

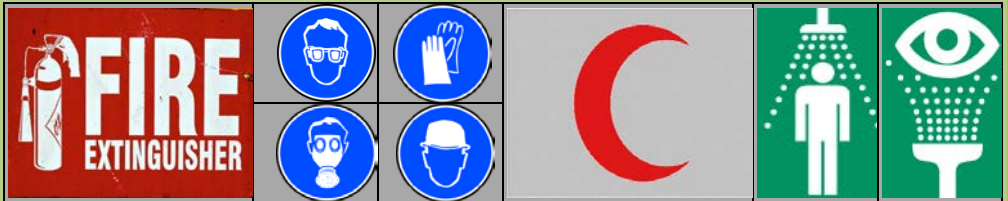


King Abdulaziz University
Faculty of Engineering



Faculty of Engineering Safety Manual

Version 2



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Dean's Message

Since its establishment in 1975, The Faculty of Engineering, King Abdulaziz University has been in line with the incredibly rapid advancement of education and research technologies. All the time, the Faculty believes that the human has the key role whatever the level of the technology is. Unless a comfortable and safe environment is provided to the human element, the effectiveness of these advanced technologies is doubtful. Based on this, The Faculty of Engineering is committed to providing a safe and healthy working and learning environment that is free from accidents, injuries and occupational hazards that might cause harm to students, employees and visitors. In this regard, the Faculty of Engineering devised its safety, health and environment policy, and allocated all necessary support to implement this policy. Along with the support of the higher administration of the Faculty, we believe that cooperation of all Faculty constituents for achieving that policy is the most crucial factor of success.

Dr. Mohammed Reda Kabli
Dean of the Faculty of Engineering

Safety and Emergency Committee Chair's Message

The continuous growth and the dramatic change of the nature of activities within the Faculty of Engineering necessarily entail revising the current safety policy and procedures. In view of this, the Faculty higher administration decided to restructure the formerly named "Laboratory and Facility Safety Committee" to expand its mission. The current name of the committee is "Safety and Emergency Committee". As might be understood from its name, the scope of the committee is extended to cover emergency response planning. In addition to the new mission, the committee is still delegated to device programs and plans to assure full compliance to the recent safety, health and environment standards and regulations. With the membership of representatives from all academic and administrative departments in the Faculty, the Committee aim to recognize and control existing and potential hazards in all locations as proactive action prior to being developed to an incident. From past experience, the Committee has recognized that enhancement of students, employees and visitors' safety culture is one of the most powerful approaches to eliminate or at least minimize the risk of injury from existent and potential hazards. In light of this, the Faculty of Engineering published the first edition of its Safety Manual in 2014. The manual, which has been prepared by faculty members who have experience in the field of safety, health and environment, contains valuable information that increase safety awareness and practice among the Faculty employees and students. In 2019, the second version of the manual has been published including updates of standards, functions and procedures related to safety and emergency plans.

Prof. Hamad Ali Alturaif

Chair of the Safety and Emergency Committee

Chapter 1

About the Faculty of Engineering Safety Manual

1.1 Introduction:

The mission of the Faculty of Engineering (FOE) – King Abdulaziz University (KAU) is to “prepare qualified engineers through education and training and conduct high-class research to sustain and maintain development of the society.” This mission includes many activities that involve potential exposure to hazardous safety and health conditions as well as environmental hazards.

The higher administration of the FOE believes that all these types of hazards are preventable. Based on this, the safety, health and environmental policy of the FOE is formulated to assure commitment to provide and maintain a safe and healthy work environment in accordance with local and international standards.

The FOE has established several procedures to assure the achievement of its safety, health and environmental policy. One of these is the formulation of the FOE Safety and Emergency Committee that has been assigned several tasks of which preparation of this safety manual is a key one. This safety manual is a part of a continuing program for providing safety information to personnel.

This manual is the second edition of the FOE Safety manual which is intended to replace the first edition.

Each laboratory in the FOE must have a copy of this manual readily accessible to employees in the laboratory. Each laboratory worker must be familiar with the contents that pertain to his or her workplace and the procedures for obtaining additional safety information needed to perform his or her duties safely.

The Safety and Emergency Committee is responsible for updating this manual with up-to-date regulations and standards of Safety, Health, and Environment (SHE).

We all share in the responsibility for the health and safety of students, staff and other employees, and visitors. All members in the FOE believe that the safety system goals cannot be satisfied and achieved without cooperation among them.

1.2 Purpose of the Safety Manual

- The purpose of the Safety Manual is to provide students, employees and visitors with general guidelines for implementing a high quality SHE program. It is not an exhaustive source document but rather an approach to SHE.

- The manual brings together information that will assist lab engineers and supervisors carry out their responsibility in ensuring a safe environment at university premises for students, staff, visitors, contractors, and employees.
- All personnel should read this manual and conduct their work accordingly.
- The graduates from the university will assume responsible positions in the industry. Hence, they must develop at least the minimum requirement of safety culture during their study in the university. The Safety Manual will also provide guidelines for the teaching of students.

1.3 Scope of the Safety Manual

- The information and requirements given in this Manual are applicable to all areas of the FOE and represent only general minimum standards. They do not substitute for special operation manuals used in certain buildings or laboratories to meet specific situations. This manual will serve as a basis to which supervisors shall add safety measures relevant to their laboratory or work operations.
- It must be emphasized that this is primarily an in-house manual. The procedures and requirements are established based on the facilities and resources available at the FOE.
- The Safety Manual contains the objectives, policies, standards, and procedures that pertain to all employees. Specific responsibilities, administrative procedures, and operational requirements are described that are relevant to work and laboratory safety and the prevention of laboratory-acquired illnesses.

1.4 Important Abbreviations

EDC: Emergency and Disaster Center

FOE: Faculty of Engineering

KAU: King Abdulaziz University

MSDS: Material Safety Data Sheet

PPE: Personal Protective Equipment

SHE: Safety, Health and Environment

1.5 Acknowledgement

This manual has been adopted from several resources, such as safety manuals of many US universities, as well as some publications related to safety and health. Examples of these are: Safety and health manuals of the University of North Carolina at Chapel Hill, University of Florida, University of California, Michigan Technological University, The University of North Carolina at Chapel Hill, as well as the previous safety manual of the FOE and the Electrical and Computer Engineering Department safety manual.

Chapter 2

SHE Policy and Responsibilities in FOE

2.1 SHE Policy at the FOE

The Faculty of Engineering conserves no effort in maintaining a safe and healthy environment for study and work. Members of the teaching staff, employees and students should preserve the environment by adhering to the conditions, regulations and standards of SHE adopted by the FOE and KAU through collaborating with other SHE-related departments or centers in the University.

This policy has been formulated to help in the avoidance of injuries with any level of severity, work-related illnesses, or any damage to the environment in conformance with local and international SHE standards. In addition, it is meant to develop a safety culture among FOE community by creating an awareness of their roles in undertaking safety responsibilities. So, every faculty member, employee, student and visitor must be aware of this policy and they must adhere to its rules and directions.

2.2 Responsibilities

As mentioned earlier, the success of the SHE programs in the FOE is a collaborative work in which all faculty staff, students and employees are involved. This chapter presents the roles and responsibilities of each of them.

2.2.1 Dean of the FOE

Responsibilities of the FOE Dean include:

- Approves SHE policy of the FOE.
- Representing the FOE in local events related to SHE.
- Providing the necessary resources needed for implementation of the SHE program throughout the departments and facilities.
- The review of SHE performance of the departments to ensure that all departments are applying the proper SHE rules and procedures.
- Approving the organization and responsibilities of the Safety and Emergency Committee.
- Approving the FOE Safety Manual.

- Encourages a positive safety culture and behavior by recognizing and rewarding departments and personnel who implement and comply with safety rules and procedures.
- Ensures that SHE issues are included in the agenda of FOE Council meetings.

2.2.2 Safety and Emergency Committee

Responsibilities of the Committee include:

- Preparation of FOE safety programs and emergency response plans.
- Reviewing up-to-date SHE national and international regulations and standards that apply for all facilities and activities in the FOE.
- Recommending compliance requirements to applicable SHE regulations and standards.
- Conducting periodical inspections to ensure SHE compliance in all departments and facilities of the FOE.
- Preparation of the necessary SHE forms and codes that are not covered in the University programs.
- Providing appropriate advice in SHE to departments and facilities.
- Reporting to the Dean about the situation of SHE in the FOE in a regular basis.

2.2.3 Chairmen of Departments

Every department chairman is responsible for:

- Appropriate allocation of resources such as personnel, tools and budget, for the implementation of faculty SHE policy.
- Maintaining positive attitude towards the faculty SHE programs.
- Using effective evaluation methods for department safety efforts by reviewing safety inspection results and injury reports as well as visiting all department areas.
- Appreciation, recognition and rewarding of the staff and supervisors' efforts.
- Paying more attention to the significant safety issues within department, safety protection of the students, staff, laboratories advisors and environment as a key part of all performance activities.

- Ensuring that all students, contractors, visiting scholars and scientists, and employees are being informed with the requirements and responsibilities towards the faculty safety programs, health and environmental protection policies.
- Ensuring that students, contractors, visiting scholars and scientists, and employees were updating with the appropriate and timely safety and environmental information and training.
- Maintaining up-to-date and available department written SHE plans, chemical inventories, and material safety data sheets, where necessary.
- Assigning of the department safety supervisors and direct their activities.
- Preparing, in collaboration with the Safety and Emergency Committee, a list of SHE training required for department employees and make sure that all employees receive the required training.
- Ensuring that appropriate corrective measures have been taken in case where existing or potential SHE hazard is recognized.
- Filling and submitting an annual department SHE report to the Dean.

2.2.4 Faculty and Lab Supervisors

Every faculty member and lab supervisor is responsible for:

- Including safety, health, and environmental protection within the daily activities of students, employees, and any other persons they supervise.
- Facilitating training and information to students, employees, and all others they supervise as being requested by departmental administration and as under the faculty SHE programs and policy requirements.
- Recommending new equipment and procedures for recognized SHE hazards and take appropriate precautions before they are used or implemented.
- Study of all incidents resulting in injury or property damage and report them to their department administrator and Safety and Emergency Committee.
- Each employee fatality immediately must be reported to the faculty management and safety committee regardless of causes.
- Impose safety rules and check of work areas daily.
- Keep a written record of the content of each training session and identification of trainer and all attendees.

2.2.5 All Students and Employees

- All students and employees are requested to carefully read the FOE Safety Manual and to study the safety plan.
- Attending SHE training and informational sessions/meetings as needed.
- Application of appropriate work procedures and wearing all proper designated personal protective equipment.
- Reporting all hazardous conditions and incidents to their supervisor, instructor, or any other appointed person.
- Employees are also encouraged to take part in the development of safe work procedures and environment protection and to be involved in the Safety and Emergency Committee or any other means of feedback to the FOE.

2.2.6 FOE Emergency Personnel

The main responsibilities of the Emergency Personnel are to:

- Be the key link between the FOE and other Administrations related to safety and emergency inside and outside KAU.
- Be aware of the official procedures and requirements of KAU and local organizations as related to safety and emergency response.
- Provide assistance to FOE employees, faculty members and students in case of emergencies.
- Participate in FOE emergency planning.
- Report any hazardous conditions to the Safety and Emergency Committee.

Chapter 3

General Safety

This chapter describes several safety principles and practices that all employees and students need to be familiar with. Main topics covered in this chapter are: Important safety definitions, safety awareness; eating, drinking & smoking; housekeeping; working alone; unattended operations; signs & placards; and personal protective equipment.

3.1 Important Safety Definitions

Safety: A measure of the degree of freedom from risk in any environment. Also, it is defined as the freedom from those conditions that can cause death, injury, occupational illness, or damage to or loss of equipment or property.

Occupational safety and health: Conditions and factors that affect, or could affect, the health and safety of employees or other workers (including temporary workers and contractor personnel), visitors, or any other person in the workplace (such as students).

Safety, health and environment policy: Overall intention and direction of an organization related to its SHE performance as formally expressed by top management. The HSE policy provides a framework for action and for the setting of SHE objectives.

Accident: An unwanted event resulting from the occurrence of one or more fault incidents that have a negative impact on a system, product, equipment, or personnel.

Accident sources: Accidents generally involve one or all of five elements: people, equipment, material, procedures, and the work environment, each of which must interact for successful business operations. However, when something unplanned and undesired occurs within either of these elements, there is usually some adverse effect on any one or all of the other elements, which, if allowed to continue uncorrected, could lead to an incident or accident and subsequent loss.

Hazard: A condition or situation that exists within the working environment capable of causing an unwanted release of energy resulting in physical harm, injury, and/or damage.

Risk: The likelihood or possibility of hazard consequences in terms of severity and probability. It may be expressed in quantitative terms, taking values from zero (certainty that harm will not occur) to one (certainty that it will), or qualitatively (i.e., as high, low, or trivial).

Danger: Term of warning applied to a condition, operation, or situation that has the potential for physical harm to personnel and/or damage to property.

Work environment: The physical location, equipment, materials processed or used, and the kinds of operations performed in the course of an employee's work, whether on or off the employer's premise, comprise the employee's work environment.

Engineering controls: Measures taken to prevent or minimize hazard exposure through the application of controls such as improved ventilation, noise reduction techniques, chemical substitution, and equipment and facility modifications.

Administrative control: A measure initiated to reduce worker exposure to various stresses in the work environment. An example is limiting the amount of time that an employee can work around health hazards.

Unsafe act: Any act or action, either planned or unplanned, that has the potential to result in an undesired outcome or loss (injury, property damage, lost production time, etc.).

Unsafe condition: Any existing or possible condition that, if allowed to continue, could result in an undesired outcome or loss (injury, property damage, lost production time, etc.).

3.2 Safety Awareness

Everyone involved in laboratory operations - from the highest administrative level to the individual workers - must be safety minded. Safety awareness can become part of everyone's habits only if senior and responsible staff demonstrates a sincere and continuing interest in safety, and discusses it repeatedly.

Over-familiarity with a particular laboratory operation may result in overlooking or underrating its hazards. This attitude can lead to a false sense of security, which frequently results in carelessness.

Be alert to unsafe conditions and actions and call attention to them so that one can make corrections as soon as possible.

Every laboratory worker has a basic responsibility to himself/herself and colleagues to plan and execute laboratory operations in a safe manner.

3.3 Eating, Drinking & Smoking

Ingestion of hazardous substances may occur as a result of contamination of food, drink, tobacco products, and cosmetics. KAU policy prohibits smoking in University

buildings. Furthermore, FOE prohibits eating and drinking in all laboratories and workshops. Store, handle, and consume food/drink in areas free of hazardous materials.

Consider designating non-laboratory areas, such as nearby break rooms, lounges or conference rooms, as food storage and eating areas for laboratory personnel. Laboratory refrigerators, ice chests, and cold rooms are not allowed, in any circumstance, for food storage.

3.4 Housekeeping

Many incidents, involving fatal and non-fatal injuries are related to bad housekeeping. Housekeeping means cleanliness and orderliness.

- Keep work areas clean, and properly label and store chemicals and equipment.
- Cleanup should follow the completion of any operation or at the end of day.
- Deposit wastes in appropriately labeled receptacles, and clearly mark temporary holding containers.
- Do not accumulate unneeded chemicals.
- Stairways and hallways cannot be storage areas.
- Maintain free, unobstructed access to exits and emergency equipment, such as eyewash stations, emergency showers and fire extinguishers.

3.5 Working Alone

Students, contractors, scientists and employees may not work alone if the work involves exposure to hazards that are potentially life threatening, could inhibit self-rescue, could cause injuries requiring immediate assistance, or pose a fire or explosion hazard beyond the person's ability to respond effectively.

Appropriate methods to address the need to perform such hazardous operations include the buddy system, intercom communication to a nearby area, periodic supervisor inspections, periodic phone contacts, etc., as long as the method implemented is appropriate to the level of hazard and the required response time in the event of an incident. Each department is responsible for establishing a system and criteria for approving requests to work alone.

3.6 Unattended operations

Unattended operations are laboratory operations that must run continuously or overnight. Examples are continuous reactor systems, Soxhlet extractor, hot plates, solenoid valves, gas valves, etc. Equipment and experiments that run unattended during the day or overnight can cause significant problems and harm to personnel, facilities, and equipment.

If unattended operations are necessary, it is essential to plan for potential interruptions in utility services such as electricity, water and inert gas. Make sure you perform a hazard analysis to identify potential consequences of failures in utility services or equipment. Design operations to be “fail-safe”, so that one malfunction will not cause a propagation of additional failures.

If necessary, arrange for routine inspection of the operation. If appropriate, leave laboratory lights on during unattended operations, and place a sign on the entrance door to convey critical information to personnel (such as other lab personnel, maintenance, housekeepers, or incident responders) who could encounter your unattended operation.

3.7 Visitors

It is the responsibility of laboratory staff to guide visitors of the lab and explain the potential hazards they may encounter in the lab. Visitors must wear the correct personal protective equipment for the hazards present in the lab, no matter if they are visitors or maintenance workers, no matter how long they will be in the lab. Generally, they must follow the lab regulations that keep them and the others safe.

3.8 Signs and placards

Post laboratory areas that have special or unusual hazards with hazard information signs and labels. Standard signs and symbols exist for a number of special situations, such as radioactive materials, radiation hazards, biological hazards, fire hazards and laser operations.

Other signs shall be posted to show the locations of safety showers, eyewash stations, exits and fire extinguishers. Fire extinguishers are to be labeled to show the type of fire for which they are intended. A green on white placard must be posted to designate emergency eyewash and shower facilities.

Waste containers must be labeled for the type of waste for which they are intended. The safety- and hazard- sign systems in the laboratory should enable a person unfamiliar with the usual routine of the laboratory to escape in an emergency (or help combat it, if appropriate).

Laboratory entrance signs are required by regulatory agencies and are essential to safety by providing critical information to lab users, visitors, and emergency responders, alerting them to specific hazards in the respective lab. Lab entrance signs are to be posted at **all** entrance(s) to each functionally separate laboratory.

The following figure shows examples of signs used in the FOE laboratories that are used commonly worldwide.



Biological Hazard



Radiation Hazard



Electrical Hazard



Corrosive Material



Explosive Material



Toxic Material



Flammable Material



Laser Beam



Oxidizing Agent



Hot Surface



Hazard Caution



No Smoking



Don't Touch



Entry Not Allowed



Mobile Not Allowed



Fire Extinguisher



Body Protection



Eye Protection



Face Protection



Hand Protection



Foot Protection



Head Protection



Respirator



Hearing Protection



Safety Shower



Eye wash



Exit



First Aid

Figure 1: Examples of standard safety signs commonly used in FOE

3.9 Personal protective equipment

University students and employees may be required to wear personal protective equipment (PPE) as identified by department safety plans, job-hazard analyses, posted signs, written procedures, or regulatory requirements. It is the responsibility of all employees and students to wear the required personal protective equipment. It is the responsibility of the faculty/supervisor to make it available to employees, as well as students, contractors, vendors, and visitors, and to ensure that it is worn where required.

3.9.1 Selection of Personal Protective Equipment

PPE requirements must be determined for each job or task assignment and will be determined by the supervisor or faculty member in charge with assistance from the Safety and Emergency Committee as needed or required. Once the appropriate PPE has been determined, its use is mandatory. It is the responsibility of the faculty/supervisor to ensure that proper training or other required prequalification has been implemented before the student or employee begins a task for which PPE is required. The following guidelines are intended to assist the faculty member or supervisor in selecting appropriate PPE.

3.9.2 Eye and Face Protection

Each affected person shall use appropriate eye or face protection if a hazard exists due to any of the following:

- Flying objects or particles
- Moving or dangling objects like slings and chains
- Dusts and mists
- Molten metal
- Liquid chemicals
- Acids or caustic liquids
- Chemical gases or vapors
- Glare
- Injurious radiation
- Electrical flash
- Any combination of the above hazards

The Safety and Emergency Committee should be contacted for additional information and assistance in the selection of appropriate eye protection. The requirements for eye protection include:

Side protection shall be used whenever there is a hazard from flying objects. Spectacles without side shields are allowable for frontal protection only (it should be noted that this situation would be extremely unlikely).

A face or eye protector shall be in compliance with all of the following minimum requirements:

- It shall protect against the particular hazards for which it is designed.
- It shall fit snugly and shall not unduly interfere with movements of the wearer.
- It shall be capable of withstanding sanitizing.
- Care shall be taken to recognize the possibility of multiple and simultaneous exposure to a variety of hazards.
- Adequate protection against the highest level of hazard must be provided when multiple hazards are present.
- Operations involving heat may also involve optical radiation. Protection from both hazards shall be provided.
- Safety glasses or goggles must be worn under face shields.
- Persons whose vision requires the use of prescription lenses shall wear either protective devices fitted with prescription lenses or protective devices designed to be worn over regular prescription eyewear.
- Wearers of contact lenses shall also be required to wear appropriate eye and face protection devices in a hazardous environment.
- Caution should be exercised in the use of metal frame protection devices in electrical hazard areas.
- Welding helmets or hand shields shall be used only over primary eye protection.



Spectacle or glasses



Goggles



Face shield



Shaded face shield

Figure 2: Examples of eye and face protection devices

3.9.3 Hand Protection

Each affected person shall use appropriate hand protection when their hands are exposed to hazards that may cause any of the following:

- Skin absorption of harmful substances
- Severe cuts or lacerations
- Severe abrasions
- Punctures
- Chemical burns
- Thermal burns
- Harmful temperature extremes

Selection of the appropriate hand protection shall be based on an evaluation of the performance characteristics of the hand protection relative to all of the following:

- The task to be performed
- Conditions present
- Duration of use
- The hazards and potential hazards identified

Selection of chemical-resistant gloves should be based on manufacturer-specific permeation and degradation data when prolonged contact is expected. Assistance in the selection of chemical-resistant gloves is available from most vendors and manufacturers.



Cotton gloves



Chemical resistant gloves



Heat resistant gloves



Electrical resistant gloves

Figure 3: Examples of hand protectors

3.9.4 Head Protection

Each affected person shall be provided with, and shall wear, head protection equipment and accessories in areas where a hazard exists from falling or flying objects, other harmful contacts or exposures, or where there is a risk of injury from electric shock, hair entanglement, chemicals, or temperature extremes.

Head protection equipment that has been physically altered or damaged shall not be worn or reissued to a student or employee.

Protective helmets or safety hats and caps shall be of the following types:

- Class-A—Limited voltage protection
- Class-B—High voltage protection
- Class-C—No voltage protection

A Class-C helmet or any metallic head device shall not be furnished or used for head protection, except where it has been determined that the use of other types of protective helmets or safety hats or caps is impractical, such as where chemical reaction will cause the deterioration of other types of head protection.

Bump hats or caps or other limited-protection devices shall not be used as a substitute for protective helmets for the hazards described in this section.

A hat, cap, or net shall be used by a person where there is a danger of hair entanglement in moving machinery or equipment, or where there is exposure to means of ignition. It shall be designed to be reasonably comfortable to the wearer, completely enclose all loose hair, and be adjustable to accommodate all head sizes.

Material used for a hair enclosure shall be fast dyed, nonirritating to the skin when subjected to perspiration, and capable of withstanding frequent cleaning. It shall not be reissued from one person to another unless it has been thoroughly sanitized.



Figure 4: Head protection helmet

3.9.5 Hearing Protection

When a noise exposure of 85 dBA (an environment where normal speech levels can not be understood) is exceeded for any eight-hour time period, a hearing conservation program shall be established. If there are concerns that this action level of 85 dBA may be exceeded, the Safety and Emergency Committee should be contacted to make noise measurements and to assist in selecting appropriate noise abatement measures and establishing a hearing conservation program, if necessary.



Figure 5: Examples of ear protectors

3.9.6 Foot Protection

Each affected person shall wear protective footwear when working in areas where their feet are exposed to electrical hazards or where there is a danger of foot injuries due to falling or rolling objects or a danger of objects piercing the sole of the shoe. Safety shoes and boots which are not worn over shoes and which are worn by more than one person shall be maintained, cleaned, and sanitized inside and out before being reissued.

Where a hazard is created from a process, environment, chemical, or mechanical irritant that would cause an injury or impairment to the feet by absorption or physical contact—other than from impact—footwear, such as boots, overshoes, rubbers, wooden-soled shoes, or their equivalent, shall be used.



Figure 6: Examples of safety shoes and boots

3.9.7 Respiratory Protection

Selection of respiratory protection is the responsibility of both the lab supervisor and the Safety and Emergency Committee. Any person who suspects the presence of a hazardous air contaminant must request assistance and obtain approval from Safety and Emergency Committee before selecting, or using, a respirator or dust mask.



Figure 7: Examples of masks and respirators

3.9.8 Hot Work

Hot work is any temporary activity involving an open flame or that produces heat, sparks, or hot slag. This includes, but is not limited to, brazing, cutting, grinding, soldering, thawing pipes, torch-applied roofing, and welding. Such activities will require the issuance of a Hot Work Permit before beginning hot work and adherence to the standard procedures.

3.9.9 Exposure to Blood-borne Infectious Diseases

Each department must determine if they have employees whose required job duties result in actual or potential exposures to human blood or other potentially infectious body fluids. If so, a blood-borne infectious diseases program must be established to protect them from exposure. The program will include a written compliance plan, employee training, the use of universal precautions, personal protective equipment, engineering controls, and offering the hepatitis-B vaccination series.

Employees who believe that their required job duties involve exposure to blood or other infectious materials should contact their supervisor to see if they should be part of the department blood-borne infectious diseases program. If the department does not have an existing blood-borne infectious diseases program, the supervisor should contact the Safety and Emergency Committee for information and assistance in determining whether a program is needed.

Students or employees who are concerned about potential exposure to blood-borne infectious diseases may also contact the Safety and Emergency Committee for information about protective measures that can be taken.

3.10 Safety and Health Training

Each department shall be responsible for providing safety orientation training for each new employee. Additional training must also be provided as required for specific tasks and, depending on the task, may be required before the employee is permitted to begin work.

3.10.1 Training Responsibilities

- Individual department chairs and Dean of FOE, and directors are responsible for ensuring that safety training is provided for all employees, as appropriate.
- Supervisors and faculty members are responsible for providing training to employees and students under their supervision and are responsible for requesting the Safety and Emergency Committee assistance when needed.
- Safety training may be organized with university centers or departments outside FOE, such as KAU Emergency and Disaster Center, Security and Safety Administration, Quality Assurance Administration, etc., as appropriate.

3.10.2 Qualifications, Training Content, and Record Keeping

Except where the qualifications of the trainer are specified in a regulation or standard, Dean of FOE and department chairs may assign training duties to knowledgeable employees as appropriate. Likewise, the content of the training may be determined by the trainer, except where specified in a regulation or standard.

The Safety and Emergency Committee should be consulted to determine whether the training content is specified under a particular regulation and can assist with content and training materials and aids.

All safety training shall be documented in writing and a record retained for a period of no less than two years for annual training and for the duration of employment for one-time training.

3.10.3 Training Topics

Every employee, including student, temporary, and part-time employees, shall be given safety orientation training before beginning any job assignments. The safety orientation should include general information about emergency response procedures, how to report injuries, how to obtain emergency assistance, and how to get additional safety information.

Additional training may be required by specific safety and health standards before an employee is assigned to perform tasks covered under the standard. Examples include heavy equipment operation, electrical work, exposure to blood-borne pathogens, work with radioisotopes, chemical laboratory work, respirator use, hazardous materials shipping and receiving, and many others.

All departments are responsible for contacting the Safety and Emergency Committee to assist them in determining what type of safety training is required and appropriate for their employees.

3.11 Incident and Injury Investigations and Reporting

Supervisors, including faculty, laboratory managers, office managers, are responsible for investigating and reporting incidents involving injury or property loss in their area as well as close calls or “near misses.” The supervisor will complete a supervisor's incident and injury investigation report and submit a copy to the Safety and Emergency Committee. The form also serves as a helpful investigation guide.

Incident investigations typically involve a review of the location as well as interviews of all who were involved in or observed the incident. Emphasis should be placed on identifying the underlying causes of the incident rather than placing blame. The investigation is not considered complete until all actions that will prevent recurrences have been identified. Corrective actions taken as a result of the investigation should be documented.

The supervisor may insist that an injured employee be seen by a doctor if in his/her judgment it is prudent to do so. Injuries to students during class activities or on University property should also be reported, however, students may not be forced to accept medical treatment.

All employee fatalities must be reported to both the Safety and Emergency Committee and college administration immediately, regardless of cause.

Chapter 4

Emergency Response and Fire Prevention Plan

This chapter shows the general emergency response procedures to be taken in case of departmental unavailability- or facility-specific procedures. The supervisor or person in charge of the area is responsible to investigate all emergency incidents whenever emergency occurs and to report them immediately to the Safety and Emergency Committee.

In cases of emergencies, the person in charge is the FOE Emergency Personnel who is a representative of the Emergency and Disaster Center, KAU. Call this officer in emergency cases and he is responsible for giving the right guidance and taking the proper action. His permanent telephone number is **0563077606**.

4.1 Building Evacuations

There are several situations of actual and possible emergencies which would require building evacuation such as: fire, explosion, chemical spill, gas leak, terrorist threats, etc. The evacuation alarm is initially intended to start a general evacuation during fire emergencies.

In case of other non-fire emergencies, consideration should be given to the possibility that occupants may pass through a danger area (e.g., chemical spill in exit path, potential explosion area, exposure to gunman, etc.) during exiting out of the building before initiating evacuation alarm. In such cases general evacuation is not safe, evacuation process recommended to be conducted room by room in buildings that do not have a public access system.

For more information about evacuation plans and instructions, please visit the Emergency and Disaster Center website (URL: http://edc.kau.edu.sa/Content.aspx?Site_ID=355100&lng=AR&cid=211511).

4.1.1 Physically Disabled Occupants

Faculty are asked to inform students in each class with the need to identify themselves (in private, if desired) if they in need of assistance during a building evacuation and to organize an evacuation plan for identified ones. Such evacuation plans may include co-operation system and use of refuge safe areas— locations relatively resistant to heat and smoke within the building (for example a sprinkler protected room or hallway, or a stairway landing) where an occupant could wait for help to assist in an evacuation. When allocating refuge safe area, it is essential to assign, at the time of the emergency, a specific task individual to direct emergency responders of the location of waiting occupants.

Employees are responsible to identify themselves to their supervisor if they will need assistance during a building evacuation, and the supervisor is responsible to design workable evacuation plan for his subordinates.

4.2 Building Fires

- Use the closest alarm pull station to start building evacuation.
- Immediately call the Emergency Personnel (0563077606) or dial 6951111 to call Emergency and Disaster Center.
- If the fire is a tiny one you may try fire extinguishing if you have been trained to use firefighting portable extinguishers.
- Cover your nose and mouth with wet cloth.
- Get down on the floor and crawl out of the building.
- Use the closest safe way out to exit of the building. Shut all doors on the way exit barring the spread of fire and smokes.
- Immediately when exiting out proceed directly to a safe area at least 100 feet from the building.
- Never use the elevators to evacuate.
- Whatever the reasons, please don't try to re-enter the building until all-done, all-out announced by EDC.

4.3 Building Fire Safety

- Occupants of the building should not be blocked by any objects of safety such as exit signs, heat and smoke detectors, sprinkle systems, strobes, horns and alarm pull, etc.
- Fire doors are not automatically opened unless with an approved magnetic interlock device.
- Don't use sprinkler heads and pipes to support decorations or any other items and a sprinkler head. Must be at least eighteen inches over the stored materials.
- Flammable and combustible storages must confirm with relevant provisions of this document and with the General Directorate of Civil Defense standards.
- Stairways must be maintained free of obstacles and shall not be used as storage, or for Garbage bags, containers or scrap machines, etc.

- Entrances should not be used for storage of flammable materials, items that would unintentionally be placed into the traffic paths during an emergency or items that narrow the width of the corridors.
- Vending machines should not be located into places that may narrow the width of a corridor or other building outlets within refilling operations and should not be placed into stairways.
- Items should not be located in the pathways without approval from the Safety and Emergency Committee. Cabinets with doors or drawers will not be approved if the open drawer or door will block the pathways width above the minimum required level.
- Maintain at least minimum 36-inches clear outlet from each workstation.
- Special scenarios must be planned so that displays and refreshment so that tables will not block outlets, exits, pathways or access routes.
- Classrooms with mobile seating shall be roll up to open more space for access to the exit door(s) among seats rows, whereas seats should not exceed 49 ones in rooms with only one exit.
- Additional occupants should not be settled in passages exit ways, or any other parts of classrooms and other assembly points equipped with fixed seating.
- Open flames are allowed only in laboratories and any other particular hot work areas are allowed only by obtaining a hot work permit.
- Decorations must be set up in a way that don't block any exits, passages, stairs, or firefighting equipment from sight or use. Decorative lights or lighting should not be placed on or beside an exit signs.
- Combustible decorations are not allowed to be placed in stairways and should be maintained to a minimum in hallways.
- Candle lightings are allowed only in supervised dining areas, and to be carefully secured supported on a noncombustible base, and strict protection of flame.

4.4 Chemical Spills

Each employee in charge of a task including use of a hazardous material, must organize written steps to be followed in case of spill incidents and notify the procedures to all students, contractors, visiting scholars and scientists, and other employees included in the activity. The written steps and associated training must state clearly information on when to request external assistance. Below are the steps for chemical spills that cannot be handled safely by persons acting in the area.

4.4.1 Chemical Spills and Gas Leaks Indoors

- If an odor of gas or toxic material is detected go outside the building immediately.
- If the spill incidents cause immediate danger to life or health (IDLH), evacuate the room and, if necessary, evacuate also the whole building.
- Call the Emergency Personnel (0563077606) or dial 6951111 to call Emergency and Disaster Center and request assistance. Give all details of the incident and whether there is a possibility of fire or injuries. Be ready to give description of the spilled materials, and prepare material safety datasheet (MSDS), if applicable.
- Incident's area of the spill must be obstructed to block the students or employees from entering zone of dangerousness.
- From a safe area, communicate all information of the area and details about the spill to the Emergency Personnel (0563077606).

4.4.2 Chemical Spills Outdoors

- Call the Emergency Personnel (0563077606) or dial 6951111 to call Emergency and Disaster Center. If the hazard is potentially dangerous to the environment carefully clean up all the spill zone by on-site personnel, and request assistance of the Safety and Emergency Committee in the faculty if the spill is too large to handle. However, if there is a danger to the people within vicinity area and potential fire or toxic vapors, request Emergency and Disaster Center assistance.
- Apply the emergency response procedures of your Department to control the spill. Do not try to cleanup once you have determined calling for external assistance, or if the spill leaked into the soil, groundwater, or surface water.
- Maintain a safe distance far from the spill area and warn walkers to stay away until help arrives. Be ready to communicate all details about the spilled substances, including Material Safety Data Sheet, to emergency responders.

4.5 Medical Emergencies

- Immediately start investigating the area for possible safety hazards (fire, toxic or explosive gas vapors, etc.) or cases that may require referring the injured to a safer site. Otherwise don't move the injured if no more necessary.
- Call the Emergency Personnel (0563077606) or dial 6951111 to call Emergency and Disaster Center.

- Apply first aid emergency as needed if you have been trained in doing so.
- If the injuries involve exposure to chemical hazardous, provide medical emergency responders with the Material Safety Data Sheet.

4.6 First Aid

First aid is the most crucial and critical job that must be performed in case of a hazard. All labs must have first-aid kits and lab engineers must be trained to do the job.

4.6.1 Typical Hazards and First-Aid Guide

4.6.1.1 Burns

1. Remove the person from danger.

Heat Burns: have him/her drop and roll if he/she is on fire. Smother flames. Don't try to remove clothing embedded in the burn.

Chemical Burns: Remove the person's clothing and rinse chemicals off the skin by placing the victim in a shower for 15 to 20 minutes. (Rescuers should wear rubber gloves to protect themselves from chemicals as much as possible.) Seek immediate medical treatment.

2. Check breathing. If victim is not breathing, start rescue breathing (call 996 or emergency number.)
3. Raise burned arms or legs higher than the person's heart.
4. Cover the person with cool, wet cloths. Do not use butter, ointments, or any other home remedy. Do not break blisters or remove burned skin.
5. Call the Emergency Personnel (0563077606) or dial 6951111 to call Emergency and Disaster Center.

4.6.1.2 Electric Shock

1. Check to see if the person is still in contact with the electric current. If so, don't touch him/her. Shut off the power at the circuit or breaker box.
2. Check breathing and feel for pulse on side of neck.
3. Call the Emergency Personnel (0563077606) or dial 6951111 to call Emergency and Disaster Center.

4.6.1.3 Fever

If fever is 38.5°C or above, orally:

1. Take off unnecessary clothing.
2. Give acetaminophen as instructed on the label. If you are unsure if the dosage is correct, call your doctor. Note: Never give aspirin to children, because aspirin used in conjunction with viral illnesses such as colds, flu, and chicken pox may increase the risk of Reye's Syndrome, a life-threatening disease of the brain and liver.
3. If fever is 40°C or higher, begin the following steps to cool the person, and call a doctor or take the person to the emergency department.
 - a. Sponge the person with lukewarm water, put her/him in a tub of cool water, or let him/her rest under a single layer of thin towels that have been dipped into cool water and wrung out.
 - b. Don't let the person get chilled.
 - c. Don't use ice water or alcohol for sponging.
 - d. Continue these steps on the way to the emergency department.
4. Give plenty of cool things to drink. Gelatin, sherbet or ice pops are also good.
5. Call your doctor or the emergency department if you are worried or don't know what to do.

Seek immediate medical attention if the person's fever is accompanied by any of the following symptoms, which may indicate a serious or life-threatening illness:

- Pain or tenderness in the abdomen
- Nausea or vomiting
- Severe headache
- Stiffened neck, which resists movement
- Sensitivity to light
- Convulsions or seizures
- Difficulty breathing
- Strange behavior, altered speech
- Rash
- Mental status changes, confusion, difficulty waking up, extreme sleepiness.

4.6.1.4 Head Injuries

Head Injuries: Loss of consciousness, vomiting, sleepiness, and blurred vision, difficulty waking the person, a change in mental status (unusual behavior, confusion, etc.) or headache unrelieved by over-the-counter pain medication requires immediate medical evaluation. (Don't take aspirin or any other nonsteroidal anti-inflammatory drug for a head injury.)

4.6.1.5 Heatstroke

If you become overheated or uncomfortable, sit in the shade. Be alert for symptoms of heatstroke. Heatstroke appears in form of fainting or dizziness, headache, nausea, or loss of consciousness, rapid pulse, flushed skin, and a body temperature of 40°C or more. It is a potentially life-threatening illness that requires immediate medical attention.

1. Cool the body of a heatstroke victim immediately.
2. If possible, put him in cool water; wrap him in cool wet clothes; or sponge his skin with cool water, rubbing alcohol, ice, or cold packs.
3. Once the victim's temperature drops to about 38.5 °C, you may lay him in the recovery position in a cool room.
4. If the temperature begins to rise again, you will need to repeat the cooling process.
5. If he/she is able to drink, you may give him some water.
6. Do not give a heatstroke victim any kind of medication.
7. You should watch for signs of shock while waiting for medical attention.

Heat exhaustion results from a loss of water and salt. Symptoms include weakness, heavy sweating, nausea, and giddiness. Treat by resting in a cool area and sipping cool, nonalcoholic drinks. Try to keep the skin cool and moist.

4.6.1.6 Neck and Back Injuries

1. Call the Emergency Personnel (0563077606) or dial 6951111 to call Emergency and Disaster Center.
2. Immobilize the head, neck and shoulder area to prevent movement. Do not move the person unless he/she is in further danger.
3. If he/she is not breathing or has no pulse, begin CPR.

4.6.1.7 Nosebleeds

1. Sit down and pinch the nostrils together between two fingers for 10 minutes.
2. If bleeding does not stop, see a physician.

4.6.1.8 Poisonings

Swallowed Poisons:

1. Make sure the victim is breathing. If not, start rescue breathing
2. Call the Emergency Personnel (0563077606) or dial 6951111 to call Emergency and Disaster Center. Describe the product, how much was swallowed and how long ago.

3. Follow the instructions given by the poison control center or emergency department. Keep *syrup of ipecac* in the home, but use it only with the advice of a medical professional.

Smoke or chemical inhalation:

1. Immediately get the person to fresh air. Avoid breathing the fumes.
2. If the victim isn't breathing, start rescue breathing.
3. If the victim has difficulty breathing, call emergency number. All cases need immediate medical evaluation.

Chemical contamination (skin)

1. Remove contaminated clothing and flood the skin with water for at least 15 minutes. (Use rubber gloves if you're removing clothes from someone else.)
2. Wash the skin gently with soap and water. Rinse.
3. If irritation continues, seek medical evaluation.

Chemicals in the eye:

1. While holding the eyelid open, flood the eye with water poured from a large glass 2 or 3 inches above the eye.
2. IF you cannot hold the eyelid open, have the victim blink as much as possible while flooding the eye.
3. Repeat for 15 minutes.
4. Seek medical evaluation for any continued irritation.

4.6.1.9 Electrical Shock First Aid

1. Remove the victim from the source of electricity before you touch him. Either turn off the master switch to disconnect the power, or use a nonmetal, dry object such as a stick to pull the wire or electrical source away from the victim's body.
2. If he is not breathing, begin rescue breathing immediately; a victim whose heart has stopped breathing needs CPR.
3. If the person is unconscious, but is breathing and has a heartbeat, you should place him in the recovery position and monitor his breathing and heart rate until medical help arrives.

4.6.1.10 Asphyxiation

Asphyxiation is a loss of consciousness due to the presence of too little oxygen or too much carbon dioxide in the blood. The victim may stop breathing for a number of reasons (i.e. drowning, electric shock, heart failure, poisoning, or suffocation). The

flow of oxygen throughout the body stops within a matter of minutes if a person's respiratory system fails. Heart failure, brain damage, and eventual death will result if the victim's breathing cannot be restarted.

Rescue Breathing - Respiratory Restoration

A person suffering from asphyxiation should be given rescue breathing. Before you begin rescue breathing, be certain that the victim has actually stopped breathing.

1. Kneel beside the victim, place your ear near his nose and mouth, and watch his chest carefully. You should feel and hear the breaths and see his chest rise and fall if he is breathing.

If He/She is Not Breathing

1. Provide an open airway. Carefully place the victim on his back and open his mouth. If any material is blocking the airway, it must be cleared out.
2. Tilt the victim's head back by placing the heel of one hand on his forehead and the other hand under the bony part of his chin to lift it slightly.
3. Straddle his thighs, placing one palm slightly above the navel but well below the breastbone. Cover this hand with the other and interlace the fingers.
4. Without bending your elbows, press sharply on the victim's abdomen 6-10 times.
5. Turn the victim's head to one side and sweep out any contents in his mouth with your fingers.
6. If the victim's breathing is not restored after removing the object, reposition his head in the head-tilt/chin-lift position and continue breathing for him as long as is necessary or until help arrives.
7. If there are no signs of breathing, pinch the victim's nostrils closed. Seal your mouth over the victim's mouth and blow two full breaths. A rising chest indicates that air is reaching the lungs. If the stomach is expanding instead, the victim's neck and jaw are positioned improperly. Gently push on the victim's abdomen with the palm of your hand until the air is expelled, because the extra air in the stomach may cause vomiting.
8. Look, listen, and feel again for signs of breathing. If the victim is still not breathing on his own, continue blowing into his mouth one breath every five seconds until help arrives.

4.6.1.11 Fainting - Know the Symptoms and What to Do

Before losing consciousness, the victim may complain of:

1. lightheadedness
2. weakness

3. nausea
4. skin may be pale and clammy

If a person begins to feel faint, he should:

1. lean forward
2. Lower head toward knees. As the head is lowered below the heart, blood will flow to the brain.

What to do if someone becomes unconscious:

1. keep the victim lying down with head lowered and legs elevated
2. loosen any tight clothing
3. apply cool, damp cloths to face and neck

In most cases, the victim will regain consciousness shortly after being placed in this position.

After the victim regains consciousness, do not let him get up until you have questioned him (Who are you? Where are you? Do you know what day it is?) to be sure he has completely recovered.

4.6.2 First Aid Kit

4.6.2.1 The Essentials:

- First Aid Manual (clearly explains how to handle basic problems)
- Basic Bandages (assorted adhesive bandages, athletic tape, moleskin)
- Basic Drugs/Lotions (aspirin, antiseptic, antacid tablets)
- Basic First Aid Tools (tweezers, small mirror, razor blade)
- CPR Shield

4.6.2.2 The Extras (For Long Trips):

- Additional Bandages (gauze pads, ace bandages, butterfly bandages)
- Additional Drugs/Lotions (burn ointment, skin lotion, Caladryl)
- Additional First Aid Tools (sling, basic splint, instant ice pack)

4.7 Natural Disasters:

4.7.1 Heavy Rains and Floods

- Move to the higher ground areas instructed by the Emergency Personnel of your building.

- Stay away of the flood water by all means.
- Don't try to pass an aqueous stream if the water level is above ankle.

4.7.2 Severe Storms

- Go to the lowest floor of the building as soon as possible.
- Stay away from windows and the walls with large glass area.

4.7.3 Earthquakes

- Stay away from glass, windows, shelves, heavy equipment and walls.
- Drop down onto your hands and knees.
- Cover your head and neck under a sturdy table if available.
- Hold on to your shelter until the shaking stops.
- Be prepared to move with your shelter if the shaking moves it.
- Do not run outside or to other room during shaking.
- Do not stand in a doorway.
- Do not jump out of the building.
- Expect aftershocks.

4.7.4 Volcanoes and Ash Fallout

- Stay indoors and avoid going out.
- Close all ventilation and AC devices to prevent them from delivering gases and dust from outside.
- Place damp towels at thresholds and openings.

4.8 Shelters and Assembly Points

Please consult the Emergency and Disaster Center website to know more about:

- List of KAU assembly points, including FOE (URL: <http://edc.kau.edu.sa/Pages-List-of-Assembly-Points.aspx>) and their locations on KAU map (URL: <http://edc.kau.edu.sa/Pages-KAU-Map-Assembly-Points.aspx>).
- List of main shelters in KAU (URL: <http://edc.kau.edu.sa/Pages-List-of-Main-Shelters-PhaseI.aspx>) and their locations on KAU map (URL: <http://edc.kau.edu.sa/Pages-KAU-Map-Main-Shelters-PhaseI.aspx>).

Chapter 5

Storage and Handling of Hazardous Materials

The use and storage of hazardous materials is regulated by the Protective Requirements of Hazardous Materials published by the General Authority of Civil Defense (<http://www.998.gov.sa/Ar/Safety/Pages/default.aspx>) and the FOE Hazard Communication Plan.

5.1 The FOE Hazard Communication Plan

The FOE Hazard Communication Plan requires containers to be properly labeled and Material Safety Data Sheets (MSDS) to be maintained in an organized collection and available at all times to employees in each work area. It also requires each employee to be trained in the interpretation of MSDSs, the protective measures to be taken, the symptoms of exposure, and other information related to the substances they use. Each person who supervises students or employees exposed to hazardous substances must be familiar with the FOE Hazard Communication Plan and comply with its requirements.

5.1.1 Policy

FOE has established a written hazard communication program to ensure that employees with exposure or potential exposure to hazardous chemicals are provided with appropriate health and safety information. The written hazard communication program applies to all areas where employees are exposed to hazardous chemicals during their work or in a foreseeable emergency.

Supervisors or managers of storage areas where the containers remain sealed are responsible only for maintaining and making available the MSDSs for the hazardous chemicals stored, not removing or defacing the container labels, and for the information and training requirements of this program to the extent necessary to protect employees in the event of a spill or leak.

Laboratories covered under a written chemical hygiene plan need only comply with the requirements for maintaining container labels, the requirements for providing labels and MSDSs when transporting or shipping hazardous chemicals outside the laboratory, and the requirement to maintain material safety data sheets that are received with shipments of hazardous chemicals.

For the purposes of this program, *hazardous chemical* shall mean any chemical that is a physical or health hazard as defined in the standard, including mixtures and gases.

5.1.2 Hazard Determination

The FOE will rely on MSDSs from suppliers to meet hazard determination requirements. It is strongly encouraged, however, that students and employees seek out additional sources of safety and health information rather than rely solely on MSDSs.

5.1.3 Labeling

The need for adequate labeling extends far beyond the immediate requirements of the individual user, since the individual user may not be present in case of fire or explosion when containers are broken or spilled. The individual user may not be around years later when the containers have deteriorated or otherwise lost their value. Therefore, do not use wax pencil markings, abbreviations, formulas only, code names, or numbers. All labeling will be in conformance with the following:

- The immediate supervisor/faculty member for each work area or unit will be responsible for ensuring that all containers received or shipped are properly labeled.
- Labels on incoming containers of hazardous chemicals may not be removed or defaced unless the container is immediately marked with all of the required information.
- The labels on all containers will include:
 - the identity of the hazardous chemical(s); and
 - appropriate hazard warnings or combination of words, pictures, and symbols that provide at least general information regarding the hazards of the chemicals, and which, in conjunction with the other information immediately available to employees under the hazard communication program, will provide employees with the specific information regarding the physical and health hazards. The hazard warnings and information must also be in accordance with the labeling requirements of any substance-specific standards applicable to the chemical.
- Supervisors and faculty members will be responsible for ensuring that all portable containers used in their work areas are labeled with identity and hazard warning unless the chemical is used by the person who made the transfer and is present only during the shift the transfer was made.
- The faculty member supervising students or other employees who transport or ship laboratory preparations outside the laboratory or FOE shall ensure that the container is labeled in accordance with this document.

- Building utility pipes will be labeled with the common name of their contents, for example, natural gas, steam, hot water, etc.

5.1.4 Material Safety Data Sheets (MSDSs)

- Each department will designate where the MSDSs for all hazardous chemicals to which various employees may be exposed will be kept and ensure that they are systematically organized and that each affected employee knows how to access them.
- Department supervisors and faculty will be responsible for properly displaying the required postings for notifying employees of new or revised MSDSs in their areas.
- The faculty member supervising students or other employees who transport or ship laboratory preparations outside the laboratory or FOE shall ensure that a material safety data sheet is prepared and included with the chemical or shipment.

5.1.5 Employee Information and Training

The department chair/director/manager will be responsible for ensuring that initial and refresher training is performed as required in each department. Records of training conducted will be maintained by each department.

Employees who work in an area where there is exposure to hazardous chemicals during use or in foreseeable emergencies will receive hazard communication training at the time of initial assignment and whenever a new physical or health hazard for which they have not been trained is introduced into their work area. Information and training may be designed to cover categories of hazards or specific chemicals. Employees must be informed of:

- the training requirements of the hazard communication standard;
- any operations in their work area where hazardous chemicals are present; and
- the location and availability of this written hazard communication program, including the required hazardous chemical inventory and MSDSs required by this program.

Employee training shall include at least all of the following:

- Methods and observations that may be used to detect the presence or release of a hazardous chemical in the work area (for example: odor, appearance, monitoring devices, etc.).
- The physical and health hazards of the chemicals in the work area.

- 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.
- The details of the hazard communication program developed by FOE, including an explanation of the labeling system and the MSDS, and how employees can obtain and use the appropriate hazard information.

5.1.6 Recordkeeping

Each department shall be responsible for maintaining the most recent training record for each affected employee for the duration of employment. The training record shall include the training topics covered, the instructor's name, date of training and the signature of each employee trained.

MSDSs will be maintained for a minimum of 30 years after the last use of the chemical. Material safety data sheets for chemicals still in use or storage shall be replaced by updated sheets when they become available.

A written or electronic inventory of each hazardous chemical shall be maintained within each department and updated at least annually. The inventory will include the chemical or product name, the amount present, and the work area(s) where it is used.

5.1.7 Non-Routine Tasks

Prior to beginning any non-routine task involving actual or potential exposure to hazardous chemicals, employees will be informed of the hazards present and be given training in appropriate work practices and the use of any personal protective equipment necessary. Required personal protective equipment will be provided to the employee before starting the task. Hand protection will be selected on the basis of MSDS recommendations, the physical environment, and the manufacturer or vendor's chemical resistance and permeation data when it is available. The employee's supervisor, the area supervisor, or Safety and Emergency Committee will be responsible for the selection of personal protective equipment and clothing and for training related to non-routine tasks.

A non-routine task is one that the employee does not normally perform and for which the employee has not previously been trained. An example of a non-routine task would be when a custodian is asked to clean chemical residue from a floor or remove spill debris after a chemical spill in a laboratory. In this example the laboratory supervisor would have primary responsibility for selection of personal protective equipment and training.

5.1.8 Outside Contractors and Vendors

The chair/director/manager of the department responsible for soliciting the services of an outside contractor or vendor shall be responsible for ensuring compliance with the requirements of this section if the contractor's employees may be exposed to chemical hazards while working at FOE.

The outside contractor or vendor shall be informed of the following:

- How MSDSs will be made available for each hazardous chemical their employees may be exposed to while working.
- Any precautionary measures that need to be taken to protect employees under normal operating conditions and in foreseeable emergencies.
- The type of labeling used in the work area.

5.2 Flammable Liquids Outside of Laboratories

Storage of flammable liquids in buildings shall be limited to that required for the operation of office equipment, maintenance, and classroom demonstrations in addition to the following restrictions:

- Containers of Class IA liquids shall not exceed one pint capacity for glass containers, one gallon capacity for metal, or two gallons capacity for safety cans.
- Containers of Class IB liquids shall not exceed one quart capacity for glass containers, one gallon capacity for metal, or two gallons capacity for safety cans.
- Containers of Class IC liquids shall not exceed one gallon capacity for glass containers, one gallon capacity for metal, or two gallons capacity for safety cans.
- Containers of combustible liquids shall not exceed one gallon capacity for glass containers or five gallons capacity for metal containers and safety cans.
- Not more than ten gallons (or 25 gallons in safety cans) of Class I and combustible liquids combined shall be stored in a single fire area outside of a UL-listed or FM-approved storage cabinet or an inside flammable liquids storage area.
- **Definitions:** *Class IA flammable liquid*—a liquid having a flash point below 73 F (22.8 C) and having a boiling point below 100 F (37.7 C). *Class IB flammable liquid*—a liquid having a flash point below 73 F (22.8 C) and having a boiling point at or above 100 F (37.7 C). *Class IC flammable liquid*—a liquid having a flash point at or above 73 F (22.8 C) and below 100 F (37.7 C). *Combustible liquid*—a liquid having a flash point at or above 100 F.

5.3 Compressed Gases

Compressed gas cylinders, either empty or full, shall be used, handled, and stored in accordance with the following:

- Compressed gases cylinders must be stored in a vertical position and may not be stored in hallways, stairwells, receiving areas, or locations where they are subject to damage.
- A chain, bracket, clamp, or other restraining device shall be used at all times to prevent cylinders from falling.
- Acetylene or liquefied gas cylinders shall not be placed on their sides, but shall be stood valve-end up.
- A cylinder, whether empty or full, shall not be used as a roller or as a support.
- A cylinder, whether empty or full, in storage or during shipment, shall have the valve closed and cap connected in place, if a cap is provided in the design, or the valve shall be otherwise protected.
- Cylinders shall be marked with either the chemical or trade name. Marking shall be by stenciling, stamping, or labeling and shall not be tampered with or be readily removable. If the labeling is unclear or defaced, return the cylinder or obtain a new label from the supplier. Unlabeled cylinders shall not be used.
- Empty cylinders shall be marked “empty” or “MT” at time of depletion.
- Cylinders of oxidizers such as oxygen shall be stored at least 20 feet from fuel gas cylinders or a highly combustible material such as, but not limited to, oil, grease, flammable gas or a source of ignition, or be separated from the material by a noncombustible wall, not less than five feet high, having a fire resistance rating of one hour. All cylinders shall be stored away from heat in excess of 125 degrees Fahrenheit.
- Where different gases are stored, they shall be grouped by types. Groupings shall separate the flammable gases from the oxidizing gases.
- Storage shall be set up to ensure “first-in, first-out” usage.
- A cylinder storage area shall be posted with the names of the individual gases stocked, and a warning posted against tampering by an unauthorized employee. An assigned storage area shall be located where a cylinder will not be knocked over or struck by a passing or falling object.
- A storage area for cylinders shall be well ventilated. A cylinder shall not be stored in basements or pits except where appropriate ventilation is furnished to keep the area purged of any accumulation of gases.

- Cylinders shall be transported in an upright position and securely fastened by a restraining device to the truck or handcart. Approved handcarts are to be used when transporting cylinders within a building.
- When transported, the regulator must be removed and the protective cap replaced.
- A cylinder shall not be dropped, dragged, rolled on its side, or struck violently.
- A cylinder shall be lifted only by enclosed platforms when using a crane or hoisting device. Electromagnets, ropes, or slings shall not be used.
- When transporting cylinders in an elevator, other passengers should not be allowed to occupy the elevator.
- Use cylinders in an upright position and secure them firmly with chains or clamps.
- Do not use a cylinder of compressed gas without reducing the pressure through a regulator attached to the cylinder valve.
- Use regulators and pressure gauges only with gas for which they were designed and intended. Do not use adapters or modify connectors to circumvent this rule.
- Make sure the threads on a regulator or union correspond with those on the cylinder valve outlet. Do not force mismatched connections.
- Never use oil or grease on valves or attachments for oxygen cylinders. Avoid handling oxygen cylinders and apparatus with oily hands, gloves, or clothing.
- Open cylinder valves slowly with valve outlet directed away from personnel. Close the main cylinder valve as soon as it is no longer necessary to have it open.
- Gases shall not be mixed within a cylinder except by the supplier.
- A cylinder shall not be placed where it will become a part of the electrical circuit by accidental grounding or where it may be burned by electric welding arc. A cylinder shall not be placed so that hot slag or flame will reach it or it shall be protected by a fire resistant shield. An electrode shall not be tapped against a cylinder to strike an arc.
- A frozen or ice-clogged valve shall be thawed either by warm air or use of warm water and dried before using. Boiling water or a flame shall not be used. Force shall not be applied to a valve or cap to loosen a cylinder frozen in place.
- A cylinder without fixed hand wheels shall have keys, handles, or non-adjustable wrenches on valve stems while in service. A multiple cylinder

installation shall require only one key or handle for each manifold. A hammer shall not be used to open a cylinder valve or loosen a cap.

- A leaking cylinder or a cylinder with a valve stuck open or a valve in need of repair shall be taken outdoors —if it is safe to do so—away from sources of ignition, slowly emptied, tagged with a warning sign, and the manufacturer or distributor notified. Complete removal of the stem from the cylinder valve shall be avoided.
- Nothing shall be placed on top of a cylinder that would damage a safety device or interfere with the quick closing of the valve.
- Return empty cylinders to the vendor as soon as possible.

Chapter 6

Environment Protection

6.1 Waste Disposal

Numerous types of wastes are generated at the University, and their disposal is regulated under a variety of federal, state, and local laws and regulations. The following is a general description of most waste streams and how they are regulated and disposed of. The Safety and Emergency Committee should be contacted for specific information regarding proper waste disposal procedures.

6.1.1 Office Waste

KAU solid waste rules regulate the disposal of solid office waste, which includes such things as paper, cardboard, textiles, etc. These items may be placed in wastebaskets and the large trash receptacles outside each building. Office equipment and machines, furniture, and liquid wastes may not be disposed of in these office waste receptacles.

6.1.2 Sewer Waste

The City of Jeddah municipal waste ordinance regulates the disposal of wastewater from bathrooms and work areas. The intent of the ordinance is to avoid the accumulation or release of toxic or flammable vapors within the system and to prevent damage to the treatment plant or contamination of the environment. Solvents, cleaners, and other substances that are not intended for use in the fixtures connected to the sewerage system may not be disposed of in any drain.

6.1.3 Old Furniture and Equipment

Municipal solid waste rules for scrap metals apply to the disposal of metal furniture and equipment or components. As long as the scrap does not include other regulated substances like mercury, PCBs, or oil, it can be disposed of as per KAU regular procedure by the Inventory Administration. Also contact the Inventory Administration for disposal of wood or plastic furniture, large pieces of wood, equipment, computers and monitors.

6.1.4 Laboratory Waste

Laboratories generate a number of waste streams that include medical waste, hazardous waste, liquid industrial waste, broken glassware, empty containers, chemical spill cleanup debris, and supplies.

Once appropriate waste collection procedures have been implemented, a waste chemical or any hazardous waste may be disposed of by submitting a completed collection request form available from the Educational Services Administration, which will pick up the waste, place it in temporary storage, and then arrange for its disposal.

Broken glass must be collected in a designated broken glass container; labels on empty reagent containers should be defaced prior to disposal in the regular trash.

6.1.6 Non-Laboratory Chemical Waste

Chemical wastes (such as old cleaning products, fuels, solvents, asbestos contaminated materials), and biohazardous wastes (such as blood-contaminated sharps) are regulated in KAU. Educational Services Administration should be contacted for information related to the generation and disposal of these types of wastes.

6.2 Spill Prevention and Control

Highly toxic, flammable, or environmentally hazardous liquids should be stored in unbreakable containers, when possible and glass containers should be placed in secondary containment devices. When these liquids are dispensed, provisions must be made to prevent them from spilling into or entering a sink or floor drain. This can be accomplished by working within a containment device or area, covering the drain opening, etc. All drum quantities of hazardous liquids should be stored in a secondary containment device. An appropriate type and quantity of liquid absorbent material should always be available wherever hazardous liquids are used or stored. Users must be trained in spill cleanup procedures, as well as when and how to request outside assistance. See more in section (4.4).

Chapter 7

Electrical Safety

7.1 Portable Equipment, Tools, and Appliances

All portable devices must be UL- (or equivalent) listed for the intended use. In addition, tools that are not double insulated and appliances with metal housings must be grounded. Electrical cords must be free from damage, unauthorized repairs, and deterioration. Portable tools or devices used in wet or damp locations or near a source of water must be protected by a ground fault circuit interrupting (GFCI) outlet or adapter. The following requirements are to be fulfilled:

- The appliance is placed on a non-combustible surface.
- For cooking appliances, a clearance of at least 18 inches from combustibles is maintained in all directions.
- A clearance of 3 feet from combustibles is maintained around space heaters.
- Appliance and power cord are both UL- (or equivalent) listed for proper use.
- Broilers, portable water heaters (such as coffee makers), percolators, electric heaters, hot plates, and similar heat producing equipment shall be UL- (or equivalent) listed.
- Appliance has a visual (lamped) signal indicating that the power is turned on.
- Coffee makers and hot plates shall be unplugged after use.
- Coffee makers and hot plates shall not be placed in rooms that may be locked and cannot be easily checked by a security officer patrolling the area.
- Existing electrical circuits are capable of handling electrical warming/cooking devices.
- Combustibles shall be kept a minimum of 18 inches from boilers, dryers, Bunsen burners, ovens, portable unit heaters, and gas or oil burner flames, furnaces, hot ducts, mufflers for engines, electric lamps, and irons.

7.2 Fixed and Hardwired Equipment

Non-portable equipment wiring, and connections must meet the requirements of the relevant Saudi electrical codes. A local disconnect capable of being locked out must be provided. All persons performing maintenance and repairs must be qualified and authorized by the FOE to do so and follow all the applicable hazardous energy control methods, such as “Lockout” program.

In addition:

- Plaster surfaces that are broken or incomplete must be repaired so there are no gaps or open spaces at the edge of the box fitting.
- Each outlet box must have a cover, face plate, or fixture canopy.
- Water, oil, chips and excessive dust around electrical equipment and machinery must be removed to prevent deterioration of conductors and equipment.
- A minimum 36-inch clear space shall be provided and maintained around all electrical equipment and electrical panels to permit ready and safe operation and maintenance.
- Grounding of cord-and-plug-connected equipment must be by metal enclosure, grounding conductor, or separate flexible wire or strap.
- All electrical panel boards, boxed, cabinets, and switch enclosures must be covered or isolated to prevent accidental contact with live parts, and to protect electrical switches, relays, and wiring from contamination.
- All cable, conduit, and raceway connections, joints, and fittings must be tight to assure proper grounding. All enclosures and conduits must be free from rust and corrosion.

7.3 Extension Cords

The use of extension cords is restricted to portable equipment intended to be moved from place to place. Items that are capable of being moved, for example a desktop computer, but are part of a fixed workstation are not considered portable. Surge protection devices are not considered to be extension cords when used to protect sensitive electronics.

Extension cords may not be used as an alternative to fixed wiring or to extend the existing electrical supply capacity of a work area. Instead, request that Facilities install additional outlets.

Never combine extension cords end to end and always verify that an extension cord is rated for the maximum capacity of the load to be applied and for the environment in which it is to be used. Do not run an extension cord under carpeting or where it will be damaged or cause a tripping hazard.

All extension cords with multiple outlets should be protected by an internal fuse or circuit breaker. They must be of the grounded type regardless of the intended use.

7.4 Fixtures

- Fixtures on lighting equipment (i.e., lampshades) shall be constructed of non-combustible or flameproof materials.
- Lamp fixtures must not be suspended from electrical connections.
- Fluorescent light fixtures having exposed ballasts or transformers must not be installed in contact with combustible material unless the fixtures are specifically designed for such installation.
- Electrical wiring and fixtures must be of an approved explosion-proof or dust-proof type (as required by regulations or NFPA 70) when installed or used in places where dangerous concentrations of explosive vapors, gases, or dusts may be present.

7.5 Electrical Safety-Related Work Practices

The FOE Safety and Emergency Committee should be contacted to design or review the following aspects of electrical safety:

- General requirements
- Wiring, design and protection
- Wiring methods, components and equipment
- Specific purpose equipment and installations
- Hazardous locations and special systems

Appendix A: Lab Safety Checklist

King Abdulaziz University Faculty of Engineering Laboratory and Workshop Safety Checklist

Department:

Lab/Workshop

Name:

Building No.:

Room No.:

Lab/Workshop Supervisor's Name:

Safety Elements		Y	N	IC	NA	Comments/Recommendations
A.	Safety Management Plans					
1	Documented safety and health plan exist					
2	Documented emergency plan exist					
3	Safety training is provided for employee					
4	Safety instruction session for students is mandatory					
5	Safety statistics and records (accidents, injuries)					
B.	General Lab/Workshop Environment					
1	General ventilation is adequate					
2	Illumination is adequate					
3	Clean floors, walls, doors, windows, etc.					
4	Proper lab/workshop layout					
5	Adequate space for students					
6	Absence of obstacles and undue accumulation of materials and/or waste					
7	AC is efficient and thermal condition is comfortable					
C.	Fire Prevention and Fire Fighting					
1	Flammable materials are stored in suitable containers					
2	Flammable materials are stored away from strong oxidizers					
3	Flammable materials are stored away from hot objects, electrical connections and spark generating equipment					
4	Flammable materials are minimized (less than 10 gallons)					

Safety Elements		Y	N	IC	NA	Comments/Recommendations
5	Flammable materials are used in fume hoods					
6	Warning sign of flammable material is observable					
7	"No Smoking" sign is observable					
8	Fire detectors and alarms exist					
9	Fire detectors and alarms are tested regularly					
10	Fire extinguishers are mounted near doorway					
11	Fire extinguishers are unobstructed and easily accessed					
12	Fire extinguisher fully charged					
13	Fire extinguisher tamper indicator in place					
14	Fire extinguisher inspected (inspection tag)					
15	Storage at least 18 inches (45 cm) below sprinkler head					
D. Emergency Planning and Procedures						
1	"In Case of Emergency" or "Emergency Instructions" visibly posted and current					
2	Laboratory doors are labeled with emergency contact notification names & numbers					
3	Exits and aisles are clear and free of obstructions in case of emergency					
4	Exit signs clearly visible					
5	Width of exit aisles and pathways within laboratory no less than 44 inches (112 cm)					
6	Fire doors not blocked or wedged open					
7	Alternate exit available					
8	Chemical spill kit/cleanup materials provided					
9	Training in spill clean-up procedures provided and documented					
10	Eye wash and emergency showers are provided					
11	First aid materials kept in adequate supply (in a sanitary and usable condition) and made readily available					
E. Chemical Hygiene						
1	Labels are clean and intact on all chemical containers and cabinets					
2	Chemicals are not stored on laboratory benches in excessive quantities					
3	Expired or chemicals not used are disposed of as hazardous waste					
4	Defined area for highly toxic or carcinogens clearly marked					

	Safety Elements	Y	N	IC	NA	Comments/Recommendations
5	Secondary containment is provided for liquid chemicals					
6	All chemical containers are closed, except when actively adding or removing materials from them					
7	Material Safety Data Sheets (MSDS) and laboratory chemical inventory are up-to-date and readily available					
8	Chemicals (liquids) are stored below eye level and not directly on the floor					
9	Large/heavy chemical containers stored on lower shelves					
10	All compressed gas cylinders secured with cap in place, if not in use. Eight tank limit for non-flammable gases & five tank limit for flammable gases.					
11	Stock materials of radioactive materials are secured against unauthorized removal					
12	Specific storage containers provided for chemical waste and radioactive waste					
13	All hazardous chemical waste is arranged to be picked up by safety department					
14	Chemical warning signs are posted when needed (e.g., signs for hazardous chemicals, poisons, carcinogens, flammable, corrosives, explosive, radioactive, oxidizing, irritating, etc.)					
15	Biological waste is appropriately marked with a biohazard symbol					
16	Radioactive waste is properly marked with radiation symbol					
17	All fume hoods unobstructed (i.e. no equipment and bottles in the path of the exhaust)					
18	Fume hood appear to work properly					
F. Electrical Safety						
1	Proper wiring system (three lines)					
2	Flexible cords in good condition					
3	Cover plate in place for outlets and switches					
4	Circuit breaker panels unobstructed					
5	Machine/instrument access panels in place					
6	No exposed electrical conductors					
7	No extension cords are used					
8	Multiplug adapters have overload protection					

Safety Elements		Y	N	IC	NA	Comments/Recommendations
9	Guards/covers used for electrophoresis devices					
G. Machines, Cylinders, Tools, Glassware						
1	All moving parts on machinery are guarded					
2	Overhead equipment are secured					
3	Hand tools are safely used and stored					
4	Compressed gas cylinders are secured with chains					
5	Cylinder carts used for transport					
6	Regulators compatible with gas cylinder					
7	Protective caps in place while cylinders are in storage					
8	Gas cylinders are properly marked as to their contents					
9	Glassware is free from cracks, chips, sharp edges and other defects					
10	Broken glass containers are available and in use					
H. Personal Protective Equipment						
1	Eye and face protection (spectacles, goggles, face shields) is provided when dealing with chemicals, UV, IR, sparks, etc.					
2	Hearing protection (e.g., plugs and muffs) is provided in noisy operations					
3	Hand protection (gloves) is provided when dealing with chemicals, hot objects, sharp objects, etc.					
4	Foot protection is provided when dealing with chemicals or heavy object					
5	Head protection is provided in presence of falling objects					
6	Aprons are provided for protection from chemicals or radiation					
7	Respirators are provided when dealing with hazardous chemicals					
8	Radiation dosimeters are provided for radiation lab employees					
9	All PPE are suitable and according to standards					
I. Labels						
1	No smoking					
2	Eating is not allowed in the lab					
3	Chemical hazards labels					

Safety Elements		Y	N	IC	NA	Comments/Recommendations
4	Radiation hazards labels (ionizing and non-ionizing)					
5	Biohazards labels					
6	Emergency labels					
7	Lab/workshop layout drawing					
8	Safety instructions and warnings					
J.	Others					

Evaluator's Comments:

Appendix B: University Forms Related to SHE

Chemical Disposal Form (Administration of Academic Services):

<http://www.kau.edu.sa/GetFile.aspx?id=199387&fn=اتلاف+الكيمويات+نموذج.docx>

Medical Examination Request (Medical Administration):

<http://www.kau.edu.sa/GetFile.aspx?id=79781&fn=VDWS80.4.F04..doc>

Security and Safety Administration Forms:

http://security-safety.kau.edu.sa/content.aspx?Site_ID=436&lng=AR&cid=47581

Occupational Injury Report (General Organization of Social Insurance):

http://www.gosi.gov.sa/portal/c/document_library/get_file?uuid=24272ad4-f29c-44da-bcc6-7a43e35d5837&groupId=16

Emergency and Disaster Forms (From EDC):

http://edc.kau.edu.sa/Show_Files.aspx?Site_ID=355100&Lng=AR

Appendix C: List of Websites for National and International Standards, and Organizations Related to Safety

I. Local Regulations and Standards:

1. Saudi Law of Labor (Ministry of Labor):

<https://mlsd.gov.sa/sites/default/files/LABOR%20LAW.pdf>

<https://mlsd.gov.sa/ar/policies/%D9%86%D8%B8%D8%A7%D9%85-%D8%A7%D9%84%D8%B9%D9%85%D9%84-0>

2. Saudi Law of Social Insurance (General Organization of Social Insurance):

https://www.gosi.gov.sa/GOSIOnline/Social_Insurance_Law

3. General Directorate of Civil Defense Standards:

<http://www.998.gov.sa/Ar/Safety/Pages/default.aspx>

4. General Authority of Meteorology and Environmental Protection (PME), General Environmental Law:

<https://www.pme.gov.sa/Ar/Environment/Pages/GeneralEnvironmentalRegulations.aspx>

5. Saudi Red Crescent Authority:

<https://www.srca.org.sa/>

II. International Standards:

1. OSHA Laboratory Standards:

<https://www.osha.gov/SLTC/laboratories/standards.html>

2. Other International Laboratory Safety Standards:

http://webstore.ansi.org/laboratory_safety/

3. National Fire Protection Association (NFPA), USA:

<http://www.nfpa.org/codes-and-standards/document-information-pages>

4. BSI Fire Standards:

<http://shop.bsigroup.com/en/Browse-by-Subject/Fire/>

5. Occupational health and safety management systems (BS ISO 45001: 2018):

<https://shop.bsigroup.com/ProductDetail/?pid=00000000030299985>

Appendix D: Important Contact Numbers

SECURITY AND SAFETY OPERATIONS:

Calling from inside KAU:

7777
61000
52999

Calling from external line (or mobile phone):

(012)6401440

EMERGENCY PERSONNEL IN THE FACULTY OF ENGINEERING:

0556616151

EMERGENCY AND DISASTER CENTER (EDC):

(012)6951111

SAUDI GENERAL DIRECTORATE OF CIVIL DEFENSE:

998

SAUDI RED CRESCENT AUTHORITY:

997

ENVIRONMENTAL EMERGENCIES:

988