" below) for disposal. Once the temporary holding/collection vessel is full, or reasonably heavy (50 lbs or less), it shall then be taken by authorized users to the appropriate building dumpster for emptying or disposal. Housekeeping personnel are not responsible for removing these empty-container-collection vessels from the lab, but may be willing to do so if contacted.

e) Set empty containers (metal, plastic, or glass) 2.5 liter or greater in size in a safe area. (A holding vessel is not required.) Authorized users shall take the containers to the appropriate building dumpster for disposal. Housekeeping personnel are not responsible for removing these empty containers, but may be willing to do so if contacted.

Authorized Users and Authorized Occupants shall:

6.2.1.4) Never place **Non-Contaminated Sharps** into any normal trash receptacles unless packaged as follows:

a) Place Non-Contaminated Sharps into a plastic-lined heavy cardboard box (Glass Disposal Box) or an impermeable plastic sharps container, such as those sold by Fisher, or available in: Chemistry Department Storeroom (B007 Malott), Biology Division Bio-Store (3027 Haworth), or Higuchi Biosciences Storeroom (107 McCollum Labs).

b) When full or reasonably heavy (<50 lbs), the box shall be sealed with tape and plainly marked as being broken glass or non-contaminated sharps for disposal.

c) Take the box or container of non-contaminated sharps to the appropriate building dumpster for disposal . Housekeeping personnel are not responsible for removing these containers or boxes from the lab, but may do so if contacted.

Note: Non-contaminated sharps consist of broken glass or glassware, slides, capillary tubes, needles, or other sharp objects which are not hazardous because of contamination with any hazardous chemicals, bio-hazards, or radioactive materials but which have the ability to puncture or cut people handling them.

6.2.2) Prohibitions for Disposal into the Sanitary Sewer System

Any material(s) identified or classified below are specifically prohibited from disposal into the sanitary sewer system in accordance with the City of Lawrence Wastewater Discharge Pretreatment Ordinance. POTW - Public Owned Treatment Works.

Authorized Users shall not dispose of any of the following materials in the sewer system:

6.2.2.1) Any flammable or explosive liquids, solids, or gases that might be injurious to the POTW or to its operation. Prohibited flammable or explosive materials include, but are not limited to: Gasoline, Kerosene, Naphtha, Benzene, Toluene, Xylene, Ethers, Alcohols, Ketones, Aldehydes, Peroxides, Chlorates, Perchlorates, Bromates, Carbides, Hydrides, and Sulfides. Additionally, any waste material with a flash point of less than 140°F or 60°C, and all aqueous alcohol solutions with > 24% alcohol by volume.

6.2.2.2) Any noxious or malodorous liquids, solids, or gases that singly or by interaction with other wastes are sufficient to create a public nuisance or hazard to life or are sufficient to prevent entry into the sewers for maintenance or repair. Examples: Thiols (Mercaptans), Pyridine, Sulfides, Cyanides, Phenols, etc.

6.2.2.3) Solid or viscous substances that may cause obstruction to the flow in the sewer, or other interferences with the operation of the POTW.

6.2.2.4) Any Wastewater having a pH <5.0 or >10.0, or having corrosive properties capable of causing damage or hazard to structures, equipment, and/or individuals by the POTW.

6.2.2.5) Any wastewater containing toxic pollutants in sufficient quantity to injure or interfere with the POTW's process, constitute a hazard to humans or animals, or create a toxic effect in the receiving stream.

6.2.2.6) Any wastewater with objectionable color not capable of being removed by the POTW's treatment process. Example: inks, dye wastes, food and pet food colorings, and vegetable tanning solutions.

6.2.2.7) Any waste water containing fats, wax, grease, or oils whether emulsified or not, in excess of 100 mg/l or containing substances that may solidify or become viscous at temperatures between 32 and 150 degrees F.

6.2.2.8) Any wastewater containing contaminants above the City's specified pollutant limitations. This list includes: Antimony, Arsenic, Beryllium, Cadmium, Copper, Cyanide, Lead, Mercury, Nickel, Selenium, Silver, Total Chromium, Thallium, Zinc, Organic Priority Pollutants, Total Organic Halogens, and Phenolic Compounds. Contact EHS for specific pollutant limitations.

6.2.2.9) Any radioactive materials . See section 4.9 and 13.3.7 of Part IV

6.2.2.10) Any untreated hazardous biological materials/agents.

6.2.3) Hazardous Materials Requiring Special Disposal

The Authorized User shall collect any hazardous materials that are spent, used, unwanted or surplus for special disposal as specified in section 6.3 below unless the conditions of section 6.2.1 are met and special disposal is not required. Materials that cannot be placed into the sanitary sewer (see 6.2.2 above) or meet any of the criteria of this section require special disposal. These materials include:

6.2.3.1) Hazardous Chemicals

Any materials that meet the definition of a hazardous chemical as defined in the OSHA Hazard Communication Standard (29 CFR 1910.1200). This includes:

Chemicals that are Physical Hazards - Combustible liquids, explosives, flammable liquids, flammable solids, oxidizers, organic peroxides, pyrophorics, water reactives, and unstable reactives;

Chemicals that are Health Hazards - Carcinogens, toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, hematopoietic system agents, and agents that can damage the lungs, skin, eyes, or mucous membranes.

6.2.3.2) Hazardous Wastes

Any materials that exhibit the characteristics of hazardous waste as identified in 40 CFR 261 Subpart C or are listed as Hazardous Waste in 40 CFR 261 Subpart D under the federal Resource Conservation and Recovery Act.

Hazardous Waste Characteristics - Ignitability, Corrosivity, Reactivity, Toxicity
(See Part II - Appendix 8.6.1.)

Hazardous Wastes Lists - U List, P List, F List, K List.
(See Part II - Appendix 8.6.2.)

6.2.3.3) Biohazard Waste

Any materials meeting the definition of a biohazard.

6.2.3.4) Radioactive Materials Waste

Any materials meeting the definition of a radioactive material.

6.2.3.5) Any other materials that are not identified above, but that are believed by the Authorized User/Authorized Laboratory Supervisor to pose some danger to human health, safety, or the environment.

6.3) Hazardous Materials Collection & Disposal Procedures

The Authorized User shall:

6.3.1) Collect and dispose of any material that is identified as a hazardous chemical in accordance with the procedures identified in Part II-Chapter 6.

6.3.2) Collect any material that is identified as a hazardous waste in accordance with the procedures identified in Part II-Chapter 6.

6.3.3) Collect, process and dispose of any material that is identified as a biohazard waste in accordance with the procedures identified in Part III-Chapter 6.

6.3.4) Collect and dispose of any material that is identified as a radioactive waste in accordance with the procedures provided by the Radiation Safety Service. Contact 4-4089 for directions.

6.4) Pollution Prevention, Waste Minimization & Reduction

Federal and State laws require the University to certify that it has a program in place to prevent, minimize and reduce the amount of hazardous waste it generates. We cannot meet this mandate without the assistance of everyone who uses hazardous chemicals or materials. Pollution prevention, waste minimization, and waste reduction have numerous advantages: conservation of material usage, savings both in material purchase and disposal costs, reduction in the need for disposal, protection of the environment from potential contamination, and protection of the health and safety of individuals from potential hazards. All users of materials shall actively engage in these activities and follow prudent safe practices in the handling and disposal of Hazardous Materials. Contact EHS if you need assistance in implementing pollution prevention, waste minimization & reduction activities or would like further specific information.

6.4.1) Materials Redistribution & Reuse

Authorized Users should:

6.4.1.1) Return unused chemicals to unit stockrooms or make them available for others to use.

Chemical users are encouraged to check with all campus departmental stockrooms for available chemicals before purchasing new items. EHS routinely picks up chemicals from across campus and attempts to redistribute them at no cost. Most of the chemicals eligible for redistribution are free and available on a first come, first served basis.

6.4.2) Source Reduction

Authorized Users should:

6.4.2.1) Substitute non-hazardous or less-Hazardous Materials for Hazardous Materials whenever possible.

6.4.2.2) Actively seek and adopt modifications in the procedures that minimize the amount of Hazardous Materials used and/or minimize waste generation.

Examples: Micro scale techniques should be pursued wherever possible. The use of instrumentation or scaled-down analytical techniques is preferred over traditional wet chemistry techniques. Newer models of equipment produce less waste and are more efficient than older models.

Authorized Laboratory Supervisors and Authorized Users should:

6.4.2.3) Implement a thorough Inventory Management Program.

Stringent purchasing and inventory controls are the best way to minimize excess materials or waste. Hazardous Materials should only be purchased in the quantities needed and not in large volumes. Units should maintain up-to-date inventories of materials available in order to avoid duplicate stock. Excess or surplus materials should be returned to departmental stockrooms or EHS for redistribution.

Authorized Laboratory Supervisors and Authorized Users are encouraged to:

6.4.2.4) Implement a Reclamation Program.

Units are encouraged to investigate and implement processes to reclaim their spent, used, or waste materials. Any material that can be reclaimed and reused provides a substantial cost savings both in materials purchasing and disposal to the University. Segregation of waste streams is the key to implementing successful reclamation processes. Examples would be: solvent re-distillation and precious metals reclamation, etc.

6.4.3) Waste Reduction

Authorized Laboratory Supervisors and Authorized Users are encouraged to:

6.4.3.1) Establish and implement Treatment Procedures that render Hazardous Materials less or non-hazardous. There are various reactions that can be incorporated into the experiment or process to render materials non-hazardous, de-toxify or destroy the waste. Some examples of acceptable treatment at the unit level are: Neutralization, Heavy Metals Precipitation, Solidification, Oxidation, Reduction, etc.

Special Notice #1: Incineration, evaporation, or dilution ARE NOT acceptable laboratory treatment methods. However, evaporation or dilution that is part of a standard laboratory procedure is permitted.

Special Notice #2: Treatment should only be performed by competent individuals utilizing proper safety precautions. It is important for the individual to be knowledgeable in the chosen destruction procedure and aware of potential adverse reactions that may present a risk to health & safety. EHS has several references that identify potential and acceptable treatment reactions.

***7) Record Keeping**

***7.1) Auditable Records**

Authorized Laboratory Supervisors and/or Unit Safety Coordinators shall:

7.1.1) Establish and maintain auditable records of the following:

7.1.1.1.) All Unit Safety Coordinator appointments

7.1.1.2) Laboratory-specific Standard Operating Procedures, forms, plans, and/or applicable Laboratory-Specific Safety Plans .

7.1.1.3) Copy of LHRSA form.

7.1.1.4) Copy of Laboratory Entrance Posting.

7.1.1.5) Hazardous Materials Inventory List.

Note: Separate lists are to be kept for hazardous chemicals, hazardous biological agents, and radioactive materials. See Part IV for instructions concerning the radioactive materials.

7.1.1.6) Material Safety Data Sheets and/or other Safety Data Sheets

7.1.1.7) Laboratory safety inspections and documentation of required corrective actions

7.1.1.8) Prior approvals for hazardous lab operations and/or applicable Laboratory-Specific Safety Plans

7.1.1.9) Information & Training Documentation

Note: For training in Radiation Safety, records are maintained by the Radiation Safety Service and duplication in the laboratory is not required but is recommended for local review since the ALS is responsible for ensuring that all individuals under his/her supervision have up-to-date training.

7.1.1.10) Accident/Incident Reports Form.

7.1.1.11) Exposure Assessments Form.

7.1.1.12) Required radiation safety evaluations--contamination surveys, radiation surveys, radioactive waste, etc. See Part IV.

7.1.1.13) Medical Examinations.

***7.2) Identification and Dating of Records**

Authorized Laboratory Supervisors/Unit Safety Coordinators shall:

7.2.1) Keep records that are dated and have the appropriate identification (for example, Authorized Laboratory Supervisor, person if applicable, location, etc.).

7.2.2.) For records that involve periods of time and for which renewals or amended changes are issued, require that the date at which the old conditions ended and the new conditions were established are recorded.

***7.3) Retention of Records**

Authorized Laboratory Supervisors and/or Unit Safety Coordinators shall:

7.3.1) Maintain records that do not involve exposures of or injuries to individuals at least 3 years.

7.3.2. Maintain records of exposures of or injuries to individuals (medical records) and associated records that clearly provide information relevant to such exposures or injuries for the duration of the individual's employment or residency and at least 30 years after the individual leaves the campus. (These may be transferred to EHS.)

Note: Indefinite retention of all safety-related records is recommended if such retention is readily feasible. Experience has shown that they can be invaluable when questions of safety conditions arise at later dates.

***7.4) EHS Records**

EHS shall:

7.4.1) Establish and maintain EHS-specific Standard Operating Procedures for the creation and maintenance of records for which it is responsible.

Note: As appropriate, these may be incorporated as specific sections in this manual.

8) Part I - Appendices

8.1) Appendices for Part I - Chapter 1

8.1.1) Copy of OSHA Lab Standard

8.2) Appendices for Part I - Chapter 2

8.2.1) Blank Example of SOP Format

8.3) Appendices for Part I - Chapter 3

8.3.1) Lab Hazard Registration/Safety Authorization Application

8.3.2) Hazard Warning Signage

8.3.2.1) Hazardous Chemical Sign (NFPA Fire Diamond)

8.3.2.2) Biohazard Sign

8.3.2.3) Radiation Hazard Sign

8.3.2.4) Laser Hazard Sign

8.3.3) Example of Lab Entrance Posting

8.3.4) EHS Lab Inspection Checklist

8.4) Appendices for Part I - Chapter 4

8.4.1) Training Documentation Form

8.5) Appendices for Part I - Chapter 5

None - reserved

8.6) Appendices for Part I - Chapter 6

None - reserved

8.7) Appendices for Part I - Chapter 7

None - reserved

Appendix 8.1.1) Copy of OSHA Lab Standard

Standard Number: 1910.1450

Standard Title: Occupational exposure to hazardous chemicals in laboratories.

Subpart Number: Z

Subpart Title: Toxic and Hazardous Substances

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(a) Scope and application.

(1) This section shall apply to all employers engaged in the laboratory use of hazardous chemicals as defined below.

(2) Where this section applies, it shall supersede, for laboratories, the requirements of all other OSHA health standards in 29 CFR part 1910, subpart Z, except as follows:

(i) For any OSHA health standard, only the requirement to limit employee exposure to the specific permissible exposure limit shall apply for laboratories, unless that particular standard states otherwise or unless the conditions of paragraph (a)(2)(iii) of this section apply.

(ii) Prohibition of eye and skin contact where specified by any OSHA health standard shall be observed.

(iii) Where the action level (or in the absence of an action level, the permissible exposure limit) is routinely exceeded for an OSHA regulated substance with exposure monitoring and medical surveillance requirements paragraphs (d) and (g)(1)(ii) of this section shall apply.

(3) This section shall not apply to:

(i) Uses of hazardous chemicals that do not meet the definition of laboratory use, and in such cases, the employer shall comply with the relevant standard in 29 CFR part 1910, subpart 2, even if such use occurs in a laboratory.

(ii) Laboratory uses of hazardous chemicals that provide no potential for employee exposure. Examples of such conditions might include:

(A) Procedures using chemically-impregnated test media such as Dip-and-Read tests where a reagent strip is dipped into the specimen to be

tested and the results are interpreted by comparing the color reaction to a color chart supplied by the manufacturer of the test strip; and

(B) Commercially prepared kits such as those used in performing pregnancy tests in which all of the reagents needed to conduct the test are contained in the kit.

(b) Definitions -

"Action level" means a concentration designated in 29 CFR part 1910 for a specific substance, calculated as an eight (8)-hour time-weighted average, that initiates certain required activities such as exposure monitoring and medical surveillance.

"Assistant Secretary" means the Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, or designee.

"Carcinogen" (see "select carcinogen").

"Chemical Hygiene Officer" means an employee who is designated by the employer, and who is qualified by training or experience, to provide technical guidance in the development and implementation of the provisions of the Chemical Hygiene Plan. This definition is not intended to place limitations on the position description or job classification that the designated individual shall hold within the employer's organizational structure.

"Chemical Hygiene Plan" means a written program developed and implemented by the employer that sets forth procedures, equipment, personal protective equipment and work practices that (i) are capable of protecting employees from the health hazards presented by hazardous chemicals used in that particular workplace and (ii) meets the requirements of paragraph (e) of this section.

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

"Compressed gas" means:

- (i) A gas or mixture of gases having, in a container, an absolute pressure exceeding 40 psi at 70 deg. F (21.1 deg. C); or
- (ii) A gas or mixture of gases having, in a container, an absolute pressure exceeding 104 psi at 130 deg. F (54.4 deg C) regardless of the pressure at 70 deg. F (21.1 deg. C); or
- (iii) A liquid having a vapor pressure exceeding 40 psi at 100 deg. F (37.8 C) as determined by ASTM D-323-72.

"Designated area" means an area that may be used for work with "select carcinogens," reproductive toxins or substances that have a high degree of acute toxicity. A designated area may be the entire laboratory, such as a laboratory hood.

"Emergency" means any occurrence such as, but not limited to, equipment failure, rupture of containers or failure of control equipment that results in an uncontrolled release of a hazardous chemical into the workplace.

"Employee" means an individual employed in a laboratory workplace who may be exposed to hazardous chemicals in the course of his or her assignments.

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

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

- (i) "Aerosol, flammable" means an aerosol that, when tested by the method described in 16 CFR 1500.45, yields a flame protection exceeding 18 inches at full valve opening, or a flashback (a flame extending back to the valve) at any degree of valve opening;
- (ii) "Gas, flammable" means:
 - (A) A gas that, at ambient temperature and pressure, forms a flammable mixture with air at a concentration of 13 percent by volume or less; or
 - (B) A gas that, at ambient temperature and pressure, forms a range of flammable mixtures with air wider than 12 percent by volume, regardless of the lower limit.

(iii) "Liquid, flammable" means any liquid having a flashpoint below 100 deg F (37.8 deg. C), except any mixture having components with flashpoints of 100 deg. C) or higher, the total of which make up 99 percent the total volume of the mixture.

(iv) "Solid, flammable" means a solid, other than a blasting agent or explosive as defined in 1910.109(a), that is liable to cause fire through friction, absorption of moisture, spontaneous chemical change, or retained heat from manufacturing or processing, or that can be ignited readily and when ignited burns so vigorously and persistently as to create serious hazard. A chemical shall be considered to be a flammable solid if, when tested by the method described in 16 CFR 1500.44, it ignites and burns with a self-sustained flame at a rate greater than one-tenth of an inch per second along its major axis.

"Flashpoint" means the minimum temperature at which a liquid gives off a vapor in sufficient concentration to ignite when tested as follows:

(i) Tagliabue Closed Tester (See American National Standard Method of Test for Flash Point by Tag Closed Tester, Z11.24 - 1979 (ASTM D 56- t9)) for liquids with a viscosity of less than 45 Saybolt Universal Seconds (SUS) at 100 deg. F (37.8 deg. C), that do not contain suspended solids and do not have a tendency to form a surface film under test; or

(ii) Pensky-Martens Closed Tester (See American National Standard Method of Test for Flashpoint by Pensky-Martens Closed Tester, Z11.7 -1979 (ASTM D 93-79)) - for liquids with a viscosity equal to or greater than 45 SUS at 100 deg. F (37.8 deg. C), or that contain suspended solids, or that have a tendency to form a surface film under test; or

(iii) Setaflash Closed Tester (see American National Standard Method of test for Flash Point by Setaflash Closed Tester (ASTM D 3278-78)). Organic peroxides, that undergo autoaccelerating thermal decomposition, are excluded from any of the flashpoint determination methods specified above.

"Hazardous chemical" means a chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees. The term "health hazard" includes chemicals that are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents that act on the hematopoietic systems, and agents that damage the lungs, skin, eyes, or mucous membranes. Appendices A and B of the Hazard Communication Standard (29 CFR 1910.1200) provide further guidance in defining the scope of health hazards and determining whether or not a chemical is to be considered hazardous for purposes of this standard.

"Laboratory" means a facility where the "laboratory use of hazardous chemicals" occurs. It is a workplace where relatively small quantities of hazardous chemicals are used on a non-production basis.

"Laboratory scale" means work with substances in which the containers used for reactions, transfers, and other handling of substances are designed to be easily and safely manipulated by one person. "Laboratory scale" excludes those workplaces whose function is to produce commercial quantities of materials.

"Laboratory-type hood" means a device located in a laboratory, enclosure on five sides with a movable sash or fixed partial enclosed on the remaining side; constructed and maintained to draw air from the laboratory and to prevent or minimize the escape of air contaminants into the laboratory; and allows chemical manipulations to be conducted in the enclosure without insertion of any portion of the employee's body other than hands and arms. Walk-in hoods with adjustable sashes meet the above definition provided that the sashes are adjusted during use so that the airflow and the exhaust of air contaminants are not compromised and employees do not work inside the enclosure during the release of airborne hazardous chemicals.

"Laboratory use of hazardous chemicals" means handling or use of such chemicals in which all of the following conditions are met:

- (i) Chemical manipulations are carried out on a "laboratory scale;"
- (ii) Multiple chemical procedures or chemicals are used;
- (iii) The procedures involved are not part of a production process, nor in any way simulate a production process; and
- (iv) "Protective laboratory practices and equipment" are available and in common use to minimize the potential for employee exposure to hazardous chemicals.

"Medical consultation" means a consultation that takes place between an employee and a licensed physician for the purpose of determining what medical examinations or procedures, if any, are appropriate in cases where a significant exposure to a hazardous chemical may have taken place.

"Organic peroxide" means an organic compound that contains the bivalent -O-O- structure and that may be considered to be a structural derivative of hydrogen peroxide where one or both of the hydrogen atoms has been replaced by an organic radical.

"Oxidizer" means a chemical other than a blasting agent or explosive as defined in 1910.109(a), that initiates or promotes combustion in other materials, thereby causing fire either of itself or through the release of oxygen or other gases.

"Physical hazard" means a chemical for which there is scientifically valid evidence that it is a combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer pyrophoric, unstable (reactive) or water-reactive.

"Protective laboratory practices and equipment" means those laboratory procedures, practices and equipment accepted by laboratory health and safety experts as effective, or that the employer can show to be effective, in minimizing the potential for employee exposure to hazardous chemicals.

"Reproductive toxins" means chemicals that affect the reproductive chemicals that affect the reproductive capabilities including chromosomal damage (mutations) and effects on fetuses (teratogenesis).

"Select carcinogen" means any substance that meets one of the following criteria:

- (i) It is regulated by OSHA as a carcinogen; or
- (ii) It is listed under the category, "known to be carcinogens," in the Annual Report on Carcinogens published by the National Toxicology Program (NTP)(latest edition); or
- (iii) It is listed under Group 1 ("carcinogenic to humans") by the International Agency for research on Cancer Monographs (IARC)(latest editions); or

(iv) It is listed in either Group 2A or 2B by IARC or under the category, "reasonably anticipated to be carcinogens" by NTP, and causes statistically significant tumor incidence in experimental animals in accordance with any of the following criteria:

(A) After inhalation exposure of 6-7 hours per day, 5 days per week, for a significant portion of a lifetime to dosages of less than 10 mg/m (3);

(B) After repeated skin application of less than 300 (mg/kg of body weight) per week; or

(C) After oral dosages of less than 50 mg/kg of body weight per day.

"Unstable (reactive)" means a chemical which is the pure state, or as produced or transported, will vigorously polymerize, decompose, condense, or will become self-reactive under conditions of shocks, pressure or temperature.

"Water-reactive" means a chemical that reacts with water to release a gas that is either flammable or presents a health hazard.

(c) Permissible exposure limits. For laboratory uses of OSHA regulated substances, the employer shall assure that laboratory employees' exposures to such substances do not exceed the permissible exposure limits specified in 29 CFR part 1910, subpart Z.

(d) Employee exposure determination -

(1) Initial monitoring. The employer shall measure the employee's exposure to any substance regulated by a standard which requires monitoring if there is reason to believe that exposure levels for that substance routinely exceed the action level (or in the absence of an action level, the PEL).

(2) Periodic monitoring. If the initial monitoring prescribed by paragraph (d)(1) of this section discloses employee exposure over the action level (or in the absence of an action level, the PEL), the employer shall immediately comply with the exposure monitoring provisions of the relevant standard.

(3) Termination of monitoring. Monitoring may be terminated in accordance with the relevant standard.

(4) Employee notification of monitoring results. The employer shall, within 15 working days after the receipt of any monitoring results, notify the employee of these results in writing either individually or by posting results in an appropriate location that is accessible to employees.

(e) Chemical hygiene plan - General. (Appendix A of this section is non-mandatory but provides guidance to assist employers in the development of the Chemical Hygiene Plan).

(1) Where hazardous chemicals as defined by this standard are used in the workplace, the employer shall develop and carry out the provisions of a written Chemical Hygiene Plan which is:

(i) Capable of protecting employees from health hazards associated with hazardous chemicals in that laboratory and

(ii) Capable of keeping exposures below the limits specified in paragraph (c) of this section.

(2) The Chemical Hygiene Plan shall be readily available to employees, employee representatives and, upon request, to the Assistant Secretary.

(3) The Chemical Hygiene Plan shall include each of the following elements and shall indicate specific measures that the employer will take to ensure laboratory employee protection;

(i) Standard operating procedures relevant to safety and health considerations to be followed when laboratory work involves the use of hazardous chemicals;

(ii) Criteria that the employer will use to determine and implement control measures to reduce employee exposure to hazardous chemicals including engineering controls, the use of personal protective equipment and hygiene practices; particular attention shall be given to the selection of control measures for chemicals that are known to be extremely hazardous;

(iii) A requirement that fume hoods and other protective equipment are functioning properly and specific measures that shall be taken to ensure proper and adequate performance of such equipment;

(iv) Provisions for employee information and training as prescribed in paragraph (f) of this section;

(v) The circumstances under which a particular laboratory operation, procedure or activity shall require prior approval from the employer or the employer's designee before implementation;

(vi) Provisions for medical consultation and medical examinations in accordance with paragraph (g) of this section;

(vii) Designation of personnel responsible for implementation of the Chemical Hygiene Plan including the assignment of a Chemical Hygiene Officer, and, if appropriate, establishment of a Chemical Hygiene Committee; and

(viii) Provisions for additional employee protection for work with particularly hazardous substances. These include "select carcinogens," reproductive toxins and substances which have a high degree of acute toxicity. Specific consideration shall be given to the following provisions which shall be included where appropriate:

(A) Establishment of a designated area;

(B) Use of containment devices such as fume hoods or glove boxes;

(C) Procedures for safe removal of contaminated waste; and

(D) Decontamination procedures.

(4) The employer shall review and evaluate the effectiveness of the Chemical Hygiene Plan at least annually and update it as necessary.

(f) Employee information and training.

(1) The employer shall provide employees with information and training to ensure that they are appraised of the hazards of chemicals present in their work area.

(2) Such information shall be provided at the time of an employee's initial assignment to a work area where hazardous chemicals are present and prior to assignments involving new exposure situations. The frequency of refresher information and training shall be determined by the employer.

(3) Information. Employees shall be informed of:

(i) The contents of this standard and its appendices which shall be made available to employees;

(ii) the location and availability of the employer's Chemical Hygiene Plan;

(iii) The permissible exposure limits for OSHA regulated substances or recommended exposure limits for other hazardous chemicals where there is no applicable OSHA standard;

(iv) Signs and symptoms associated with exposures to hazardous chemicals used in the laboratory; and

(v) The location and availability of known reference material on the hazards, safe handling, storage and disposal of hazardous chemicals found in the laboratory including, but not limited to, Material Safety Data Sheets received from the chemical supplier.

(4) Training.

(i) Employee training shall include:

(A) Methods and observations that may be used to detect the presence or release of a hazardous chemical (such as monitoring conducted by the employer, continuous monitoring devices, visual appearance or odor of hazardous chemicals when being released, etc.);

(B) The physical and health hazards of chemicals in the work area; and

(C) The measures employees can take to protect themselves from these hazards, including specific procedures the employer has implemented to protect employees from exposure to hazardous chemicals, such as appropriate work practices, emergency procedures, and personal protective equipment to be used.

(ii) The employee shall be trained on the applicable details of the employer's written Chemical Hygiene Plan.

(g) Medical consultation and medical examinations.

(1) The employer shall provide all employees who work with hazardous chemicals an opportunity to receive medical attention, including any follow-up examinations which the examining physician determines to be necessary, under the following circumstances:

(i) Whenever an employee develops signs or symptoms associated with a hazardous chemical to which the employee may have been exposed in the laboratory, the employee shall be provided an opportunity to receive an appropriate medical examination.

(ii) Where exposure monitoring reveals an exposure level routinely above the action level (or in the absence of an action level, the PEL) for an OSHA regulated substance for which there are exposure monitoring and medical surveillance requirements, medical surveillance shall be established for the affected employee as prescribed by the particular standard.

(iii) Whenever an event takes place in the work area such as a spill, leak, explosion or other occurrence resulting in the likelihood of a hazardous exposure, the affected employee shall be provided an opportunity for a medical consultation. Such consultation shall be for the purpose of determining the need for a medical examination.

(2) All medical examinations and consultations shall be performed by or under the direct supervision of a licensed physician and shall be provided without cost to the employee, without loss of pay and at a reasonable time and place.

(3) Information provided to the physician. The employer shall provide the following information to the physician:

(i) The identity of the hazardous chemical(s) to which the employee may have been exposed;

(ii) A description of the conditions under which the exposure occurred including quantitative exposure data, if available; and

(iii) A description of the signs and symptoms of exposure that the employee is experiencing, if any.

(4) Physician's written opinion.

(i) For examination or consultation required under this standard, the employer shall obtain a written opinion from the examining physician which shall include the following:

(A) Any recommendation for further medical follow-up;

(B) The results of the medical examination and any associated tests;

(C) Any medical condition which may be revealed in the course of the examination which may place the employee at increased risk as a result of exposure to a hazardous workplace; and

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

(ii) The written opinion shall not reveal specific findings of diagnoses unrelated to occupational exposure.

(h) Hazard identification.

(1) With respect to labels and material safety data sheets:

{i} Employers shall ensure that labels on incoming containers of hazardous chemicals are not removed or defaced.

{ii} Employers shall maintain any material safety data sheets that are received with incoming shipments of hazardous chemicals, and ensure that they are readily accessible to laboratory employees.

(2) The following provisions shall apply to chemical substances developed in the laboratory:

{i} If the composition of the chemical substance which is produced exclusively for the laboratory's use is known, the employer shall determine if it is a hazardous chemical as defined in paragraph (b) of this section. If the chemical is determined to be hazardous, the employer shall provide appropriate training as required under paragraph (f) of this section.

{ii} If the chemical produced is a byproduct whose composition is not known, the employer shall assume that the substance is hazardous and shall implement paragraph (e) of this section.

{iii} If the chemical substance is produced for another user outside of the laboratory, the employer shall comply with the Hazard Communication Standard (29 CFR 1910.120) including the requirements for preparation of material safety data sheets and labeling.

(i) Use of respirators.

Where the use of respirators is necessary to maintain exposure below permissible exposure limits, the employer shall provide, at no cost to the employee, the proper respiratory equipment. Respirators shall be selected and used in accordance with the requirements of 29 CFR 1910.134.

(j) Recordkeeping.

(1) The employer shall establish and maintain for each employee an accurate record of any measurements taken to monitor employee exposures and any medical consultation and examinations including tests or written opinions required by this standard.

(2) The employer shall assure that such records are kept, transferred, and made available in accordance with 29 CFR 1910.1020.

(k) Dates -

(1) Effective date. This section shall become effective May 1, 1990.

(2) Start-up dates.

(i) Employers shall have developed and implemented a written Chemical Hygiene Plan no later than January 31, 1991.

(ii) Paragraph (a)(2) of this section shall not take effect until the employer has developed and implemented a written Chemical Hygiene Plan.

(l) Appendices.

The information contained in the appendices is not intended, by itself, to create any additional obligations not otherwise imposed or to detract from any existing obligation.

[61 FR 5507, Feb. 13, 1996]

Appendix 8.2.1) Blank Example of SOP Format

Lab Specific Standard Operating Procedure

Authorized Supervisor _____

Building _____ Room/s _____ Dept _____

Process Identification: _____

Hazard Assessment: _____

*Hazard Controls: _____

*Emergency Procedures: _____

*Experimental Methodology: _____

Written by: _____ Date: _____

Approved by: _____ Date: _____

Lab Supervisor

Approved by: _____ Date: _____

EH&S Dept.

*Attach additional sheets as necessary.

Appendix 8.3.1) Hazard Registration/Safety Authorization Request Form

Please go to the EHS Dept. Website (www.ehs.ukans.edu) to download the most current version of the Laboratory Hazard Registration/Safety Authorization Application form.

You may also follow this link:

<http://www.ehs.ukans.edu/documents/LHRSAA2000.pdf>

Appendix 8.3.2) Hazard Warning Signage

Appendix 8.3.2.1) Hazardous Chemicals Sign - NFPA Fire Diamond



Appendix 8.3.2) Hazard Warning Signage
Appendix 8.3.2.2) Biohazard Sign



Appendix 8.3.2) Hazard Warning Signage
Appendix 8.3.2.3) Radiation Hazard Sign



Appendix 8.3.2) Hazard Warning Signage
Appendix 8.3.2.4) Laser Hazard Sign



Appendix 8.3.3) Example of Lab Entrance Posting

Reserved - Being developed by EHS

Appendix 8.3.4) EHS Lab Inspection Checklist

Please go to the EHS Dept. Website (www.ehs.ukans.edu) to download the most current version of the Laboratory Safety Inspection Checksheet..

You may also follow this link:

<http://www.ehs.ukans.edu/documents/LSI1.pdf>

Appendix 8.4.1) Training Documentation Form

Please go to the EHS Dept. Website (www.ehs.ukans.edu) to download the most current version of the Laboratory Safety Training Documentation Form .

You may also follow this link:

<http://www.ehs.ukans.edu/documents/LSTD1.pdf>