MacEwan UNIVERSITY
PHYSICAL SCIENCES

Department of Physical Sciences Safety Manual

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Physical Sciences Laboratory Safety Manual

1. Introduction

1.1 Purpose

The Physical Sciences Laboratory Safety Manual provides the minimum safety standards for working in the laboratory. These standards will reduce risk to an acceptable level during laboratory practices. It is the responsibility of each individual working in a laboratory to ensure their safety, that of their colleagues and ultimately, the community. The Department of Physical Sciences in consultation with MacEwan Health, Safety & Environment (HSE), conduct laboratory inspections; complete hazard assessments; provide advice on safe work procedures including the selection, use and maintenance of personal protective equipment (PPE); coordinates the Workplace Hazardous Materials Information System (WHMIS) program and Hazardous Materials Inventory System (H-MIS).

The Laboratory Safety Manual incorporates both general guidelines as well as specific information on safe work practices involving chemicals. This manual is intended to be a guidance document for hazard assessments and safe work procedures to address and mitigate the wide of range of hazards present in the lab.

Supervisors must develop and implement lab specific hazard assessments and safe work procedures that address the hazards associated with the equipment, chemicals and lab techniques. Any deviation from this manual must be to establish safer practices. Everyone should be able to justify that reasonable care and deliberation has been exercised before the implementation of any changes. If you have questions about how to undertake a task or project safely, contact your supervisor or MacEwan HSE (HSE@macewan.ca).

1.2 Disclaimer

Version/document control: this is a living document and the most current version is housed on MacEwan University's Google Drive. The Chair, Department of Physical Sciences, bears overall responsibility for the maintenance and distribution of/shared access to the most current version. Questions of content, and any corrections, should be directed to the Chair.

1.3 Legislation

All laboratory work activities must be in compliance with the Alberta Health, Safety & Environment Act, Regulations and Code (2009). Please contact MacEwan HSE (HSE@macewan.ca) for clarification and/or interpretation of current legislative requirements.

1.4 Acknowledgements

The materials used to develop this manual were provided by a variety of reliable sources. We gratefully acknowledge the contributions of other universities.

1.5 Definitions

"Contractor" means an individual, corporation, or other entity who agrees to furnish materials to, or perform services for, the University for consideration.

"Employee" means an individual who is engaged to work for the University under an employment contract.

"Dry Laboratory" refers to a laboratory where there is no exposure to chemicals and work typically involves electronic and other related equipment. This designation includes spaces where such equipment is stored. 5-004, 6-261, 6-261A, 6-298, 6-298A are all designated dry laboratories.

"Wet Laboratory" refers to a laboratory equipped for work with a variety of chemical substances and where direct ventilation is typically required. This designation includes spaces where chemicals are stored. 5-006, 5-009, 5-011, 5-013, 5-014, 5-016, 5-018, 5-024, 5-024A, 6-142, 6-142A, 6-161, 6-161A are all designated wet laboratories.

"Shared laboratory" refers to a space that is used by more than one Academic Unit.

"Laboratory Personnel" mean individuals who are authorized by a supervisor or manager to work in the laboratory.

"HSE" refers to the division of Health, Safety & Environment at MacEwan University.

"Manager" means an employee who has management responsibility (academic staff, management, or professional staff member).

"Sanctioned chemical demonstration" is a chemical demonstration used in the teaching of a regularly-scheduled chemistry class, or at a University-approved event, e.g. Open House, Engineering Bootcamp, recruitment and outreach activities.

"Supervisor" means an employee who supervises (has control over assigned work and authority over persons conducting the work) other employees or students. Faculty and staff may be a supervisor under certain circumstances, particularly when a student directly reports to the faculty or staff member. For example: a laboratory technician would be a supervisor to the student

laboratory assistant; a faculty member would be a supervisor to a for-credit, for-pay or volunteer research student; a faculty member would be a supervisor to students registered in a laboratory course assigned to that faculty member. The Department Chair has functional supervision over department members and would be a supervisor with respect to this work. Note that the term "Supervisor" is distinct from "Science Lab Supervisor". The latter is a position description found in the Faculty Association Collective Agreement.

"TDG" refers to Transportation of Dangerous Goods.

"University" means MacEwan University.

"Visitor" refers to any individual that does not have authorized and independent access to a laboratory space.

"Volunteer" means an individual who, on a voluntary basis, provides a service or materials to the University.

1.6 Responsibilities

Health, Safety & Environment (HSE) at MacEwan University is responsible for:

- Draft, recommend, and provide direction regarding the development of the university's annual HSE plans.
- Consult with management and HSE Committees regarding health, safety, environment and wellness.
- Liaise with the applicable federal, provincial and municipal regulatory agencies on behalf of the university.
- Has the authority to act on any HSE noncompliance issue, including the authority to stop University activities or take control of University infrastructure, when an immediate or significant health, safety or environmental risk or non-compliance is present.
- Approves the resumption of University affairs once compliance to applicable HSE legislative requirements are met.
- Analyze HSE data and report to the university community and regulatory agencies.
- Coordinate and administer regulated health monitoring and hazard specific programs.
- Coordinate evaluations and report to the HSE Steering Committee on the implementation of the HSE program.
- Lead and/or assist the investigation of serious incidents.
- Retain the authority to enter all university work sites.
- Develop, recommend, and maintain all elements of the HSE program.
- Develop and promote HSE and wellness initiatives.

- Identify HSE training needs, approve training content and lead the development and delivery of common training courses.

Managers and supervisors are responsible for facilitating the protection of the health and safety of the people within their areas of responsibilities by:

- Knowing and understanding the components of the HSE program that apply to their areas of responsibility.
- Communicating and reinforcing this policy and the components of the HSE program that apply to their areas of responsibility.
- Ensuring and monitoring compliance with the components of the HSE program that apply to their areas of responsibility.
- Implementing the components of the HSE program that apply to their areas of responsibility.

Employees, volunteers, students, contractors and visitors are responsible for:

- Knowing and understanding their obligations under the HSE program.
- Complying with the Department of Physical Sciences Laboratory Safety Manual.
- Taking responsible care to protect their own health and safety, and the health and safety of others who may be affected by their acts or omissions.
- Carrying out their work, research or study in accordance with the components of the HSE program that apply to their areas of responsibility.
- Ensuring they have received WHMIS training.
- Reporting workplace hazards.

Faculty and staff acting as supervisors are responsible for:

- Identifying all hazards associated with their project.
- Ensuring safe work procedures and the appropriate emergency procedures.
- Ensuring that all employees (this includes students registered in for-credit courses) know and follow the procedures.
- Correcting unsafe conditions and practices.

2. Health and Safety Hazards

2.1 Hazard inventory

A hazard is any source of potential damage, harm or adverse health effects on something or someone under certain conditions at work. Hazards can be subdivided into health hazards and physical hazards.

A health hazard is any hazard that can cause adverse health effects in the person exposed to the hazard. A health hazard may produce serious and immediate health effects (acute) or delayed health problems (latent) from repeated or chronic exposure. Examples of health hazards include:

- Exposure to hazardous substance (e.g. chemicals)
- Ergonomic hazards (e.g. poor workplace design, tools and work practices, repetitive or sustained motions, lifting and handling, vibration)
- Noise
- Sources of electromagnetic fields
- Workplace stress

Physical hazards are those which can cause immediate injury. Example physical hazards include:

- Slip/trip/fall hazards
- Cut/poke/puncture hazards (e.g. working with needles, tools)
- Flying/ejected objects or materials (e.g. broken glass, vacuum/pressure systems, dust and particles generation)
- Working from heights
- Sources of hazardous energy in systems and/or equipment
- Working with equipment that pose hazards
- Electrical hazards
- Fire and explosion hazards
- Hot/cold hazards when working with materials/equipment (e.g. cryogens)
- Poor housekeeping

A summary of common hazards routinely encountered in laboratory environments are presented below, noting that there may be other hazards that are not included in the list.

Hazard Class	Hazard Type	Hazard Information
Physical hazards of chemicals	Flammable, combustible and explosive solids, liquids and gases	Flammable, combustible and explosive materials can vaporize and form flammable mixtures with air when containers are left open, when leaks occur, or when heated, or become flammable with certain catalysts.
	Oxidizing solids, liquids and gases	An oxidizer in itself may not necessarily be combustible, but may, generally by yielding oxygen, cause or contribute to the combustion of other material.
	Gases under pressure	Compressed gases can be toxic, flammable, oxidizing, corrosive, inert or a combination of hazards. In addition to the chemical hazards, compressed gases may be under a great deal of pressure.
	Self-reactive (unstable) substances	Self-reactive substances are thermally unstable liquids or solids liable to undergo a strongly exothermic thermal decomposition even without participation of oxygen (air).
	Water reactive materials	Water reactive substances are dangerous when wet because they undergo a chemical reaction with water. This reaction may release a gas that is either flammable or presents a toxic health hazard.
	Pyrophorics	A pyrophoric is liable to ignite after coming into contact with air, even in small quantities.
	Asphyxiants	An asphyxiant is a substance that can cause unconsciousness or death by suffocation (asphyxiation) or aspiration. Aspiration is the entry of a liquid or solid directly through the oral or nasal cavity, or indirectly from vomiting, into the trachea and lower respiratory system. Aspiration toxicity includes severe acute effects such as chemical pneumonia, varying degrees of pulmonary injury or death following aspiration.
	Carcinogens	Carcinogen means a chemical substance or a mixture of chemical substances which may induce cancer or increase its incidence.
	Reproductive toxins	Reproductive toxicity includes adverse effects on sexual function and fertility in adult males and females, as well as developmental toxicity in offspring.
	Sensitizers	Working with some chemicals can in increase the risk of developing sensitivities.

Laboratory equipment hazards	Cuts, punctures, scrapes, bruises	The most common laboratory injuries come from contact with sharp equipment or tools (needles, scalpels), slips, trips, falling objects, broken glass, etc.
	Sharps	Sharps-related injury is a penetrating stab wound from a needle, scalpel, or other sharp object that may result in exposure to blood or other infectious body fluids.
	Electrical hazards	Electrical hazards include use of high-voltage equipment, wet environments, malfunctioning or improperly maintained equipment, or improper use of power cables.
	Mechanical hazards	Some equipment has moving parts that may present pinching or crushing hazards, may catch loose clothing, or may vibrate or move while running.
	Burns	Fires, hot plates, extreme cold, and hot equipment are common in labs and may cause burns without proper precautions.
	Flying particles	Flying particles and chemicals may occur frequently and without warning from various lab equipment and operations.
	Vacuum/pressure	Containers placed under high vacuum or pressure can become hazardous (implode or explode) in certain circumstances.
	Noise	Equipment may generate enough noise to cause damage to hearing or prevent communications in an emergency situation. Also, high frequency sound or sustained exposure to noise may cause hearing damage.
	Magnetic fields	Magnetic fields are invisible lines of force associated with the use of high-voltage electric power. Health effects are uncertain, but individuals with pacemakers or metallic implants should take precautions.
Workplace environmental hazards	Ergonomics	Certain tasks in the laboratory may involve heavy lifting or repetitive motions, sustained or awkward positions, that may, over time, lead to musculoskeletal disorders.
	Hot/cold environments	Field work may present hazards from exposure to temperature extremes.

Table 1: summary of common hazards encountered in the laboratory

2.2 Hazard identification techniques

When identifying and assessing hazards in a laboratory environment, it is important to engage the persons involved in the process (e.g. hazard assessments, workplace inspections, etc.). Those individuals exposed to the hazards are well positioned to provide good information and advice as well as protective and preventative measures that will work. Engaging laboratory personnel in the process also supports a collective ownership in health and safety. Workplace hazards may be identified through a number of formal and informal processes summarized below.

Technique	Process
Hazard assessment	A hazard assessment involves examining the work environment, processes, equipment and activities to identify hazards for the purposes of determining appropriate safety control measures. A common form of hazard assessment is a job demands analysis (JDA). In a JDA, work activities are broken down into their functional steps and hazards associated with each step are identified together with appropriate safety control measures. A JDA has been completed for laboratory technicians in the Department of Physical Sciences. When there are changes to activities and/or processes, existing hazard information should be reviewed or a new hazard assessment performed. During the development and implementation of new (or existing) research protocols, health and safety hazards should be considered in the development process.
Faculty, staff, and student engagement	Faculty, staff and students should be required to report identified hazards, safety issues/concerns, and gaps in procedures or processes within the laboratory environment. Routine safety meetings provide faculty and staff an opportunity to talk about safety in their work areas and to raise issues or concerns related to their work environment.
Routine workplace inspections	Routine workplace inspections performed by supervisors, faculty and staff are an effective technique for identifying hazards, safety issues and unsafe behaviours of personnel working in the laboratory environment.

	Formal workplace safety inspections should be conducted on a regular frequency (based on risk), and documented with clear assignments and accountabilities to address the findings of the inspections.
Incident/non-conformance investigations	Faculty, staff and students are required to report incidents, near miss events, and non-conformances in the laboratory work environment. Reported incidents, near misses, and non-conformances serve as an important mechanism to assess workplace conditions, hazards, and practices towards minimizing a recurrence of the incident or non-conformance, and to addressing gaps in health and safety.

Table 2: processes for identification of work place hazards

2.3 MacEwan Hazard Assessment and Control Report

A hazard assessment is used to identify, quantify, and control hazards or risks. This is a proactive approach to safety wherein possible risk exposures are identified to insure a safe work environment. The MacEwan *Hazard Assessment and Control Report* form facilitates the process of hazard assessment, and is found in the *Forms Cabinet* at *MyMacEwan.ca*.

To complete the *Hazard Assessment and Control Report*:

1. Identify health and safety hazards.
2. Analyze the risk associated with each hazard.

Risk analysis is an evaluation of risk factors associated with each identified hazard to determine the degree of risk the hazard poses to employees. Risk analysis helps the supervisor determine the type or number of controls needed to eliminate, reduce, or minimize the risk.

2.4 Hazard control

Once hazards have been identified, hazards should be managed according to a risk priority process. This process should take into account the relative severity of the hazard occurring, as well as the relative probability of the hazard occurring. Highest risk activities must be managed immediately, and other activities should be managed according to the risk they present on a priority basis.

The following priority should be used when deciding on the appropriate preventive and protective measures for each hazard:

1. Eliminate the hazard
2. Substitute with other materials, processes or equipment
3. Use engineering controls
4. Provide administrative controls
5. Behaviour
6. Provide personal protective equipment (PPE)

Whenever possible, the hazard should be managed at the highest level possible on the priority list above. For example, if the hazard cannot be eliminated entirely, then substitution with other materials, processes or equipment should be considered. If substitution is not effective at managing the hazard, then engineering controls should be established if possible, etc. This priority approach to instituting preventive and protective measures should continue until a suitable solution is achieved. In most cases, a combination of measures will be necessary to effectively manage the hazard. When determining preventive and protective measures, all applicable legal and university requirements must be met and any standards, codes or best practices should be used to guide the process.

Hazards in the workplace may be addressed using a combination of methods summarized below, presented in order of effectiveness:

Elimination: The process of removing a hazard from the workplace. This is the preferred method of controlling a risk because the hazard has been removed. An example of elimination could include ceasing or altering how a job is performed or the application of engineering controls, such as automating a hazardous process, or isolating a hazard, to eliminate worker contact with the hazard.

Substitution: The process commonly employed is to substitute a hazardous substance (typically chemicals) with a less hazardous alternative effectively reducing the hazard associated with the initial hazardous substance. An example is substituting organic solvents with water-based equivalents. In considering substitution, it is important to have a good understanding of the hazards of the chemical being considered for substitution. The substituted chemical may have other or unique hazards that may need to be addressed or which may offset the value of using it.

Engineering Controls: Include systems and structures that are built into the design of a facility, equipment or processes to minimize/eliminate the hazard. Engineering controls are a very reliable way to control laboratory personnel exposures as long as the controls are designed, used and maintained properly. The basic types of engineering controls include process control and

automation, enclosure and/or isolation of emission source, guards and shields, and ventilation. Common examples of engineering controls used in a laboratory environment include fumehoods and flammable storage cabinets.

Administrative Controls: Controls that are put into place to direct activities in a workplace. Administrative controls typically take the form of worker training, policies, operational rules, practices, and procedures. Administrative controls may also include lighting, alarms, and warning signs to increase awareness of hazards.

Behavioural: Behavioural Controls are based on changing the way people conduct work (e.g. following safe work and laboratory practices).

Personal Protective Equipment (PPE): Refers to clothing or equipment laboratory personnel can wear to protect against injury from such things as hazardous substances, cuts, heat, flying debris, falling objects, and inhalation. PPE is worn to protect against exposures from workplace hazards when engineering and/or administrative controls are unable or insufficient alone in providing protection from these hazards. PPE is generally considered the least effective hazard control method, as it is the "last line of defence" to protect you from a hazard. As such, the appropriate PPE must be selected and its use enforced when working in the laboratory.

For further information, hazard assessment tools, or assistance, contact MacEwan HSE.

2.5 Insurance risk

The Department of Physical Sciences has research assistants and volunteers working in its laboratories. Approval of the Department Chair is required for all research assistants and volunteers prior to commencement of work. Such approval is necessary to ensure appropriate orientation and training, and risk mitigation. While research assistants and volunteers provide a valued addition to research activities at MacEwan University, they may not be covered under the existing University Insurance Program. The following guidelines currently exist at the institutional-level (and are subject to modification/updating). They should be noted and followed:

1. Generally, research assistants and adjunct faculty should be involved in research in their discipline of study or instruction.
2. The research activity should demonstrate value to MacEwan University.
3. Non-MacEwan volunteers must have their own coverage.
4. Each case must be examined individually.
5. Decisions must be documented with the student's name, name of the research activity, MacEwan researcher's name and the benefit to MacEwan.

- Students registered at MacEwan but not currently enrolled in a research-based for-credit module are covered under MacEwan University General Liability Policy (Sec 6.1 part (f)).
- Students who have completed their degree requirements but are yet to graduate are covered under MacEwan University General Liability Policy (Sec 6.1 part (f)).
- Alumni who have either graduated from MacEwan or transferred to another institution may be covered, as long as the participants are providing a benefit to MacEwan University and not just to themselves. Each case must be scrutinized by the faculty supervisor on an individual basis.
- Community volunteers with no prior history at MacEwan University are not covered and such volunteers (or their representative organizations) are responsible for their own liability coverage. MacEwan should ensure that this is articulated in the agreement arrangements. Risk Management has developed a new form for volunteers on campus; the *Volunteer Registration Form* (see appendix 1) is signed by a volunteer and kept on file until after the volunteer has left.
- Adjunct Faculty working on campus and in MacEwan laboratories are for all practical purposes MacEwan employees/faculty. Although the benefit to MacEwan is almost a given, each case should be considered and documented as part of an application for adjunct status.

3. Training and education

Based on the learning, work, or research activities to be performed, and the work environment, supervisors must assess and determine what training is required for faculty, staff and students they oversee, as well the retraining frequencies.

Comprehensive orientation and safety training is essential for faculty, staff and students, prior to working in the laboratory environment. Supervisors must ensure all faculty, staff and students working in a laboratory receive a site-specific safety orientation. Minimum training and awareness expectations are described in this section.

3.1 Safety Data Sheets (SDS)

Suppliers of hazardous products are also required to provide Safety Data Sheets (SDS) with products. An SDS is a technical document developed by the supplier that provides specific hazard information, safe handling information, and emergency procedures for the controlled product.

The SDS is important for developing safe work procedures and control measures, and a key element of the education and training for laboratory personnel. Before working with any hazardous material, laboratory personnel should read the Safety Data Sheet (SDS) carefully. SDS are available for every hazardous substance under WHMIS. The SDS contains sixteen categories of information. They are: identification; hazard identification; composition/information on ingredients; first aid measures; fire-fighting measures; accidental release measures; handling and storage; exposure controls/personal protection; physical and chemical properties; stability and reactivity; toxicological information; ecological information; disposal considerations; transport information; regulatory information, and; other information.

The SDS may be in paper format or accessible through a computer system. The SDS must be readily available to all employees working with the hazardous product. If the information in an SDS changes then the SDS is required to be updated.

SDS are currently available to laboratory personnel through the MacEwan Hazardous Materials Inventory System (H-MIS). This can be found online at www.macewan.ca/hmis, see section 5.10 *MacEwan Hazardous Materials Information System* for more information.

3.2 Key access to laboratories

The *Department of Physical Sciences Laboratory Access Form* and accompanying instructions must be used for new faculty, staff, or students in order to gain card access to Physical Sciences

laboratory spaces, or to increase previously approved access. The access form is a google form; the link to this form can be obtained by contacting the Department of Physical Sciences Chair. Access cards must be obtained and signed for in person.

3.3 Faculty, staff and research students (for-credit, for-pay, or volunteers) working in laboratories

Supervisors are responsible to complete site-specific health and safety orientation checklists with laboratory personnel to address critical health and safety issues before starting normal job responsibilities using the *Department of Physical Sciences Laboratory User Orientation and Safety Record* (see appendix 2). These include the following:

- Laboratory hazard assessment and control form
- Laboratory safety manual
- Work activities being performed in the laboratory environment
- Hazards in the laboratory (health and physical hazards)
- Operational procedures, processes and rules governing the laboratory and work including protective measures (e.g. techniques, equipment use and care, required PPE, engineering controls, use, storage and disposal of hazardous materials)
- Laboratory safety equipment
- Emergency response
- Emergency instructions
- Emergency communication/notification
- Campus Security
- Laboratory policies
- Reporting of hazards, concerns and incidents
- Hazardous Materials Inventory System (H-MIS)
- Standard operating procedures

The following training may be required based on the work, or research activities to be performed:

- First aid and CPR training (number of trained personnel to be consistent with the hazard level of hazard and total number of laboratory personnel in an area at any time of the day; the Physical Sciences Department Safety Committee will designate laboratory personnel who must undergo training)
- Fire extinguisher training (recommended all faculty and staff in the Department of Physical Sciences; the Physical Sciences Department Safety Committee will designate laboratory personnel who must undergo training)

- Transportation of dangerous goods training (mandatory training for faculty, staff, and students in the Department of Physical Sciences who handle, offer for transport, or transport dangerous goods as defined in the Transportation of Dangerous Goods (TDG) Regulations)
- Spill response training (mandatory for all faculty and staff working in laboratories, and for research students working with hazardous materials)
- Sapphire fire suppression system training (mandatory for all faculty, staff and research students working in the instrument laboratory, 5-013)

Supervisors and Managers are responsible to ensure that new laboratory personnel complete WHMIS and the laboratory safety course provided by HSE. WHMIS, and the laboratory safety course, is mandatory for all laboratory personnel at MacEwan University. A certificate confirming successful completion will be emailed to the attendee and supervisor. A copy will be kept on file.

3.4 WHMIS and laboratory safety course

The Workplace Hazardous Material Information System (WHMIS) is a national hazardous materials classification system intended to provide workplace standards for the control, handling, storage, and disposal of controlled products which can impact the health and safety of the workplace and its employees. Hazardous products are the name given to products, materials, and substances that are regulated by WHMIS legislation. WHMIS contains three major components: Labels, Safety Data Sheets (SDS) and Training.

Under WHMIS regulations, suppliers must provide labels on containers of all controlled products sold or imported for use in the workplace. Supplier labels must include specific hazard information related to the materials.

Workplace labels are required on containers of controlled products produced in laboratories, and on secondary containers where the product has been transferred from the original container. Workplace labels may also be used to replace a damaged or missing supplier label on the original containers. Workplace labels must include:

- Product identifier (product name)
- Safe handling information
- Reference to SDS
- Hazard symbols (optional)

Topics covered in the WHMIS and laboratory safety course include:

- Rights and Responsibilities
- Alberta Health and Safety Act, Regulation and Code

- MacEwan University Occupational Health and Safety Policy
- Hazard Identification, Assessment and Control Procedure
- Laboratory Safety Rules
- Authorized Access
- Movement of Hazardous Materials
- Working Alone
- After Hours Operations
- Unattended Operations
- Laboratory, Equipment and fumehoods
- Formal Workplace Inspections
- Emergency Response Planning
- Incident Reporting and Investigation
- Workers Compensation Board (WCB) Reporting
- Workplace Hazardous Materials Information System (WHMIS)

3.5 Students (taking for-credit courses which involve laboratory work)

Students working in Physical Sciences laboratories are required to demonstrate an understanding of general laboratory safety and familiarity with the Department of Physical Sciences safety rules. Supervisors and Managers are responsible to ensure that all students taking for-credit courses that involve laboratory work complete WHMIS and the laboratory safety course provided by HSE. WHMIS is mandatory for all laboratory personnel. A certificate confirming successful completion will be emailed to the attendee and supervisor. A copy should be kept on file.

As part of the first laboratory session, faculty members are responsible to ensure that students also receive orientation concerning:

- Hazards in the laboratory (health and physical hazards)
- Operational procedures, processes and rules governing the laboratory and work including protective measures (e.g. techniques, equipment use and care, required PPE, engineering controls, use, storage and disposal of hazardous materials)
- Laboratory safety equipment
- Personal protective equipment
- Emergency response
- Emergency instructions
- Emergency communication/notification
- Campus Security
- Laboratory policies

When students take a course which has some unusual hazards associated with the laboratory, special instructions are given. These are written instructions documenting the hazard and safety procedure and are accompanied by a brief explanation by the faculty member.

4. Emergency equipment and procedures

4.1 Emergency Contact

The default contact for all incidents and emergencies is Campus Security (497-5555).

4.2 Notification contact list

The contact information below establishes a primary, secondary, and alternate contact for each of the Department's laboratory spaces. The Department Chair can be contacted at any time and for matters relating to any laboratory space. Telephone numbers that are highlighted indicated contacts that may be used for the indicated space in the event of an emergency outside of normal building hours. A person contacted in an emergency and outside of normal building hours will not be required to attend to the emergency.

Department Chair		Dr. Jonathan Withey	(780)497-4039	(780)913-9373	witheyj@macewan.ca
5-004/5-006	1	Jeffery Witty	(780)633-3819	(780)863-7194	wittyj0@macewan.ca
	2	Terri-Ann Alton	(780)633-3749	(780)965-1736	altont@macewan.ca
	Alt.	Jonathan Withey	(780)497-4039	(780)913-9373	witheyj@macewan.ca
5-009/5-011	1	Terri-Ann Alton	(780)633-3749	(780)965-1736	altont@macewan.ca
	2	Jeffery Witty	(780)633-3819	(780)863-7194	wittyj0@macewan.ca
	Alt.	Jonathan Withey	(780)497-4039	(780)913-9373	witheyj@macewan.ca
5-013 *Shared with Bio	1	Aaron Skelhorne	(780)497-5243	(780)224-8508	skelhornea@macewan.ca
	2	Terri-Ann Alton	(780)633-3749	(780)965-1736	altont@macewan.ca
	Alt.	Jonathan Withey	(780)497-4039	(780)913-9373	witheyj@macewan.ca
5-014/5-016	1	Jeffery Witty	(780)633-3819	(780)863-7194	wittyj0@macewan.ca
	2	Terri-Ann Alton	(780)633-3749	(780)965-1736	altont@macewan.ca
	Alt.	Jonathan Withey	(780)497-4039	(780)913-9373	witheyj@macewan.ca
5-018 *Shared with Bio	1	Jeffery Witty	(780)633-3819	(780)863-7194	wittyj0@macewan.ca
	2	Terri-Ann Alton	(780)633-3749	(780)965-1736	altont@macewan.ca
	Alt.	Jonathan Withey	(780)497-4039	(780)913-9373	witheyj@macewan.ca
5-024	1	Terri-Ann Alton	(780)633-3749	(780)965-1736	altont@macewan.ca
	2	Jeffery Witty	(780)633-3819	(780)863-7194	wittyj0@macewan.ca
	Alt.	Jonathan Withey	(780)497-4039	(780)913-9373	witheyj@macewan.ca
6-142/6-161	1	Terri-Ann Alton	(780)633-3749	(780)965-1736	altont@macewan.ca
	2	Jeffery Witty	(780)633-3819	(780)863-7194	wittyj0@macewan.ca
	Alt.	Jonathan Withey	(780)497-4039	(780)913-9373	witheyj@macewan.ca
6-261/6-298	1	Michelle Hanlon	(780)497-4690	(780)716-3486	hanlonm2@macewan.ca
	2	Terri-Ann Alton	(780)633-3749	(780)965-1736	altont@macewan.ca
	Alt.	Jonathan Withey	(780)497-4039	(780)913-9373	witheyj@macewan.ca

Table 3: laboratory notification contact list

4.3 Incident reports

An incident is any event occurring in the laboratory that involves injury, damage (fire, flood, structural), or release (i.e. chemical spill). Faculty, staff or students involved in an incident while engaged in activities in Physical Sciences laboratories shall adhere to the following incident response and reporting processes. The individuals involved in the incident are responsible to:

- Contact Campus Security (497-5555) for medical assistance and to initiate an *Incident Report Form*.
- Complete the University's digital *Incident Report Form* within 24 hours of the incident (found in the *Forms Cabinet* at *MyMacEwan.ca*)
- Notify their supervisor as soon as possible and, at the least, by submitting the *Incident Report Form* to the supervisor within the stipulated timeline.
- Participate and cooperate with their supervisor and MacEwan HSE representatives in the review of the incident, and the determination and implementation of appropriate corrective and preventative measures to minimize a recurrence.

The individual's supervisor is responsible to discuss the incident with the individual who reported the incident and, where necessary, to determine corrective and preventative measures to minimize a recurrence. MacEwan HSE will follow up on reported incidents, provide advice, and support to ensure that appropriate corrective and preventative actions have been taken.

4.4 Laboratory safety equipment

All laboratories in the Department of Physical Sciences are equipped with safety equipment. Laboratories in the Department of Physical sciences include some or all of the following:

- Building fire safety systems (e.g. fire alarms, smoke alarms, sprinklers, exit signage)
- Fire extinguisher(s)
- First aid kit
- Emergency eyewash and/or shower
- Spill kit
- Personal protective equipment
- Fumehoods and vented cabinets
- Gas monitoring systems (e.g. oxygen sensor)
- Sapphire fire extinguisher system

Refer to the *Emergency Equipment and Supplies Map* (see appendix 3) for the location in each laboratory.

Safety equipment must be maintained on a regular basis to ensure its proper operation. Equipment maintenance schedules and responsibilities are summarized in the two tables below. The responsible person(s) maintain inspection, testing and maintenance records for the relevant safety equipment.

Safety equipment	Frequency of inspection/testing/maintenance	Responsible person(s)
Eyewash and safety showers (flush testing)	Weekly	Laboratory technicians
Fire extinguishers (visual gauge check)	Monthly	Laboratory technicians
Spill Kits	Monthly	Laboratory technicians
First aid kits	Monthly	Laboratory technicians
Chemical Inventory	Annually	Laboratory technicians

Table 4: Department of Physical Sciences safety equipment maintenance schedule

Safety equipment	Frequency of inspection/testing/maintenance	Responsible person(s)
Fire safety systems (detectors, alarms, sprinklers)	Annually	MacEwan Maintenance Department
Fumehoods	Biannually	MacEwan Maintenance Department
Oxygen sensors	Biannually	MacEwan Maintenance Department
Sapphire fire suppression system	Biannually	MacEwan Maintenance Department
Vented cabinets	Annually	MacEwan Maintenance Department
Fire extinguishers	Annually	MacEwan Maintenance Department
Eyewash and safety showers (Inspection)	Annually	MacEwan Maintenance Department

Table 5: MacEwan Facilities Department safety equipment maintenance schedule

Notify MacEwan HSE immediately of any safety equipment that is malfunctioning. All equipment or devices undergoing repair or maintenance must be decontaminated before being released.

4.5 Fire extinguishers

It is the responsibility of the supervisor to ensure that the location of the fire extinguishers are known to all laboratory users. Refer to the *Emergency Equipment and Supplies Map* (see appendix 3) for the extinguisher location in each laboratory.

All fire extinguishers are inspected annually and maintained by Facilities. Laboratory personnel should perform visual checks monthly to ensure fire extinguishers are fully charged. For those fire extinguishers with a readout dial, the indicator arrow on the readout dial must be within the green zone. If the indicator arrow is on either side of the green zone, which indicates a problem, contact Facilities (5500) to have the fire extinguisher replaced. The *Fire Extinguisher Monthly inspection Checklist (see appendix 4)* is to be posted next to each extinguisher.

Any fire extinguisher that has been used, even if not fully discharged, needs to be reported to Facilities (5500).

4.6 Sapphire fire suppression system

A Sapphire fire suppression system is located in laboratory 5-013. The system quickly suppresses fires and protects sensitive equipment by using 3M Novec fire protection fluid for total flooding. It is the responsibility of the supervisor to ensure that all laboratory users have been trained on the use of the Sapphire fire suppression system.

Operation of any marked pull-station in the laboratory area will:

1. Operate the building alarm system, sounding the building alert message over the speakers
2. The laboratory area pre-discharge horn strobes will sound a temporal pattern
3. The 8 second internal time will start to count down to release Sapphire

Detection of smoke on one detector will:

1. Operate the building alarm system, sounding the building alert message over the speakers
2. No Sapphire release
3. No horn strobe operation

Detection of smoke on two detectors will cause:

1. The laboratory area pre-discharge horn strobes to sound a temporal pattern
2. The 8 second internal timer to commence countdown to release Sapphire

After the 8 second delay is complete:

1. The post-discharge horn strobes will sound a steady tone
2. The Sapphire will release into the laboratory

The abort buttons are “dead man switches” and must be pushed and held in to operate. Note:

1. The aborts only function to stop release of Sapphire when it is initiated by two smoke detectors and will not stop a release when activated by a pull station
2. When the abort button is pushed, release of Sapphire will not occur, but if the button is released without the alarm condition being cleared, or the Sapphire manual bypass being turned on, the 8 second counter will resume and Sapphire will release at the completion of this timer
3. When the abort button is pushed the horn strobes will continue to sound the pre-discharge temporal sound. An abort bell will also sound to notify others that the abort button has been activated

4.7 First aid kits

Stocked Type 3 first aid kits are available in all laboratories. Health and Safety regulations require kits in the following laboratories: 5-009, 5-014/5-018, 5-024, 6-142/6-161, 6-261/6-298. First aid kits must be inspected monthly and restocked as required. The *First Aid Kit Monthly Inspection Checklist (see appendix 5)* are to be posted next to each kit. It is the responsibility of the supervisor to ensure that the location of the first aid kit and its contents are known to all laboratory users. Refer to the *Emergency Equipment and Supplies Map* (see appendix 3) for the first aid kit location in each laboratory. A list of area first aiders must be posted next to each first aid kit (see appendix 6: *Area First-aid Designates*). A list of contents is provided below.

- Antiseptic cleansing towellettes, individually packaged (24)
- Sterile adhesive dressings, individually packaged (100)
- 10 centimeters × 10 centimeters sterile gauze pads individually packaged (50)
- 10 centimeters × 10 centimeters sterile compress dressings , with ties, individually packaged (6)
- 15 centimeters × 15 centimeters sterile compress dressings, with ties, individually packaged (6)
- 20 centimeters × 25 centimeters sterile abdominal dressings, individually packaged (4)
- Conform gauze bandages; 75 millimeters wide (6)
- Cotton triangular bandages (12)
- Safety pins; assorted sizes (12)
- Pair of scissors (1)

- Pair of tweezers (1)
- 25 millimeters × 4.5 meters rolls of adhesive tape (2)
- Crepe tension bandages; 75 millimeters wide (4)
- Resuscitation barrier device with a one-way valve (1)
- Pairs of disposable surgical gloves (12)
- Sterile, dry eye dressings, individually packaged (2)
- Tubular finger bandage with applicator (1)
- First aid instruction manual, condensed (1)
- Inventory of kit contents (1)
- Waterproof waste bags (2)

An *Incident Report Form* (found in the *Forms Cabinet* at *MyMacEwan.ca*) must be completed within 24 hours of using the first aid kit due to an injury/illness.

4.8 First aid and medical emergency procedures

Call Campus Security (780-497-5555) for any emergency or incident that requires first aid or other medical attention. This includes incidents such as: cuts, burns (chemical and heat) and fainting.

- Protect the victim from further injury or harm by removing any persistent threat to the victim or by removing the victim to a safe place; however, do not move the victim unnecessarily.
- Notify Campus Security (780-497-5555) of the incident. Always call from a safe location.
- If you have appropriate training and equipment and it is safe to do so, provide first aid until help arrives.
- Complete an *Incident Report Form* (found in the *Forms Cabinet* at *MyMacEwan.ca*) within 24 hours of incident.

4.9 Eyewashes and safety showers

It is the responsibility of the Supervisor to ensure that all persons working in a hazardous environment have been trained in the use, and are familiar with the location and operation, of emergency eyewash stations and safety showers. Refer to the *Emergency Equipment and Supplies Map* (see appendix 3) for the eyewash and safety shower location in each laboratory.

The following steps outline the proper use of emergency eyewash stations:

1. Without delay, make your way to the nearest eyewash station, activate and flush eyes and/or skin for a minimum of 15 minutes.
2. Hold eyelids open with the hands to fully irrigate the entire eye.

3. Seek assistance from any other lab personnel in flushing the eyes.
4. If an assistant is available, have the SDS reviewed for any further first aid requirements for the hazardous material involved. Call Campus Security (5555).
5. Seek medical attention following flushing of the affected area.
6. Once the emergency has subsided, notify the supervisor of the incident.
7. The Supervisor must complete an *Incident Report Form* (found in the *Forms Cabinet* at *MyMacEwan.ca*) within 24 hours of incident.

The following steps outline the proper use of emergency safety shower stations:

1. Without delay, make your way to the nearest safety shower and activate.
2. Flush skin or affected area for a minimum of 15 minutes and remove contaminated clothing.
3. Seek assistance from any other lab personnel in flushing the affected area, or for removal of clothing.
4. If an assistant is available, have the SDS reviewed for any further first aid requirements for the hazardous material involved. Call Campus Security (5555).
5. Seek medical attention following flushing of the affected area.
6. Once the emergency has subsided, notify the supervisor of the incident.
7. The supervisor must complete an *Incident Report Form* (found in the *Forms Cabinet* at *MyMacEwan.ca*) within 24 hours of the incident.

Annual inspections are a key element to ensure the proper function of the eyewash station and shower. The responsibility for performing annual inspections belongs to the facilities maintenance department. The purpose of these checks is to engage the mixing valves, test the consistency of the eyewash nozzle protective covers to properly engage during activation of the unit, verify the availability of the flushing fluid after prolonged activation through the system, and check for proper water temperature and pressure. This will test the functionality of the safety equipment and assist in identifying any problems with the temperature and pressure that would require servicing. Weekly flushes are required to ensure nozzle covers operate properly, check for proper water temperature, and assist in clearing the supply line of sediments caused by still or sitting water that can lead to microbial contamination within the plumbed lines. Equally important is the verification of adequate clearance/access to eliminate barriers, for example temporary storage of other lab equipment, directly in front of the eyewashes and showers and visible signs of equipment damage.

Laboratory Technicians are responsible for flushing the emergency eyewash station and safety showers weekly. Weekly inspection checklists are to be posted next to the station/shower.

Eyewash stations must be tested weekly as per the following information.

1. Activate the eyewash for 30 seconds to one minute.
2. Upon activation, nozzle covers should automatically disengage from the nozzle.
3. The water should begin to flow from both nozzles within 1 second with equal pressure and should be tepid.
4. The eyewash should remain active until the lever is released or the handle is returned to the shut off position.
5. If the unit does not operate as required, notify your supervisor and contact Facilities (5500) for repair.
6. The eyewash station should be unobstructed and easily accessed.
7. The *Emergency Eyewash Station Weekly Inspection Checklist* (see appendix 7) must be filled in with the date of inspection and the initials of the inspector.

Safety showers must be tested weekly as per the following information.

1. Activate the shower for 30 seconds to one minute.
2. The water should begin to flow from the shower head within 1 second and with adequate pressure and should be tepid.
3. If the unit does not operate as required, immediately notify the Supervisor and contact Facilities (5500) for repair.
4. The shower should remain active until the lever is released or the handle is returned to the shut off position.
5. If the unit does not operate as required, notify your supervisor and contact Facilities (5500) for repair.
6. The safety shower should be unobstructed and easily accessed.
7. The *Emergency Shower Station Weekly Inspection Checklist* (see appendix 8) must be filled in with the date of inspection and the initials of the inspector.

4.10 Chemical spills

All areas that use or store hazardous materials must be prepared to respond effectively if a spill or release occurs. Laboratory personnel must follow the proper emergency response plan for spills. It is expected that lab personnel will respond and clean up minor spills appropriately. In the event of a major spill Campus Security (5555) must be notified. Caretaking personnel are not properly trained to clean up laboratory spills and will not be requested to do so. MacEwan HSE can provide advice on the proper clean-up techniques, materials and personal protective equipment, which may be required.

It is the responsibility of the supervisor to ensure that all people working in an area where they may be required to respond to a spill complete spill response training.

A minor spill (that laboratory personnel may clean up appropriately) is one in which all of the following conditions are met:

- The material spilled is known
- You know the properties of the material or have access to the SDS
- Appropriate personnel protective equipment is available & used (i.e., gloves, eye protection, booties)
- You have the necessary materials to clean up the spill
- You are trained to use the spill control kit for this material

A major spill requires that you contact Campus Security (5555) for assistance, and is one in which any of the following conditions apply:

- Someone has been injured
- A volume in excess of one litre has been spilled
- A fire or explosion has, or is likely to occur
- The material spilled is highly toxic
- The spill is in a common area (e.g., hallway) or other area accessible to non-laboratory users
- The spill requires a specialized response
- The material spilled is unknown
- A responder is unsure whether the spill should be considered minor or major

Initial response in the event of a major spill

1. Warn other personnel in the laboratory. If a volatile, flammable, or highly toxic material is spilled, extinguish all flames, depress the gas shut-off valve, turn off spark-generating. equipment and evacuate the laboratory immediately. Follow the instructions below for a major spill.
2. If clothing is contaminated, remove it and use the emergency shower to rinse the affected areas for at least 15 minutes. If contaminants are in your eyes rinse for at least 15 minutes at an eyewash station.
3. Call Campus Security (5555) for assistance and an ambulance if required. Provide the following information:
    - Your name and phone extension
    - Exact location of spill (room number)
    - Name of material spilled
    - Quantity of material spilled
    - Information on injuries to personnel

Spill clean-up procedure (Major & Minor)

1. Obtain the required spill supplies, put on appropriate protective equipment.
2. Use absorbent to dike around the spill and prevent the spill from spreading into floor drains, under equipment or lab benches. Remove other materials from around the spill area to prevent cross contamination and tripping hazards.
3. Work in teams. One person cleans the spill; the other should remain outside of the contaminated area and hand supplies to person cleaning.
4. Contain the spill by pouring a ring of absorbent around it.
5. Using forceps or tongs remove broken glass or sharp objects and place in a container.
6. Pour additional absorbent on the spill. Always pour the neutralizer or absorbent starting at the edges and moving toward the center of the spill site.
7. Using a broom or scraper work the absorbent into the spill sweeping from the outer edge toward the center.
8. Add more absorbent if the spill area appears to be wet or there is still free liquid. Repeat until all liquid is absorbed. Ensure neutralization reaction is complete by checking the pH is between 4-10 using pH paper.
9. Scoop up all absorbed material with brush and dustpan and place in a plastic bag; the absorbed material is still considered potentially hazardous.
10. Wipe the spill area with a damp paper towel and place in a plastic bag.
11. Dispose of all cleanup materials as hazardous waste.
12. Report the spill to your supervisor and complete an *Incident Report Form* (found in the *Forms Cabinet* at *MyMacEwan.ca*) within 24 hours of the incident.

Complete clean up procedure for acids, bases, and solvents can be found in the Spill Treatment Guide available in each spill kit.

Spill kit location and supplies

A spill kit is present in all laboratories and areas that utilize chemical materials. Spill kits are located in an area of the laboratory where they can be easily accessed. All people working in the laboratory must be aware of the location of the spill kit, see *Emergency Equipment and Supply Map (appendix 3)* for exact location in each lab. Chemical spill kits are to be inspected monthly by laboratory technicians to ensure that required supplies are present and in good condition. The *Spill Kit Monthly Inspection Checklist* (see appendix 9) is to be posted next to the kit. Each spill kit should contain the following:

- SPILL-X-A (acids)
- SPILL-X-C (caustics)
- SPILL-X-S (solvent)

- pH paper
- safety glasses/goggles
- Nitrile gloves
- Broom and pan
- Scraper
- Chemical spill waste bags
- Spill kit treatment guide

4.11 Laboratory fires

If you encounter a fire, or a fire-related emergency (e.g., abnormal heating, smoke, burning odor), immediately follow these instructions:

1. All unplanned or uncontrolled fires must be reported to Campus Security (5555), including those that have been extinguished. Do not hesitate to activate the fire alarm if you discover smoke or fire.
2. Alert people in the immediate area of the fire and evacuate the room.
3. Confine the fire by closing doors as you leave the room.
4. Activate a fire alarm by pulling on an alarm box.
5. Notify Campus Security (5555) of the location and size of the fire. Always call from a safe location.
6. Evacuate the building:
    - Go to the nearest exit
    - Do not use the elevators
    - Walk out of the building in an orderly manner
    - Follow instructions from floor wardens
    - Assist others
    - Notify emergency personnel and/or Campus Security (5555) of people not evacuated
    - Do not go to the underground parkade for your car
    - Move away from the building
    - Go to the nearest *Muster Point (see appendix 10)*
    - Notify emergency responders of the location, nature and size of the fire once you are outside.
    - Do not re-enter the building until the *all-clear* is announced

If you have been trained and it is safe to do so, you may attempt to extinguish a fire with a portable fire extinguisher. Attempt to extinguish only small fires and make sure you have a clear escape path. If you have not been trained to use a fire extinguisher you must evacuate the area.

If clothing is on fire:

1. Stop, drop to the floor, and roll to smother flames
2. Smother flames using a fire blanket
3. Drench with water from a safety shower or other source
4. Seek medical attention for all burns and injuries

4.12 Building emergencies (outside the laboratory)

MacEwan University's automated emergency system has a fire alarm and mass notification for information and instructions during emergencies. For a fire emergency there are 2-stages:

Upon activation – the 1st or alert stage – an alarm will sound throughout the building asking building occupants to standby. This stage is used by Facilities and Campus Security staff to investigate the situation.

Any experiments that require the use of fumehoods are to be ceased immediately but safely. Fumehood sashes should be closed. Heat sources, vacuums and water flow within fumehoods, if applicable, are to be turned off. Caps should be placed on all chemical containers.

Prepare to evacuate and continue listening to the instructions provided over the PA system. The 2nd stage alarm means evacuate! Everyone must:

- Go to the nearest exit
- Do not use the elevators
- Walk out of the building in an orderly manner
- Follow instructions from floor wardens
- Assist others
- Notify emergency personnel and/or Campus Security (5555) of people not evacuated
- Not go to the underground parkade
- Move away from the building
- Go to the nearest *Muster Point (see appendix 10)*
- Do not re-enter the building until the *all-clear* is announced

4.13 Laboratory exhaust failure

The abrupt and complete loss of airflow to a laboratory fumehood, exhaust port or chemical cabinet may create significant hazards for laboratory personnel. The purpose of this procedure is to ensure that the hazards associated with exhaust system failure are minimized. For information on volatile organic compounds (VOCs) in laboratories, see appendix 11: *Volatile Organic*

Compounds. It is the responsibility of supervisors to ensure these procedures are followed by all laboratory personnel working in areas containing or adjacent to fumehoods and vented cabinets, and working with instruments requiring exhaust. Exhaust failure is most often indicated by the sounding of an audible airflow alarm attached to the fumehoods.

Laboratory use during failure

Laboratories and areas storing hazardous chemicals may be occupied during exhaust outages provided that no work requiring a fumehood, access to a vented storage cabinets, or use of an instrument requiring venting is conducted. Fumehood sashes are to be lowered and cabinet doors are to remain closed for the duration the outage.

Work requiring fumehoods, access to vented storage cabinets, or use of an instrument requiring venting may resume after 15 minutes of continuous working exhaust.

Fumehoods

Single fumehood: In the event of a single fumehood failure the sash must immediately be lowered. Any experiments that require the use of fumehoods are to be ceased immediately but safely. No further action is required.

Multiple failures: In the event of exhaust fan/multiple fumehood and vented cabinet failure the affected items must immediately be closed: fumehood sashes are to be lowered to their lowest level and cabinet doors are to be closed and latched. Any experiments that require the use of fumehoods are to be ceased immediately but safely. Heat sources, vacuums and water flow within fumehoods, if applicable, are to be turned off. Facilities (5500), and the Supervisor(s) responsible for the affected laboratories are to be notified immediately.

Instruments

The department of Physical Sciences has two instruments that require exhaust ports to operate; the atomic absorption spectrophotometer (AAS) and the inductively coupled plasma spectrophotometer (iCAP). In the event of an exhaust failure work on these instruments must be terminated.

4.14 Laboratory gas leaks

In the event of a gas leak the following procedures should be followed.

Natural gas/compressed cylinder leak

If a gas leak is suspected:

1. Turn off the gas supply, if accessible, using the emergency gas shut-off valves or the valve on the cylinder.
2. Evacuate the lab.
3. Notify building occupants (may involve activating the evacuation alarm).
4. Call for emergency response 911 and campus security (5555).

Cryogen dewar purge

If a dewar purge (sudden evacuation of large volume of gas) is suspected:

1. Evacuate the lab.
2. Notify building occupants (may involve activating the evacuation alarm).
3. Call for emergency response 911 and campus security (5555).

4.15 Utilities shutdown

Work with chemicals must not be performed during water shutdowns. In the event of an accident or chemical spill during a shutdown, there is no water supply available for emergency showers and eyewashes. Laboratory work that does not involve the handling of chemicals, such as setting up apparatus or recording data, is permissible as long as the chance of chemical exposure is minimal.

If the building electrical supply is cut off, the safe continuation of experimental work must be carefully determined. Where necessary, experimental work may need to be shut down in a safe way, and the room evacuated until power is restored. The protocols for fumehood failure should be followed when ventilation is affected.

Unexpected power outages

Most power outages occur on a planned schedule, with notification appropriate to effective planning and mitigation. In the event of an unexpected power outage, where emergency power does not provide sufficient restoration, the following should be addressed:

- Assess the extent of the outage in the area
- Report the outage to Facilities (5500)
- Assist other building occupants to move to safe locations. Loss of power to fumehoods will require protocols for *laboratory exhaust failure (section 4.13)* to be followed
- Evaluate the laboratory for hazards created by a power outage. Secure hazardous materials. Take actions to preserve human safety and health. Take actions to preserve work

- Turn off and/or unplug non-essential electrical equipment, computer equipment and appliances. Keep refrigerators and freezers closed throughout the outage to help keep contents cold

Emergency power

The University maintains generators to provide emergency power on select electrical circuits; these electrical circuits are identified by a red plug. The generators typically engage within approximately 10-20 seconds of a power outage. The following instruments and equipment are on emergency power circuits:

Room 5-013
Nitrogen Generator
Thermo iCAP - ICP
LC-MS
GC-MS

Room 5-013A
NMR

4.16 Laboratory signage

Specific safety signs are used to make people aware of hazards that, despite reasonable control measures still have the potential to cause harm and remind users of the actions required to stay safe. The productions of these laboratory hazard placards, including their content, is the responsibility of HSE. These *Laboratory Hazard Placards*, see appendix 12, are required on every entrance into a laboratory.

The following information is required, as applicable, on each sign:
Biosafety containment level
WHMIS or TDG symbols
Required PPE
Primary Contact: office phone number & after hours phone number
Secondary Contact: office phone number & after hours phone number
Location of SDS and laboratory chemical inventory
Date of revision
Room number

To request a new laboratory hazard sign or to update an existing sign contact HSE@macewan.ca

Laboratory doors must have signs stating weather food and/or beverages are permitted in the laboratory.

The following are the responsibility of the Department of Physical Sciences and are to be posted inside all Physical Sciences laboratories:

- *Emergency procedures poster* (appendix 13); including *emergency equipment and supplies map* (appendix 3) and *muster points* (appendix 10)
- *Laboratory rules poster* (appendix 14), see section 5.3
- *Laboratory notification contact list* (appendix 15), see section 4.2
- Laboratory chemical and hazardous materials inventory
- Safety equipment signage including for fire extinguishers, emergency eyewashes and showers, first aid kits and spill kits
- *Chemical storage cabinet placards* (appendix 16) and cabinet inventory
- Other signage and documents that must be posted, as appropriate.

5. Laboratory rules and procedures

5.1 Laboratory access and security

To ensure appropriate security in laboratories, faculty, staff, students, administrators, and visitors should adhere to the following practices:

- Only authorized individuals are permitted to access laboratory spaces
- Laboratory doors are kept closed whenever unoccupied and wherever possible when occupied
- Assigned laboratory access cards and/or keys are not to be shared with other staff, students, administrators, or visitors except upon approval of the supervisor
- Immediately report to your supervisor and keys@macewan.ca (780-497-4313) if you have lost your access card/keys
- Report unauthorized access, or suspicious individuals or activities to your supervisor
- Immediately report missing hazardous materials and/or equipment to your supervisor

Laboratory personnel wishing to bring minors (those under 16 years of age) into their work areas require special permission from the Department Chair. Ordinarily, children are only permitted in University labs as a part of University-sanctioned tours or visits authorized by a Faculty/Department. In these instances, the tour leader or other knowledgeable personnel must exercise careful, direct supervision at all times.

5.2 Laboratory designation

The Department of Physical Sciences has a number of laboratories with varying levels of potential hazards. The Physical Sciences laboratories are classified as one of two categories by the Department Safety Committee: **wet labs** and **dry labs**. **Wet labs** contain significant chemical and/or biological hazards and as such require more stringent regulations. **Dry labs** pose a much lesser risk of incident from chemical or biological material. Wet laboratories may be temporarily re-designated as dry laboratories for events such as Open House, or for particular laboratory courses or specific laboratory experiments, etc. To be temporarily re-designated as a dry laboratory all chemicals must be removed or reasonably secured to not be easily accessible and the laboratory must be appropriately cleaned. Approval of the Department Chair is required for temporary re-designation.

Wet laboratories:

1. Chemistry laboratories (6-142, 6-161, 5-009, 5-014) and associated prep rooms (6-142A, 6-161A, 5-011, 5-016)
2. Earth and planetary sciences laboratory (5-024) and associated prep room (5-024A)

3. Research laboratory (5-018)
4. Instrument laboratory (5-013)
5. Solvent room (5-006)

Dry laboratories:

1. Physics laboratories (6-261, 6-298) and associated prep rooms (6-261A and 6-298A)
2. Storage room (5-004)

Users of shared laboratory spaces (5-013 and 5-018) are expected to adhere to all safety rules and protocols associated with use of the shared laboratory space.

5.3 Laboratory safety rules: general

Basic laboratory safety rules are established to safeguard the health of the University community, and are a minimum requirement for persons working in Physical Sciences laboratories (including shared laboratories) at MacEwan University. Specific laboratory safety requirements not covered in this manual must be outlined in departmental standard operating procedures (SOPs).

A *Laboratory Rules Poster* (see appendix 14) is to be posted in every Physical Sciences laboratory and can be obtained from the Department Chair. An explanation of the rules is provided below. These rules must be covered by all laboratory personnel prior to commencing work. Refer to the laboratory's hazard assessment and/or standard operating procedures to see what has been determined as the appropriate personal protective equipment for the task.

- **Be aware of the location of the first aid kit, spill kit, fire extinguisher, nearest alarm pull stations, fire exit, and other emergency response equipment.**

  Laboratories in the Department of Physical sciences include some or all of the following:

  - Building fire safety systems (e.g. fire alarms, smoke alarms, sprinklers, exit signage)
  - Fire extinguisher(s)
  - Sapphire fire suppression system
  - First aid kit
  - Emergency eyewash and/or shower
  - Spill kit
  - Personal protective equipment
  - Fumehoods and vented cabinets
  - Gas monitoring systems (e.g. oxygen sensor)

- **Do not eat or drink in the lab. No water bottles! Do not bring or store food, drinks, and related eating utensils in a laboratory.**

  The separation of food and drink from locations containing hazardous materials and potentially contaminated items minimizes the risk of accidental ingestion. Laboratory refrigerators and freezers are not to be used to store food or beverages. The use of laboratory microwave ovens for the heating of food is prohibited. The tap water and deionized water in laboratories is not safe for drinking.

- **Wear appropriate personal clothing for the laboratory to protect exposed skin. Wear shoes that provide full coverage of the feet. Tie back long hair.**

  Shorts, skirts, and dresses do not provide adequate protection and are not to be worn in the laboratory. Proper footwear has closed feet and heels and is preferably semi permeable. Flip flops, open weave shoes, sandals, etc. are not appropriate footwear.

- **Wear appropriate eye protection in the laboratory. If you wear contacts in the laboratory, you are prohibited from removing, adjusting or inserting them.**

  Wear appropriate eye protection, such as safety glasses, goggles, face shields, etc., based on the hazards.

- **Wear a laboratory coat, safety glasses and other personal protective equipment (gloves, face shield, etc.) as appropriate when in the laboratory.**

  Splashing hazardous materials onto exposed skin is a commonly encountered occurrence. The risk of exposure may also arise from spilled or splashed materials that co-workers handle. A buttoned up laboratory coat, provides the minimal protection required for handling hazardous materials. Prescription eyewear, unless CSA approved safety eyewear, is not suitable and must be accompanied by safety glasses or goggles. Gloves, appropriate to the hazard, must be available and worn when working with hazardous materials. Refer to the laboratory's hazard assessment and/or standard operating procedures to see what has been determined as the appropriate personal protective equipment for the task.

- **Perform procedures that involve the liberation of volatile, flammable, strong smelling or toxic materials in a fumehood.**

  Do not expose yourself or your colleagues to hazardous materials - use the provided fumehoods to control the hazard. Engineering controls, which put a barrier between you and the hazard, are the preferred control and provide the best protection.

- **Only allow authorized individuals in the laboratory.**

  Authorized means having business in the laboratory with the permission of the Supervisor. Authorized persons must be provided the same kind of protection from hazards as persons working in the laboratory, and be made aware of the hazards in the laboratory. Authorized persons must adhere to established rules and requirements.

- **Wash hands after removing gloves, and before leaving the laboratory.**

  Before leaving the laboratory, make sure to wash your hands to minimize the risk of carrying hazards out of your work area into areas that should be clean and uncontaminated. The wearing of gloves will not guarantee that your hands are not contaminated. Make certain that soap and towels are available in your work area.

- **Remove gloves before leaving the laboratory or before using non-hazardous equipment such as computers or instruments inside the laboratory.**

  Gloves should not be worn when working with any equipment or material where one can reasonably anticipate that a subsequent user will not be wearing gloves.

- **Keep laboratory doors closed at all times. when the laboratory is unoccupied.**

  Wherever possible, laboratory doors should be kept closed to prevent unauthorized individuals from entering the lab. when the laboratory is occupied. Ensure doors are closed and locked when the laboratory is unoccupied.

- **Identify all containers, chemical storage areas, and waste appropriately.**

  All chemicals must be labelled with either a WHMIS supplier or workplace label as appropriate. Chemical storage areas must be labelled to identify the WHMIS hazard class of the materials stored within. Waste bottles must be identified with the contents.

- **Dispose of waste frequently and in accordance with instructions.**

  Hazardous waste presents the same hazards and risk as its constituents. Frequent disposal will minimize accumulation of hazardous waste materials in work areas reducing potential risk to laboratory occupants and facilities.

5.4 Personal protective equipment

Personal Protective Equipment (PPE) is used, as the last line of defence, in laboratory environments to provide a protective barrier between the individual and hazards present. It is very important to clearly assess and establish what the PPE requirements are for the task, in consideration of other protective measures that may be available. Where practicable, hazards should be mitigated using other controls (elimination, engineering and/or, administrative) to minimize the need for PPE. Faculty, staff, students, and visitors entering laboratory spaces where hazardous materials are present must wear the appropriate personal protective equipment (PPE).

It is the responsibility of the supervisor to ensure appropriate personal protective equipment is used. On occasion it may be required to use items such as, but not limited to; gloves, particulate mask, respirator, noise protection, chemical resistant apron etc.

Dry laboratories: No pre-determined level of personal protective equipment is mandated for laboratories designated as dry. Individual experiments and activities will, at times, dictate a minimum level of personal protective equipment In these cases the hazard assessment should be consulted.

Wet laboratories: The minimum acceptable level of personal protective equipment in wet laboratories includes safety glasses or goggles, lab coat and proper footwear. Footwear must have foot coverage (no open toes or heels) and be made from sturdy material such as leather. Long hair and loose clothing and/or jewellery must be retained.

5.5 Housekeeping

Clutter in the laboratory is detrimental to efficient work and a serious safety hazard. Always keep areas clean and tidy, and free of unnecessary chemicals and apparatus. Make clean up a part of your normal work routine. Some ways to keep the lab tidy and orderly include:

- Store equipment not in active use in a designated area, away from the work area.
- Clean equipment and glassware as soon as possible.
- Return chemicals to storage after use.
- Clean work surfaces regularly to prevent accumulation of dust and spilled chemicals.
- Keep all exits, aisles and walkways in the lab clean and unobstructed to allow safe movement throughout the lab.
- Do not allow electrical cords or tubing for gas or water flow to trail across aisles or out of fumehoods. Also, do not hang cords and gas tubing from the ceiling.
- Clean up all spills immediately.
- Do not block access to emergency equipment and utility controls.

- Do not store boxes, excess equipment and personal belongings in the lab.

5.6 Safe working procedures and equipment

Laboratory users are required to:

- Perform all processes involving volatile, toxic or flammable materials, including solvents, in a fumehood.
- Use covers or lids on processes to contain hazardous materials.
- Vent any apparatus that may discharge chemical vapours.
- Never take short cuts when handling, using, storing or disposing of hazardous substances.
- Consult qualified personnel before handling an unlabelled or damaged container.
- Comply with all procedures developed for the specific laboratory or laboratory activity, as well as all other University policies, procedures and standards.
- Use required safety and personal protective equipment.
- Order minimum quantities of controlled products.
- Always substitute for a less hazardous material where possible.
- Inform co-workers of plans to carry out hazardous work before beginning the work.
- Ensure protective measures to protect the lab worker, lab partners and any persons working nearby are in place.

5.7 General rules for fumehood use

Fumehoods are a ventilated enclosure designed to capture and contain hazardous vapours, gases and fumes and exhaust them from the building. Fumehoods represent an engineering control designed to protect the worker.

- All work involving hazardous or odorous materials should be done in operating fumehoods.
- Chemicals are not to be stored in Fumehoods.
- Keep all chemicals and equipment 15 centimeters (6 inches) behind the sash during experiments.
- Do not raise sash above operating height. (typically 12 or 18 inches)
- Keep the sash clean and clear.
- Ensure that equipment is stable.
- Keep the sash completely lowered any time no "hands-on" part of an experiment is in progress.
- Close the sash completely whenever the hood is unattended.
- All electrical devices should be connected outside of the hood to avoid sparks which may ignite a flammable or explosive chemical.
- The fumehood is not a substitute for personal protective equipment. Wear gloves, lab coats, goggles, etc. as appropriate. Do not put your head inside the fumehood at any time.

- Clean all chemical residues from the hood chamber after each use.

5.8 Laboratory inspections

Conducting regular inspections of the laboratory is a proactive method to monitor work activities and behaviours and to identify health, safety or environmental hazards. Inspections may be conducted by faculty, staff and students familiar with the laboratory and the activities of the laboratory. All laboratories in use in the Department of Physical Sciences must be regularly inspected as follows:

Daily: all employees or students having a work area in a laboratory must inspect their work area each day they are in the laboratory to identify and correct hazardous conditions or report them to their supervisor.

Monthly Self inspection: Each laboratory technician or laboratory supervisor must conduct an inspection on their assigned laboratories to identify hazardous conditions, using the laboratory inspection checklist; see *Laboratory Inspection Checklist* (appendix 17). A record of completed inspection checklists will be maintained in the Department.

Departmental inspection: Every three months a member of the departmental safety committee will conduct an inspection to identify hazardous conditions, using the laboratory inspection checklist; see *Laboratory Inspection Checklist* (appendix 17). A record of completed inspection checklists will be maintained in the Department.

Special inspections: The designated laboratory personnel must conduct an inspection to identify hazardous conditions arising from change in laboratory operations or facilities, introduction of new hazardous equipment or materials, after a near-miss or other incident, or re-start of laboratory operations after short-term shut down. Special inspections may also be conducted by MacEwan HSE.

Annual inspection: Once per year a member of the departmental safety committee will audit the safety records of the department using the laboratory administration checklist; see Laboratory Administration Checklist (appendix 18). A record of completed inspection checklists will be maintained in the Department. MacEwan HSE must conduct an annual inspection of each laboratory. The report of HSE will be provided to the designated laboratory personnel, the Department Chair, and the MacEwan HSE Steering Committee.

Inspection follow-up: The designated laboratory personnel must ensure that all corrective action noted in an inspection report are completed as soon as reasonably possible. In the case of corrective action noted in a monthly or departmental inspection, the laboratory personnel is

required to record the measures taken to correct the deficiency and the date of the action. In the case of a deficiency noted by an inspection report prepared by MacEwan HSE, the laboratory supervisor must report the corrective action taken to HSE within thirty days of the date of the inspection report or within such other date as HSE may designate.

5.9 Standard Operating Procedures

Laboratories require Standard Operating Procedures (SOPs) as determined by the hazard assessments for processes performed in their area. SOPs are developed to ensure that where processes, techniques or equipment are performed or used there are clear written instructions to follow that identify the potential hazards, the controls that mitigate the hazards and the correct steps to follow to complete the task safely. SOPs are used to train new staff, as a reference when a task is to be performed, and as documentation of the correct procedure.

Supervisors will:

1. Identify when an SOP is required for a task.
2. Develop or oversee the development of SOPs as required for the task.
3. Maintain records of SOPs.
4. Ensure that when an SOP is in place that all new and current staff is aware of the SOP and follow the instruction in the SOP.

Laboratory personnel will:

1. Follow SOPs developed for their work.
2. Assist as required in the development of SOPs.
3. Bring to the attention of their supervisor any task that may require an SOP and ideas to improve or correct any existing SOPs

MacEwan HSE may:

1. Assist in the identification of processes requiring an SOP.
2. Assist when requested by reviewing SOPs.

Process

A hazard assessment of the specific task must first be performed to identify hazards and assess risk. A *Standard Operating Procedure Template* (see appendix 19) has been developed to assist in writing and formatting a proper SOP. Bullets beneath each heading recommend the information that should be included. Not all headings or information may apply so writers of SOPs may adapt

the template as required. Completed SOPs are communicated to those persons performing the task.

5.10 MacEwan Hazardous Material Inventory System (H-MIS)

Maintaining a current inventory is essential, as it allows technicians and faculty to ensure they have an adequate supply of all chemicals required for a course or research project. MacEwan University is required to have an accurate record for HSE purposes, including situations that may require emergency services.

By using the MacEwan Hazardous Material Inventory System, anyone can track the lifecycle and location of all chemicals in the Department and institution as a whole. The H-MIS system is located at www.macewan.ca/hmis. Instructions for its use can be found in *appendix 20: Accessing H-MIS - employee instructions*.

Each chemical has a unique ID number and a barcode label on its container. In addition, all chemicals have an assigned location/room in the H-MIS system. It is therefore imperative that moving chemicals and equipment between lab spaces is minimized. Where it is necessary, it should be only in accordance with the protocols outlined below.

The H-MIS system allows users to search for a chemical and determine its location. To ensure that the H-MIS system remains current and up-to-date, there are some general procedures that must be followed when chemicals are acquired, transferred or consumed.

Adding a chemical

When you purchase a new chemical for teaching or research purposes, the technician responsible for your area must be notified when the chemical arrives. The chemical will need to be submitted to the technician for proper processing. Please provide the technician with the room number, cabinet number, and shelf number where it will be stored, along with the course number or researchers name (as appropriate). The chemical's information and a SDS for the chemical will be entered into the H-MIS. The chemical will receive a barcode, and you will be notified when processing is complete.

Disposing of a chemical

If a chemical has been consumed, please remove the barcode from the empty container and place the barcode in the lab notebook next to the computer in one of the following rooms: 6-142B, 5-011, 5-016. The technician responsible for this area will dispose of the chemical in the H-MIS.

Transferring a chemical (for immediate use)

If you require a chemical that is not in the area you will be using it, the chemical can be removed from its H-MIS location, immediately used and returned to its appropriate location.

5.11 Natural gas supply

Emergency gas shut-off valves are located in every lab serviced with natural gas. When not in use, the gas supply should be shut off by depressing these valves.

Procedure for use of the natural gas supply

For a regularly scheduled laboratory course, where multiple instructors are involved:

1. The key to the shut-off valve(s) will be placed in a secure location in the instructor's bench in advance of the first laboratory period where natural gas is required.
2. At the beginning of the laboratory section, the instructor will verify all bench and fumehood spigots in the laboratory are closed, and will then turn on the natural gas supply by following the requirements outlined in **table 6**. The gas shut-off valve key will be returned to its original location in the instructor's bench.
3. At the end of each laboratory session, the instructor will verify all bench and fumehood spigots are closed, and will turn off the natural gas supply by depressing *all* shut-off valves appropriate to the particular laboratory.
4. Campus Security will be notified, in advance, of the schedule of laboratory activities requiring natural gas. Following the conclusion of each day's laboratories, it is recommended that Campus Security verify that all shut-off valves appropriate to the particular laboratory have been depressed.
5. Any irregularities noted by laboratory personnel, or by Campus Security, should be reported to the department chair (e.g. missing key, spigots left open, gas shut-off valves not depressed, etc.).

At the end of the scheduled laboratory course, the technician responsible for the particular laboratory will verify that all spigots and shut-off valves appropriate to the particular laboratory have been depressed. The technician will retrieve the shut-off valve key and place back in safe storage in room 5-138Q (office of chemistry technicians).

For a regularly scheduled laboratory course where a single instructor is involved (e.g. CHEM 211), or for ad hoc use of the gas supply:

1. The user will sign-out the key to the shut-off valve(s) from 5-138Q.

2. The user will verify all bench and fumehood spigots in the laboratory are closed, and will then turn on the natural gas supply by following the requirements outlined in **table 6**.
3. At the end of the required period of usage, the user will verify all bench and fumehood spigots are closed, and will then turn off the natural gas supply by depressing *all* shut-off valves appropriate to the particular laboratory.
4. The key will be returned to 5-138Q and the technician responsible for the particular laboratory will verify that all shut-off valves appropriate to the particular laboratory have been depressed. Any irregularities noted by the technician, should be reported to the department chair (e.g. spigot(s) left open, gas shut-off valves not depressed, etc.).

Individual users of the natural gas supply accept all responsibility for the gas supply in the appropriate laboratory. The gas supply must be turned off when the user leaves the laboratory for any reason.

Turning on the natural gas supply in each laboratory space

Table 6 indicates requirements for activating the natural gas supply in each laboratory. Note that there is variation in the number and location of gas shut-off valves and in the mode of operation of the natural gas supply (see **figures 1-4**). The natural gas supply is activated only when *all* shut-off valves are released. All laboratories contain a manual gas shut-off lever. This is typically left in the "open" position.

Location	Requirement for turning on the natural gas supply
5-009	The one gas shut-off valve in each of 5-009 and 5-011 must be unlocked with a key and released.
5-014	All three gas shut-off valves in 5-014 must be unlocked with a key and released.
5-016	The one gas shut-off valve in each of 5-016 and 5-018 must be unlocked with a key and released
5-018	The one gas shut-off valve in each of 5-016 and 5-018 must be unlocked with a key and released.
5-024	The two gas shut-off valves in 5-024 must be unlocked with a key and released.
6-142	The one gas shut-off valve in 6-142 must be unlocked with a key and released. The green power-on button must be subsequently depressed. A red light will come on to indicate the gas supply is active.
6-142A	The one gas shut-off valve in 6-142 must be unlocked with a key and released. The green power-on button must be subsequently depressed. A red light will come on to indicate the gas supply is active.
6-161	The one gas shut-off valve in 6-161 must be unlocked with a key and released. The green power-on button must be subsequently depressed. A red light will come on to indicate the gas supply is active.

Table 6: requirements for activating the natural gas supply in each laboratory

Turning off the natural gas supply in each laboratory space

To turn off the natural gas supply in any of the above locations, only *one* of the gas shut-off valves need to be depressed. This allows the supply to be easily stopped in the case of a gas leak or other emergency. For routine use of the gas supply, *all* shut-off valves controlling the supply to the particular laboratory must be depressed when the gas supply is not in use.

Natural gas leak

Laboratory users should be aware of whether or not the laboratory and building are supplied with natural gas, and if so where shut-off valves are located for the laboratory (see **figures 1-4**) so that it can be turned off in the event of a leak. If a natural gas leak is suspected:

1. Turn off the gas supply, if accessible.
2. Evacuate the lab.
3. Notify building occupants (may involve activating the evacuation alarm).
4. Call for emergency response (5555).

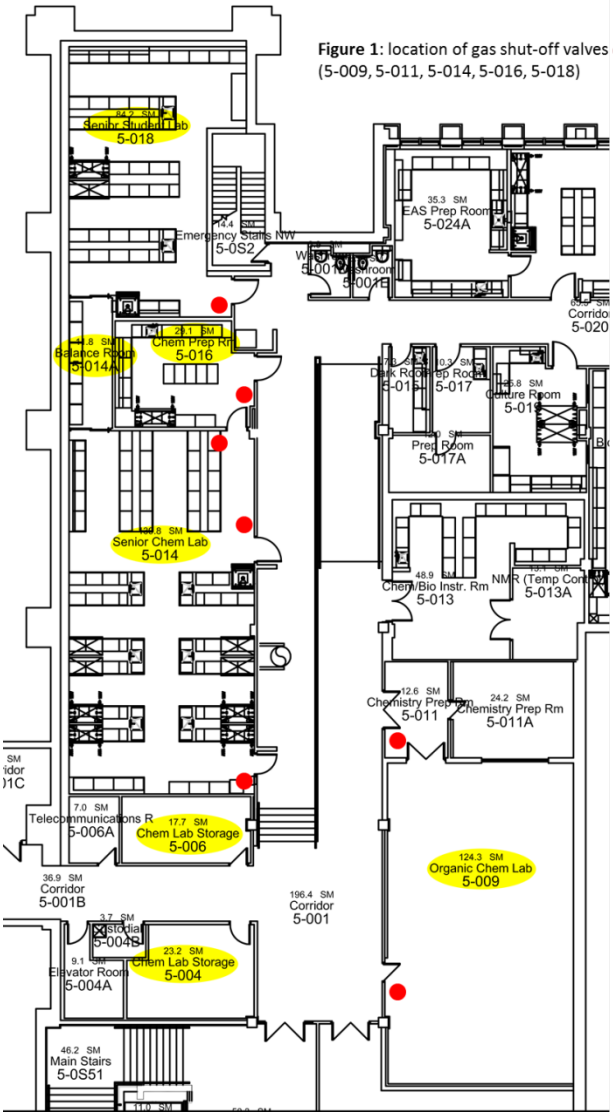


Figure 1: location of gas shut-off valves ● (5-009, 5-011, 5-014, 5-016, 5-018)

Figure 2: location of gas shut-off valves ● (5-024)

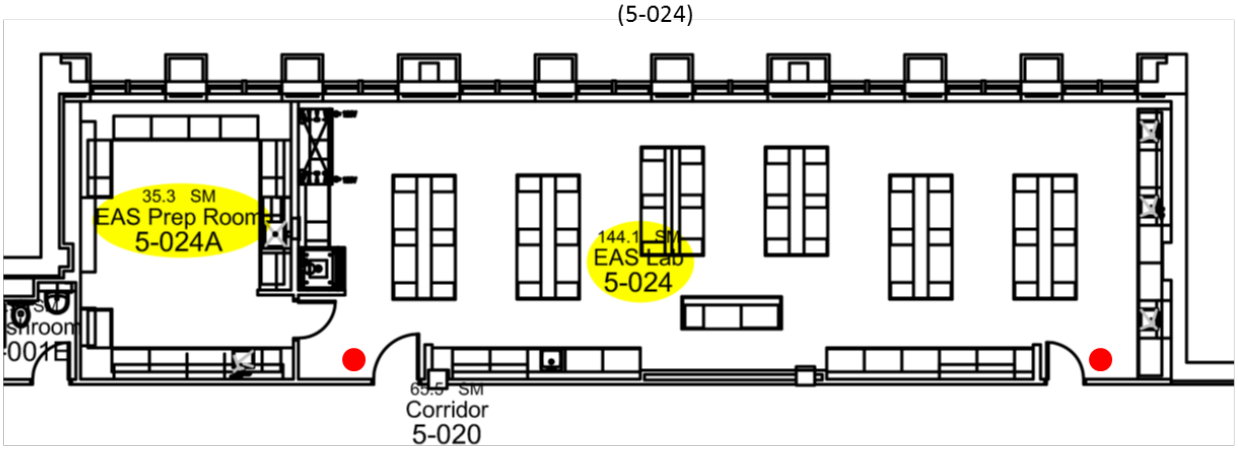


Figure 3: location of gas shut-off valves ● (6-142, 6-161)

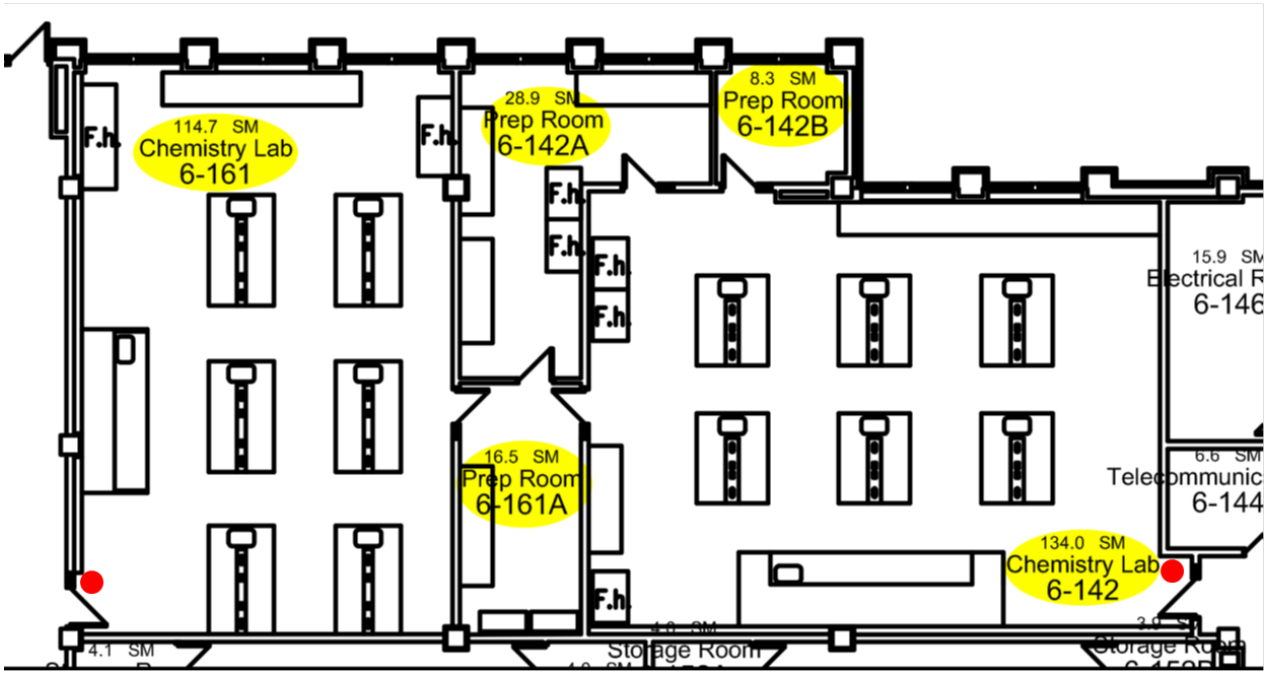


Figure 4: gas shut-off valve and manual gas shut-off detail

1. Gas shut-off valve (6-142 and 6-161)
2. Gas shut-off and manual gas shut-off (6-142)
3. Gas shut-off valve (5-009, 5-011, 5-016, 5-018, 5-024)
4. Gas shut-off and manual gas shut-off (5-014)

5.12 Working alone/after hours

If an accident, injury or illness should occur while you are alone it may be more difficult for you to get help. Extra vigilance is required in order to ensure personal safety after-hours, or when working alone. Working alone/after hours guidelines have been developed by the University to promote worker awareness and to facilitate worker safety when working alone (see D1440).

Definitions

After Hours: Hours outside of official university hours. Official university hours are 8:30am-4:30pm.

Working Alone: Refers to situations where a worker is working by himself/herself and assistance is not readily available to the worker if there is an emergency or the worker is injured or ill.

Laboratory personnel may use laboratory facilities for work only after the Supervisor has reviewed experimental procedures and any associated hazards, and has determined that the worker possesses adequate training in proper experimental and emergency procedures. Workers are responsible for performing their work in accordance with those procedures, and must report all accidents, chemical spills, and unsafe conditions to the supervising faculty or staff member. Laboratory personnel who are conducting laboratory procedures during regular building hours are encouraged to work with a qualified person nearby. Certain laboratory operations may require that another person be present regardless of the time of day. The supervisor will determine what operations require these or other special precautions and inform laboratory personnel.

Before planning any after-hours work, laboratory personnel must have completed all mandatory training, and ensure they have read all relevant SOP's related to work activities, including, and that they have received adequate training in the techniques to be used. Workers must have written permission from their supervisor prior to working after regular hours in a laboratory. See the *Working Alone Authorization form* (appendix 21). The permission form must be completed and filed in the Department of Physical Sciences, and laboratory personnel are required to have a copy of the form when working alone in the laboratory. Campus Security will require an individual to leave the laboratory outside of regular hours if the individual does not have a completed *Working Alone Authorization form* in the laboratory.

All rules of laboratory safety, standard operating procedures, and protocols are in effect as they would be during normal working hours. Laboratory personnel should be able to complete the planned activity without supervision or assistance. New procedures, for which training has not been provided, should not be undertaken. Supervisors should be made aware of any medical

conditions or disabilities which might restrict ability to work alone safely, before permission is granted.

Check-in, check-out procedure

When working alone in any laboratory outside of regular hours, a regular check-in routine with Campus Security must be established. If circumstances warrant, a check-in routine may be required during regular hours as well (e.g., if working in an isolated part of a building).

Campus Security should be informed which room(s) work will take place in, along with anticipated finish time and contact information. Faculty, staff, and students must check-out with Campus Security upon leaving.

Contingency plan and reporting

In the event of malfunction, equipment may be shut-off and a note left for the laboratory supervisor or technician in charge, as long as no further damage can occur to the equipment.

If it is a serious occurrence, which may jeopardize someone else's work or may further damage equipment, the technician responsible for this equipment, the Instrument Manager, or the supervisor must be contacted by telephone. By requesting permission to work alone, faculty, staff and students are responsible for ensuring that problems which they are unable to handle are reported to the appropriate person(s).

In case of personal injury, first aid should be administered as required and the incident reported by telephone or email to the supervisor within 24-hours. The incident must be reported to Campus Security and an *Incident Report Form (*found in the *Forms Cabinet* at *MyMacEwan.ca)* must be completed.

5.13 Unattended operations

Unattended operations pose a safety hazard if a problem occurs, especially outside of normal working hours. An *Unattended Operations Information Sign* (see appendix 22) must be posted, at eye level, on or near the apparatus in the laboratory where any equipment, experiment, process or operation is left unattended and could pose a potential risk to health, safety or security of personnel or property. The *Unattended Operations Information Sign* must include a description of the operation, the chemicals being used, and the name and phone number of a contact person. The sign should indicate when the operation was started, and when it is expected to be completed, and include emergency shutdown procedures. Like working after hours, all unattended operations require prior approval of the Supervisor.

All experiments and equipment that run unattended, such as overnight, must be designed and constructed in such a way as to minimize potential for injury and damage to property due to malfunctions, user error, or failures. Autosamplers on analytical instrumentation that meet CSA standards may be used unattended without additional unattended experiment considerations so long as the instrumentation has not been modified from its original, CSA approved, configuration.

For operations that require continuous or overnight operation, steps must be taken to prevent spills, floods and/or fires in the case of mechanical, power or water failure. Unattended experiments must be designed in such a way as to be "fail-safe." That is, a single failure must not lead to additional reasonably predicted failures. The experiment design must be such that a single failure must convert the experiment to a state in which the possibility for personal injury or damage to property is minimised. For example, an unattended reaction under reflux should have a water flow sensor; in the event of a stoppage in water flow, a water flow sensor would automatically remove power to the heat source. Additionally, experiments with continuously running water should be avoided and instead replaced with a water bath with circulator; in the event of a burst pipe or water line the flood potential is limited to the volume of the water bath reservoir. If continuously running water is used it should have an automatic water shutoff in the event of a broken water line.

- Set-up unattended operations in a fumehood, so that in the event of system failure, no hazardous materials will be released into the lab space.
- Ensure that all fumehoods will remain on during the experiment by advising Facilities (5500) of the planned experiment.
- Laboratory lights should be left on, and an *Unattended Operations Warning Sign* (see appendix 23) should be placed on the laboratory door.
- An *Unattended Operations Information Sign* (see appendix 22) must be posted at the location of the operation.
- If an operation is to be left running unattended during regular working hours, *it* should be visited periodically to ensure there are no problems.

5.14 Facilities staff, contractors, non-laboratory personnel, and visitors accessing laboratories

Facilities staff, contractors, non-laboratory personnel, and visitors are responsible to:

1. Obtain authorization from the Department Chair, or designate, prior to entering the lab;
2. Abide by the instructions of the Department Chair, or designate, regarding restricted access and the use of Personal Protective Equipment.

Information Technology Services (ITS) staff requiring access to Physical Sciences laboratories

1. ITS will not enter any laboratory space without a request being made to or by the Manager, Technology Services, Faculty of Arts and Science.
2. Where ITS initiates a request to enter a laboratory, the request will be made to the Manager, Technology Services who will liaise with the appropriate Department contact and schedule as appropriate. All work in the laboratory will take place under supervision.
3. Where the Department/Faculty initiates a request (to be made to the Manager, Technology Services), ITS will liaise with the Manager, Technology Services and the requester to make arrangements and schedule the work. All work in the laboratory will take place under supervision.

Facilities staff and contractors accessing laboratories

1. Facilities staff and contractors will not enter any laboratory space without a request being made to or by the Manager Maintenance Services, Facilities.
2. Where Facilities initiates a request to enter a laboratory, the request will be made to the appropriate Department contact and scheduled as appropriate. All work in the laboratory will take place under supervision.
3. Where the Department/Faculty initiates a request, Facilities will liaise with the Department to make arrangements and schedule the work. All work in the laboratory will take place under supervision.

"Supervision" does not require the member be present at all times while work is completed. However, the laboratory personnel supervising is responsible for ITS following the safety procedures outlined above.

Non-laboratory personnel and visitors accessing laboratories

Non-laboratory personnel and visitors are individuals that do not have authorized, independent access to the laboratory space. Such persons occasionally access laboratories, and must be adequately protected during a visit. Visitors include persons such as members of other departments, University administration, media personnel, donors, industry partners, and dignitaries etc. Visitors must be accompanied by laboratory personnel at all times.

Laboratory personnel supervising Facilities staff, contractors, non-laboratory personnel, and visitors must:

1. Determine the hazards posed to the workers and the health and safety requirements for the visit.
2. Follow and enforce the Laboratory Safety Rules.
3. Ensure the workers:
   - Follow area-specific requirements based on identified hazards.
   - Are made aware of hazards present in the laboratory.
   - Do not eat or drink in the laboratory.
   - Wear a fastened laboratory coat and appropriate personal protective equipment as required (e.g. gloves, eye protection and footwear) when in the laboratory.
   - Remove laboratory coats or other personal protective equipment before leaving the laboratory.
   - Wash hands after removing gloves and before leaving the laboratory.

4. Ensure laboratory workers in the laboratory are aware of the presence of Facilities staff, contractors, non-laboratory personnel, and visitors.

Open House

During Open House, laboratory safety rules may be relaxed in a non-operational, specially prepared laboratory. Typically, this is achieved by temporarily re-designating a wet laboratory as a dry laboratory. In order to do so, Open House visitors must be protected from the hazards within the laboratory. To achieve this, all chemicals must be removed and/or reasonably secured as to not be easily accessible, and the laboratory must be decontaminated and relatively clean. Open House visitors must be accompanied by laboratory personnel. When touring visitors around laboratories that have not been specifically prepared/re-designated for Open House, laboratory personnel must follow the procedures listed above regarding supervising visitors in the laboratories.

5.15 Chemical demonstrations

Chemistry demonstrations are a valuable part of teaching the discipline, and are frequently used in chemistry lectures at MacEwan University. All personnel performing chemical demonstrations are responsible for ensuring a safe environment for students in the classroom or equivalent demonstration space. Chemical demonstrators must:

1. Perform a hazard assessment and practice the demonstration before presenting it in front of students or the public.

2. Know the properties of the chemicals and the chemical reactions involved in all demonstrations presented. SDS for hazardous substances must be available in the location where the demonstration is being performed.
3. Take a chemical spill kit, where one is not available at the location where the demonstration is being performed.
4. Wear appropriate PPE for all chemical demonstrations. At a minimum, this includes a lab coat and safety glasses.
5. Warn the members of the audience to cover their ears whenever a loud noise is anticipated.
6. Plan demonstrations so that harmful quantities of noxious gases do not enter the local air supply.
7. Provide safety shield protection wherever there is the slightest possibility that a container, its fragments, or its contents could be propelled with sufficient force to cause personal injury.
8. Arrange to have a fire extinguisher at hand whenever the slightest possibility for fire exists.
9. Not taste or encourage spectators to taste any food, or non-food substance that is part of the demonstration.
10. Not use demonstrations in which parts of the human body are placed in danger (such as placing dry ice in the mouth, or pouring liquid nitrogen on a person).
11. Not use open containers of volatile, toxic substances without adequate ventilation as provided by fumehoods.
12. Arrange for appropriate waste containers for and subsequent disposal of materials harmful to the environment.

All chemical demonstrations sanctioned by the University are subject to section 6.4: *Transporting Chemicals*. Non-sanctioned demonstrations using MacEwan supplies on behalf of the University, either on or off University premises, are prohibited.

6. Chemical safety

6.1 Requirements for working with chemicals

Before beginning any work with chemicals in the laboratory, personnel must examine all stages of work to determine the potential hazards associated with the experiment. This includes acquisition, storage and handling, experimental protocol, decontamination, disposal, and clean-up of spills.

Laboratory personnel must review the SDS for chemicals being used, determine ways to minimize exposure to chemicals (e.g. use of gloves, fumehoods) and select appropriate PPE.

1. All chemicals must be handled with care.
2. Consider all chemicals to be dangerous (hazardous) unless you are specifically instructed otherwise.
3. Chemical reagents are stored in labelled bottles. Make sure that the chemical you have is the one that you require, and take note of any warning phrases or symbols on the label. Use care when reading reagent bottle labels. Follow any special handling instructions given on the bottle. Verify the name of the chemical as you return the bottle to the reagent shelf.
4. Be aware of the properties of the chemicals with which you are working and of the hazards, if any, of the procedures which you are attempting. In particular, read the Safety Data Sheet for each reagent before you begin an experiment.
5. Do not take more chemical than is required. Do not, under any circumstances, return unused chemical to the reagent bottle. When you have finished, replace the lid on the bottle and immediately clean up any spilled chemical.
6. Certain chemical reactions must be carried out in the fumehood. Watch for instructions in the procedures and follow them for the safeguard of your health and the health of others.
7. Bottles containing concentrated acids or bases are stored in corrosive safety cabinets. Handle these with care when using or transporting them to your bench. Spilled acid or base, and rings from acid or base bottles, must be cleaned up immediately. If a large quantity is spilled, use the appropriate Spill-X mixture and water to neutralize and clean up. Spill-X-A, or sodium hydrogen carbonate, should be used for acid spills, and Spill-X-C should be used for caustic spills.
8. Never pour water into concentrated acid. Pour the acid slowly into the water, stirring constantly. Concentrated acids are usually more dense than water and when mixed with water often evolve heat that can cause severe splattering.
9. Volatile chemicals that are poisonous, irritating to the skin, or that have unpleasant odours should always be used in the fumehood.
10. Many of the chemicals used are toxic and must not be poured down the drain. Refer to the SDS for specific disposal requirements.

6.1.1 Proper labelling

1. All chemicals must be labelled with either a WHMIS supplier label or an appropriate workplace label.
2. Workplace Labels are required when a controlled product is transferred from the supplier's container to a work site container. They must include the product name, information on how to use the product safely and reference to the SDS for further information.
3. All samples must be labelled with sample description, generator's name, and date.
4. Waste bottles must be labelled in a manner which clearly identifies the contents.

6.1.2 Instructions on reagent use

- When opening a new reagent bottle, write the date it was opened on the bottle on the label and remove the plastic ring.
- Remove all old parafilm and parafilm the bottle after closing.
- Return chemicals to appropriate location immediately after use.

6.1.3 Different chemical types

Highly Toxic Chemicals

Highly toxic chemicals are substances that when ingested, inhaled or absorbed in relatively small amounts may cause damage to bodily structure or function. They may have high acute systemic toxicity, or be substances with chronic toxic effects such as carcinogens, reproductive or developmental toxins, and mutagens. Laboratory work with highly toxic chemicals should be carried out in a fumehood. Never work alone with highly toxic substances.

Flammable and combustible Liquids

Flammable liquids (class I) are those liquids with a flash point below 37.8 degrees Celsius. Combustible liquids (class II or III) liquids are those with a flashpoint between 37.8 and 93.3 degrees Celsius. The greatest danger associated with handling these liquids is the potential for fire or explosion. Never heat an open vessel containing flammable liquids with an open flame or on a hot plate. Handle them in areas free of ignition sources. Carry out transfers in a fumehood or areas with sufficient ventilation to prevent the formation of flammable or explosive gas mixtures in the air. Keep containers of flammable liquids closed except during transfer of contents. Ground containers used to dispense flammable liquids to prevent the build-up of static electricity. Drums are grounded by connecting the container to an already grounded object that will conduct electricity. Ensure grounding connection is made to bare metal. Static electricity can also build in plastic or other non-conductive containers. To minimize build up use a slow pour rate and limit

freefall when transferring flammable liquids. In the case of a flammable liquid being spilled and/or being evaporated into the atmosphere, do not switch any electrical equipment on or off.

Highly reactive and explosive chemicals

Are chemicals that enter into violent reactions by mechanical shock, elevated temperature or chemical action during which the spontaneous release of energy and a large volume of gas, heat, and possibly toxic vapours is too rapid to be safely dissipated by the surroundings. These out-of-control reactions can result in vessels bursting, explosion, toxic vapours, flammable gases or spontaneous ignition. It is very important to use only the minimum amount of such materials with adequate shielding and PPE. Whenever possible, use chemicals with added inhibitors.

Some examples of highly reactive and explosive chemicals:

- Explosives (shock and/or heat sensitive materials): e.g. acetylides, azides, or organic nitrates, nitro compounds, perchlorates and peroxides.
- Peroxides: catalysis of the violent decomposition of hydrogen peroxide by metal ions. The instantaneous, heat induced decomposition of some peroxides. Many peroxides are highly explosive.
- Water reactive chemicals: active metals such as sodium, magnesium, lithium, and potassium and organometallics such as Grignard reagents and alkyllithiums are serious fire and explosion hazards due to reactivity with water and alcohols.
- Air reactive chemicals.
- Oxidizers and reducers: violent reaction of oxidizing agents (halogens, oxyhalogens, permanganates, nitrates, chromates, persulfates, peroxides, perchloric acid, nitric acid) with reducing agents, trace metals and ordinary combustibles.

When working with highly reactive or explosive materials take the following precautions:

- Plan experiments to minimize the need for handling of reagents and equipment while experiment is in progress.
- Use smallest quantities of reagents possible.
- Assemble apparatus in such a way that if the reaction starts to “run-away”, immediate removal of heat source, cooling or quenching of the reaction, cessation of reagent addition, and closing of the fumehood sash are possible.
- Fumehood sashes are designed to protect against chemical splash and minor explosions, additional shielding will be necessary for higher hazard work. Use barriers such as shields, barricades and guards to completely surround the hazardous area.
- Wear a face shield and heavy gloves when working with explosive or highly reactive chemicals.
- Clearly label the area where reactive chemicals are stored.

- Isolate these chemicals from any sources of heat or moisture.
- In the case of a reactive or explosive chemical being spilled and/or being evaporated into the atmosphere, do not switch any electrical equipment on or off.

Corrosives

Corrosives are those chemicals which result in an immediate, acute erosive effect on body tissue. Strong acids and bases of 1 molar or greater concentrations, non-metal halides, dehydrating agents, halogens and oxidizing agents are all corrosive. Always add acid to water, not water to acid.

6.1.4 Known "problem" chemicals

Certain chemicals are recognized as being responsible for a significant number of laboratory accidents.

- Metal azide salts
- Perchlorate salts (explosion hazards)
- Diethyl ether (fires)
- Sodium hydride, 90% (fires)
- Ethers (dangerous peroxide concentration during distillation; explosion hazards, especially with ground glass joints)
- Organic peroxides (sensitivity to shock and sparks, sensitivity to heat, friction, impact and light, sensitivity to oxidizing and reducing agents)
- Pyrophoric organometallic agents: *t*-BuLi, BuLi, alkylaluminums, alkylzincs (can ignite in air, fires on reaction set-up and quenching)

6.2 Chemical inventory

Maintaining a current inventory of the hazardous chemicals used and stored in the laboratory is a requirement of WHMIS that assists in implementing proper storage and safe work procedures and is a necessary component of proper emergency planning. The University uses a hazardous materials inventory system (H-MIS), to track the chemicals in the University. For information on using the H-MIS refer to the section 5.10: MacEwan Hazardous Materials Inventory System.

As new chemicals are received they will be added to the H-MIS by a laboratory technician and an SDS will be linked to the H-MIS entry. The storage location, date received and relevant course or researcher's name should be entered into the H-MIS. When chemicals are received they should be labelled with the date of receipt. When the bottles are opened they should be further labelled with the opened date. It is also good practice to label the bottles with the storage location. As chemicals

are used or disposed of they will be removed from the H-MIS. The chemical inventory must be reviewed annually (at a minimum) to ensure that it accurately reflects the chemicals in the laboratory.

6.3 Storage of laboratory chemicals

All chemicals should be individually evaluated to determine where and how they should be stored.

Guidelines for safe chemical storage

- Read chemical labels and SDS for specific storage requirements (e.g. temperature sensitive, light sensitive, air sensitive).
- Store chemicals in well ventilated areas; do not store chemicals in fumehoods.
- Adhere to manufacturer recommendations for the storage of chemicals Store chemicals in the appropriate storage cabinets or cupboards (e.g. acid cabinets, flammable cabinet).
- Label storage area with the appropriate warning label.
- Return chemical containers to their proper storage location after use.
- Always keep containers sealed when not in use.
- Store all hazardous chemicals below eye level.
- Store large bottles and containers as close to the floor as possible.
- No flammable storage is permitted in an exit corridor.
- Never store hazardous chemicals in a public area or corridor.
- Bulk volumes of reagents should be stored in the Chemical Storage room (5-006) not in the laboratory. Laboratories should have only 1-2 bottles of a reagent for immediate use.
- Corrosive chemicals should be stored in glass or polyethylene containers, never metal containers.

Chemicals should be stored according to chemical compatibility so that incompatible materials do not come in contact with each other in the event of breakage or spill. The best approach is to separate chemicals based on hazard class and segregate these groups from each other. In many cases, it is not practical to store all chemicals in physically separate locations. In such cases, segregate chemicals using a glass, porcelain or heavy gauge Nalgene™ (or similar plastic) container that is compatible with the material being stored. The secondary container must be large enough in volume so as to contain any spills. Dry chemicals may be grouped together by compatibility on separate shelves or areas of shelves separated by taping off sections to designate where chemicals of one type are stored. Organic solvents, acids, and bases should be physically separated from each other by storage in separate areas or through the use of secondary containment as described above. Acids and bases should be stored in dedicated caustic storage cabinets, and flammables in an approved flammable storage cabinets. Water reactive chemicals should be properly desiccated and stored in a waterproof area. Heat-sensitive flammables must be

stored in a laboratory-safe explosion proof refrigerator. Highly toxic materials should be locked in a specific storage area with limited access. Ignitable solids should be stored in an airtight container, in a flammable storage cabinet, and under an inert atmosphere if necessary. Do not keep peroxide forming chemicals longer than 12 months.

Guidelines for chemical segregation

- Inorganic and organic chemicals are stored separately.
- Liquids are separated from solids.
- Separate acids from bases.
- Flammable or combustible liquids, toxic chemicals, explosive chemicals, oxidizing agents, corrosive chemicals, water-sensitive chemicals, and compressed gases should be segregated from each other.
- Volatile liquids must be kept away from heat sources, sunlight, and electric switches.
- Chemicals must be stored in such a way that they will not mix with each other if a container leaks or breaks.
- Keep pressurized gases securely strapped to a wall or bench at all times with their safety caps on while not in use.
- Keep toxins and other especially dangerous items properly labelled and store under added security.

Some recommended compatibility groups for chemical segregation are:

- Perchloric acid and nitric acid are separated from other materials (including each other)
- Inorganic acids (except as noted above)
- Bases
- Water reactive chemicals
- Pyrophoric chemicals
- Strong oxidizing agents
- Strong reducing agents
- Flammable and combustible liquids

Many chemical suppliers use a color classification system as a way to help laboratory personnel to segregate chemicals for storage compatibility.

6.3.1 Special chemical storage considerations

Flammables and combustibles

Flammable and combustible materials are those that can ignite, explode or react with other chemicals. The volume of flammable and combustible liquids permitted in the laboratory is regulated by the Alberta Fire Code. The maximum volumes permitted in open storage are:

1. 25L of Flammable or Class I Liquids
2. Up to 300L of Combustible or Class II / III Liquids; for a combined total of no more than 300L

Open storage means any storage in the lab outside of a flammable storage cabinet. Flammable liquids and combustible liquids must be kept in closed container and stored in approved storage cabinets when quantities exceed those above. In practice, all chemicals not in immediate use should be returned to their storage location. The maximum volumes that may be stored in the laboratory in flammable storage cabinets are:

1. 250L of Flammable or Class I Liquids
2. Up to 500L of Combustible or Class II / III; for a combined total of no more than 500L

There is no restriction on the number of flammable cabinets permitted in laboratories, as long as the total volume stored in the cabinets does not exceed the volume noted above. Flammable cabinets are to be used for flammable and combustible storage only; other chemicals are not to be stored in them along with flammable and combustible liquids. Flammable cabinet doors must be kept closed at all times.

Storing chemicals in refrigerators and freezers

Laboratory refrigerators and freezers are used to store volatile, noxious and air sensitive materials. In addition to problems associated with odour, accumulated vapours arising from chemicals stored in refrigerators present a flammable or explosive hazard due to the in-built ignition sources in the refrigerators. Refrigerators and freezers used in the laboratory must be carefully selected for specific chemical storage needs. Only specially-designed lab refrigerators should be used for cold storage of flammable materials, commercial refrigeration units are not designed to meet the special hazards presented by flammable materials.

For storage of flammable materials, a unit rated for flammable storage is sufficient. Commercial refrigerators and freezers are acceptable for storage of non-flammable materials, but must be prominently labelled as not suitable for flammable storage.

The following are rules for the safe use of refrigerators and freezers:

- Never store food or drink in any refrigerator or freezer used in a laboratory.
- Ensure that the chemicals stored in the refrigerator or freezer are compatible.
- All containers placed in a refrigerator or freezer should be completely sealed and safely positioned.
- Shelves in refrigerators and freezers should all have suitable plastic trays for secondary containment. If plastic trays are not available, liquid chemicals should be placed in secondary containers to contain the spill.
- All items stored in a refrigerator or freezer must be appropriately dated and labelled.
- Store only chemicals in amounts needed over a reasonable amount of time. Each chemical has a shelf life and may form decomposition products that can be hazardous.
- Compounds stored in refrigerators or freezers may be especially prone to degradation if not properly stored and sealed.
- Remember that power outages and technology failures can cause internal temperatures to rise, which can impact chemical contents. Be aware of unusual odors, vapors, etc., when opening the refrigerator.
- An inventory must be posted on refrigerator and freezer doors.
- Units must be grounded and permanently installed; extension cords are not to be used.
- Refrigerators and freezers must be cleaned-out on a regular basis. Research samples with no anticipated further use must be disposed of rather than stored indefinitely.

Peroxide forming chemicals

Common laboratory chemicals can become dangerous with age due to a tendency to form peroxides when exposed to air or light. Chemicals which have undergone peroxidation are sensitive to heat, shock, and friction and may explode violently. Some common peroxide forming chemicals found in the Physical Sciences laboratories are tetrahydrofuran and diethyl ether. Where there is the possibility that a chemical is contaminated with peroxide, it can be tested by applying a drop to a piece of wet peroxide test strip. If the paper turns black within a minute, then peroxide is present. The presence of crystalline solids or viscous liquids in the bottom of a bottle usually indicates high concentrations of peroxides. If peroxide contaminated material is identified, HSE should be notified immediately.

To avoid the formation of peroxides; store chemicals away from heat and light, ensure there are two dates on all containers of these chemicals: the date the container was received and the date it was opened. Peroxide-forming chemicals should be checked at least once per month for the presence of peroxides. The CRC Handbook of Laboratory Safety has methods for removing low levels of peroxides from peroxide formers.

Perchloric acid

Any procedure that involves perchloric acid must be carried out in a properly designed perchloric acid fumehood. Because of this perchloric acid must not be used without proper authorization from HSE.

Perchlorates

Organic perchlorates and many heavy metal perchlorates are very sensitive to both heat and shock. Since anhydrous perchlorate salts are especially dangerous, the hydrated forms should be used whenever possible. The use of perchlorate salts should be avoided completely if suitable substitutes can be found.

6.4 Transporting chemicals

On-campus: The movement of hazardous materials within and between buildings is a concern. The following rules have been established to reduce potential incidents of spill and/or odour concerns. They must be followed when transporting hazardous materials within and between buildings:

- Chemicals must be transported in sealed containers. Note: all containers must be decontaminated on the outside, prior to leaving the laboratory, so that gloves are not required.
- Glass containers must be transported in specially designed bottle carriers or leak resistant, unbreakable secondary container.
- Gas cylinders must be transported on a cylinder cart with the cylinder capped installed and the cylinder restrained.
- A cart is required if the number or size of the transported containers exceeds what can safely be carried in one hand.
- When transporting on a cart, use a cart that has high edges or spill trays to contain leaks or spills.
- The transport route of hazardous materials is restricted to service corridors or those areas less frequented by members of the University community. The shortest route is not necessarily the most appropriate.
- Transport of hazardous materials that must go through publicly accessible areas may only occur when there is a minimum of people present (i.e. no transport during class change times or in a full elevator).
- When using an elevator right of way should be given to other passengers.
- When transporting chemicals, laboratory personnel should carry a cell phone should they need to call for assistance in the event of a spill.

The movement of hazardous materials is prohibited in food and beverage consumption areas, washrooms, libraries, recreational facilities, meeting rooms, mailrooms, and offices.

On the road: The transportation of hazardous materials by vehicle is governed by the Transportation of Dangerous Goods Act and Regulations. Employees are prohibited from transporting chemicals on public transit or in personal vehicles (unless certified for TDG). For information about TDG training contact HSE.

6.5 Compressed gases

Faculty and staff working with compressed gas cylinders need to be aware of the safe use, handling and storage requirements of the compressed gases they work with. Compressed gases differ from other hazardous materials in the laboratory because of the additional physical hazard of a high-pressure vessel. A cylinder can easily become a lethal missile if mishandled. Some compressed gases used alone or in combination present an extreme toxic, corrosive and/or flammability hazard that will require health and safety precautions above and beyond what is presented in this document. They may have specific exhaust requirements, gas detection systems and written site specific SOPs. If you require a compressed gas not currently used in the Department of Physical Sciences HSE must be consulted prior to conducting work.

The hazards of working with compressed gas include:

- Asphyxiation: all compressed gas cylinders, with the exception of those labelled “Breathable Air,” may displace oxygen and pose an asphyxiation hazard.
- Extreme cold: rapidly expanding gas escaping from a compressed cylinder may be very cold and cause severe frostbite.
- Mechanical hazards: compressed gas cylinders are heavy and may cause trauma if mishandled.
- High pressure: gas cylinders pose extreme risk if the cylinder is punctured or the valve is damaged. The entire cylinder may be propelled at a lethal velocity in the event of catastrophic failure.
- Specific chemical hazards: the specific content of the gas cylinder may pose chemical hazards. The contents may be flammable, explosive, toxic, corrosive, oxidizing or inert. Combinations of these hazards in a single cylinder are also possible.
- Jet injection: pinhole leaks in high pressure transfer lines and compressed cylinders pose a risk of jet injection into soft tissue.

Storage

On-site inventory of compressed gas cylinders will be managed so as to maintain the minimum number of cylinders required for laboratory operation and instructional use. Superfluous gas

cylinders will be returned to the manufacturer. Short term storage for large capacity gas cylinders (> 101.6 cm height e.g. K and T sizes) is available in the cryogen and gas storage shed on the north-west corner of building five. The gas storage shed can be accessed by the Instrument Manager or a Laboratory Technician. Limited short term storage for small capacity gas cylinders (< 101.6 cm height e.g. Q, G and L4 sizes) is available in the chemical storage room (5-006). Long term storage is not available. Only cylinders that are in use may be kept in a laboratory. A gas cylinder is considered to be in use if is connected through a regulator or manifold to deliver gas to a laboratory operation or is a single reserve cylinder secured alongside a cylinder that is connected through a regulator or manifold to deliver gas to a laboratory operation.

Any gas cylinder not used for 12 months will be returned to the manufacturer unless an immediate need is identified. Gas cylinders will never be kept for a period of time greater than the expiry time provided by the manufacturer. If no expiration date is provided, cylinders will be retained for a maximum of 36 months. All gas cylinders must be stored with the regulator removed and the safety cap installed. Gas cylinders must be stored upright and secured to a sturdy object using an appropriate chain or strap placed above the midpoint and below the shoulder of the cylinder to reduce the likelihood of the gas cylinder tipping. Storage of multiple cylinders should be in a racking system not a single chain. If a number of cylinders must be stored with one restraining chain then they should be nested together to always provide three points of contact. Empty cylinders must be labelled as “empty” or “MT”.

Transporting compressed gases

On-campus: All gas cylinders must be transported with the regulator removed and the safety cap installed. All gas cylinders that are to be transported more than two metres (2 m) must be done so with a cylinder cart. The cart must have means of securing the cylinder with a chain or strap placed above the midpoint and below the shoulder. Do not lift or manipulate cylinders by the safety cap. Only one large capacity cylinder should be moved at a time. Do not strike or drop cylinders. The use of CSA™ approved steel-toe footwear is recommended during transportation of gas cylinders.

On the road: The transportation of gas cylinders by vehicle on a public road is subject to TDG legislation. Employees are prohibited from transporting gas cylinders on public transit or in personal vehicles (unless certified for TDG). For information about TDG training contact HSE.

Use

Only general safe use of gas cylinders is addressed. Specific precautions based on the content of the gas cylinder (e.g. explosive hydrogen or corrosive, toxic, and oxidizing chlorine) may be necessary. It is the responsibility of laboratory personnel using the specific gas to follow the

recommendations of the manufacturer as detailed in the SDS. This may include, but is not limited to venting exhaust to a fumehood, gas sensing detectors, and use of compatible regulator and transfer line. Compressed gas cylinders used in the laboratory must be:

1. Not exposed to open flame or temperatures above 52 °C.
2. Placed in a dry and well-ventilated area.
3. Immobilized upright with a chain placed above the midpoint and below the shoulder.
4. Placed such that egress is not impaired.
5. Located so that the cylinder valves or point of use valve is away from immediate hazards and within immediate reach.
6. The main cylinder valve should be closed when the operation is complete or equipment is no longer in use.
7. Gas cylinders should never be bled below 25 psig to maintain a positive pressure and keep contaminants out of the cylinder.
8. Cylinders not attached to a device or operation must have the regulator removed and the safety cap firmly secured.
9. Cylinders must be properly labelled with the contents. Cylinders received that are not properly labelled must be returned to the vendor immediately.
10. Cylinders must be identified as either Full or In Use with tape or tags.

Gas cylinders must be used with a pressure-reducing regulator or protocol station with an attached pressure-reducing device as outlined below.

1. The pressure-reducing regulator, and all connections on the high pressure side of protocol stations, must be rated for the maximum pressure of the attached gas cylinder.
2. Never use an adaptor to connect a gas cylinder to a pressure-reducing regulator. The mating of connections is a safety procedure to reduce the likelihood of connecting incompatible gases and regulators. Conversely, successful mating between the cylinder and regulator must not be used as the sole source of assurance that the gas and regulator are compatible.
3. Check connections for leaks with a mixture of soap and water, a commercial detergent based leak detection compound, or a gas sniffing device.
4. Wear safety glasses when connecting or disconnecting regulators or connections on the high pressure side of protocol stations.
5. The use of a non-adjustable wrench for making or removing high pressure connections is recommended. If an adjustable wrench is used extra care must be taken to ensure proper wrench size is achieved. An improperly sized wrench may damage the soft brass connectors.
6. Never use thread sealant (Teflon™ tape or pipe dope), grease, or other lubricants between the regulator or high pressure connector of a protocol station and the gas cylinder. If a proper connection cannot be established, the regulator, protocol station or gas cylinder is damaged and must not be used until repair of the regulator or protocol station is complete or

replacement of the gas cylinder is complete. Under no circumstances should the repair or modification of gas cylinders be attempted.

7. The use of two stage regulators is recommended to allow monitoring of both gas content in the cylinder and delivered gas pressure. In the cases where gas is plumbed in and attached to devices requiring precise operating pressure the use of a second point-of-use regulator is recommended. For flammable gases in a manifold system there must be an identified manual shut off valve at each point of use. The identity of the gas must be labelled at each point of use when gases are being provided through a manifold or piped system.
8. All devices using compressed gas must have an easily accessible point-of-use shutoff valve. If the cylinder is located adjacent to the device the main cylinder shutoff valve is sufficient so long as access is not impeded. In all other cases a secondary point-of-use shutoff valve is required.

Procedures for installing a regulator

The first time this task is carried out it must be performed under the supervision of a person familiar with the procedure. To ensure you select the correct regulator for the gas being used and the operation being performed consult with the supplier. Tools required: non-adjustable wrench of the appropriate size (adjustable wrenches, if not tight, may damage brass nuts), leak detection solution.

1. Ensure that the gas cylinder is appropriately identified.
2. Know the hazards specific of the gas in the cylinder.
3. Be aware of any specific purging, ventilation, lab or equipment requirements that may be in addition to those listed.
4. Know the desired delivery pressure to your system, apparatus or equipment.
5. Remove cylinder cap.
6. Remove any loose debris from the threads and seat.
7. Ensure all knobs and valves are closed.
8. Thread regulator onto cylinder by hand until snug and then tighten the connecting nut with a wrench. Nuts with a notch are left hand thread, nuts without a notch are right hand thread.
9. Open the cylinder tank valve slowly. Open the cylinder valve until the pressure gauge indicates pressure. Use caution as sudden pressurization can cause the glass face to shatter.
10. Test the cylinder/regulator connection with leak detection solution or equipment. Squeeze a small amount of solution ensuring coverage of the circumference of the cylinder connection nut as well as the space between the stem and the nut. The formation of bubble indicates a loose or poor connection, try to tighten the connection. If the connection keeps leaking turn off the gas from the cylinder and disconnect the regulator. Check for damage to the face of the fitting, debris in the cylinder valve connection or a missing washer.

11. Once a leak free connection is established turn the pressure adjustment knob slowly clockwise monitoring the delivery pressure until desired delivery pressure is achieved. Use caution as to not exceed the maximum delivery pressure of the regulator or the system.

Procedures for disconnecting a regulator

1. With the equipment valve open, close the cylinder valve.
2. Slowly open the regulator outlet valve to bleed the system.
3. Monitor the pressure gauges; they should both drop to zero.
4. Disconnect the delivery hose from the equipment.
5. Disconnect the regulator from the cylinder.
6. Replace the cylinder cap.

6.6 Cryogens

Cryogenic materials (or cryogens) are characterized by extremely low temperatures; cryogenic liquids have boiling points less than −73 °C. In the Physical Sciences laboratory, the most common cryogens are liquid nitrogen and liquid helium. Cryogens are normally gases at standard temperature and pressure, and are liquefied under high pressure. They all have two properties in common; they are extremely cold, and small amounts of liquid expand rapidly into very large amounts of gas. The cold boil-off vapour rapidly freezes human tissue. The rapid expansion to gas can result in pressure build-up in vessels containing cryogens, and also presents the danger of asphyxiation as oxygen is displaced in enclosed spaces or small rooms.

Use insulating gloves that are impervious to liquid, but that are loose fitting so they can be thrown off quickly if any liquid spills in them. Metallic objects such as watches, rings, bracelets should not be worn. Always wear chemical splash goggles or a face shield if there is a chance the cryogenic liquids may splash and froth on contact with a warmer surface. Many materials, particularly rubber gloves and tubing, become brittle due to the extreme cold. If cryo-frozen rubber tubing is bent, it will shatter. Ensure that materials designed specifically for cryogenic use are used.

Store and transport cryogens only in Dewar flasks designed for that purpose. Always fill Dewar flasks slowly to reduce temperature shock effects and minimize splashing. Similar precautions should be taken when cooling an object by immersion in a liquid cryogen. Open containers should never be immersed in liquid nitrogen or liquid helium. Cryogens should be kept covered to prevent condensation of atmospheric moisture, which can be especially dangerous if a plug forms in a narrow vessel neck, resulting in an over-pressurized vessel.

6.7 Chemical waste management

It is incumbent upon all laboratory personnel to be aware of the environmental and financial impacts of hazardous waste and to actively seek to minimize the volume of hazardous waste that is generated. The management of hazardous waste should be an integral part of the laboratory setup and operating procedures, and it should be reviewed annually.

Hazardous waste requires specific disposal and treatment protocols to mitigate the threat to the environment and/or human health. These protocols are driven by City, Provincial, and Federal regulations:

- City of Edmonton Drainage Bylaw (Bylaw 16200)
- Alberta Environment Protection and Enhancement Act
- Canadian Environmental Protection Act
- Transportation of Dangerous Goods Act

The Alberta Environmental Protection and Enhancement Act: Waste Control Regulation defines hazardous waste as any solids, liquids or gases containing or contaminated with:

- Flammable or combustible liquids (e.g. acetone, methanol, dichloromethane)
- Reactive chemicals such as oxidizers, reducing agents, inorganic cyanides, water-reactive, pyrophoric, explosive or unstable material (e.g. benzoyl peroxide, potassium permanganate, sodium borohydride)
- Acute or chronic toxic material (e.g. ethidium bromide, benzene, osmium tetroxide)
- Corrosives (pH less than 2.0 or greater than 12.5)
- Toxic leachate materials (e.g. heavy metals)
- Polychlorinated biphenyl's (PCB's)
- Un-rinsed chemical containers which contained any of the above

Environmentally sound use of chemicals and disposal of laboratory waste in important and the responsibility of all laboratory personnel. The document *Waste Management and Waste Minimization in the Department of Physical Sciences* (see appendix 24) contains additional information to that presented below and must be read along with the information presented in this manual.

Waste minimization

All laboratory personnel should minimize the hazardous waste they generate as hazardous waste has significant fiscal and environmental impacts. Do not accept donations of materials you do not plan to use.

Hazardous waste handling

The precautions followed when handling, storing and using hazardous laboratory chemicals also apply to hazardous laboratory waste. "Hazardous waste being a hazardous product that is sold for recycling or recovery and is intended for disposal" is excluded under WHMIS 2015.

Hazardous waste segregation, collection and disposal

Hazardous waste must not be released to the environment through regular garbage or through the sanitary sewer system. It is the responsibility of the supervisor within the laboratory, and all individuals generating hazardous waste to properly manage its collection in order to ensure its safe and environmentally responsible disposal in accordance with federal, provincial, and municipal regulations as well as in accordance with the processes and requirements outlined below.

There are many different types of waste generated in the laboratory. Below is a list of common laboratory waste types and their disposal.

1. **Absorbent materials** (paper towel, bench coat, Kimwipes), clean: regular municipal garbage
2. **Absorbent materials** (paper towel, bench coat, Kimwipes), contaminated with chemicals: sealable, labelled container. Dispose of as chemical contaminated debris.
3. **Batteries**: are considered toxic metal waste and must not be disposed of in municipal garbage. Collect in a sealable, labelled container. For disposal contact Facilities (5500).
4. **Chemicals, solid**: package in a suitable labelled container separate from liquid chemical waste. Dispose of as chemical waste. Note: Spent drying agents and silica are collected in 10kg pails in the waste cabinet in 5-006.
5. **Chemicals, liquid, aqueous**: liquid waste safety can (preferred), or old bottle (with label removed or defaced). Full chemical names and volumes must be attached on the container. This waste should be treated (see "On-campus hazardous waste treatment" section of this manual) and if appropriate added to the 200L waste drums (6-161A or 5-006). Dispose of as chemical waste.
6. **Chemicals, liquid, halogenated and non-halogenated**: liquid waste safety can or old glass bottle (with label removed or defaced). Full chemical names and volumes must be attached on the container. Acetone, halogenated and non-halogenated waste must be collected separately. Contamination with large volumes of water should be avoided. When waste bottles are full it should be added to the appropriate 200L waste drum (5-011A). Acetone should be recovered, see "Solvent Recovery" section of this manual. Dispose of as chemical waste.
7. **Glass, clean**: Broken glass box, regular municipal waste. Boxes should only be filled half full. When ready for disposal boxes should be taped closed and marked garbage. Facilities will

collect this waste. Full boxes should be taken directly to the dumpster in shipping and receiving.

8. **Glass, contaminated with chemicals**: Broken glass box, lined with plastic bag. Dispose of as chemical contaminated debris. TLC plates should be disposed of as contaminated glass.
9. **Gloves, contaminated with chemicals**: sealable, labelled container. Dispose of as chemical contaminated debris.
10. **Pump oil**: collected in a polypropylene container. For disposal contact Facilities (5500).
11. **Sharps** (needles, scalpels, blades): puncture and leak-proof, plastic sharps disposal unit container. It is essential that sharps never be placed in municipal garbage containers.
12. **Silica**: sealable, labelled container. Disposed of as non-regulated chemical waste.

Guidelines for hazardous waste collection

1. Keep the exterior of the container free of chemical contamination.
2. Waste containers should be kept closed at all times, except when contents are being added. Do not leave funnels in the open necks of containers, even if the waste is in a fumehood. Fumehoods are not to be treated as a worry free method of waste containment or disposal.
3. Segregate by chemical compatibility; do not mix incompatible chemicals in the same container.
4. Before combining different wastes, test a small amount for reactivity.
5. Do not combine reactive chemicals waste with other wastes
6. Pour wastes into waste containers slowly in a fumehood. If waste container becomes warm, wait until cool before recapping.
7. Waste containers must be labelled with the type of waste and specific names that clearly identify the contents. A list of contents must be maintained as waste is added to the container.
8. Leave at least 20% air space in bottles of liquid waste to allow for vapour expansion, and to reduce the potential of spills occurring from moving overfilled containers.
9. Dispose of hazardous waste regularly to avoid accumulation in the laboratory. Waste generated by laboratory personnel working in the research laboratory must be disposed of at the end of each academic term at a minimum. It is the responsibility of the person generating the waste to identify and arrange disposal of waste through the laboratory technicians.

On-campus hazardous waste treatment

Corrosive hazardous waste is 3.5 times more expensive to dispose of than neutral aqueous waste; therefore all aqueous waste must be treated before hazardous waste pick-up. The waste generated by students in Physical Sciences laboratories should be collected separately each week based on the nature of the experiment. The aqueous waste generated will be either acidic or basic. Once the compatibility of the different waste is checked, acidic waste can be used to neutralize basic waste, and *vice versa*. If additional acid or base is required, sulfuric or hydrochloric acid, and sodium or magnesium hydroxide, respectively, can be used. Sodium bicarbonate can also act as a neutralizer.

After each treatment, waste must remain at a neutral pH for at least 24 hours before considered neutralized. Non-toxic neutralization products may be disposed of through the sanitary sewer. Once waste is neutral it should be placed in the 200L hazardous waste drums located in each building (5-006, 6-161A). These drums must be labelled with the type of waste and a list of the contents (chemical name, experiment, and pH). At least 20% air space in containers of liquid waste must be left to allow for vapour expansion, to allow room for further treatment if necessary, and to reduce the potential of spills occurring from moving overfilled containers. The pH of the drum should be checked using a pH electrode prior to hazardous waste pick-up and documented on the waste records. If the pH is not neutral the waste must be treated again. Once the pH of the waste drum is stable for 36 hours it may be collected. A copy of these records must be kept in the department after hazardous waste pick-up.

Solvent Recovery

The wash acetone used in the laboratories must be collected separately from all other liquid solvent waste. The acetone is recovered using the rotary evaporators in either 5-009 or 5-014. This recovered acetone is then re-used in 5-009 as "wash acetone". The volume of waste acetone and the volume of recovered acetone must be tracked each term. Refer to the *Solvent Recovery SOP*, appendix 25.

Waste disposal companies

Sharps are disposed of using G-M Pearson Biomedical Waste Specialists, (780 473-6633). This waste can often be combined with similar waste collected in the Department of Biological Sciences. Before sharps waste is sent for disposal contact a laboratory technician in Biological Science to coordinated joint waste pick-up. Other Hazardous Waste is disposed of using Tervita (780 400-2400).

6.8 Equipment disposal

All equipment and instrumentation is the property of MacEwan University and may not be disposed of without approval of the Department Chair and the Dean's office. A *Materials Transfer Form* (see appendix 26) must be filled out for any piece of equipment or instrumentation that is being disposed of. These forms are filled out by the user and submitted to the Department Chair. Following review, the Chair forwards these forms to the Dean's office for approval. Upon approval, forms are returned to the user. Once the user has a signed form, a copy is sent to facilities@macewan.ca, and a copy is secured to the equipment or instrument. Equipment for disposal must be decontaminated prior to disposal. Equipment pick-up and disposal is handled by Facilities at MacEwan University. A copy of these records must be kept in the department after disposal.

7. Equipment and instruments: safety and use

7.1 Safe use of laboratory equipment

7.1.1 Electrical safety

The following are general electrical safety considerations when working with laboratory equipment:

- Follow the manufacturer's instructions for the installation of the equipment. If the equipment has specific power requirements or must be directly connected to laboratory/building electrical systems, contact Facilities (5500).
- Review the manufacturer's operations manual and safety requirements before using the equipment.
- Ensure that laboratory personnel using the equipment receive appropriate training. As necessary, develop a standard operating procedure for the use of the equipment.
- As directed, use appropriate PPE when using the equipment.
- Each time before using the equipment, inspect the equipment and power cord. Never use an equipment that is damaged, in disrepair, or is malfunctioning.
- Only use the equipment for its intended purpose.
- Do not modify the equipment.
- Ensure that the equipment is properly maintained by utilizing only qualified technicians to perform maintenance, or make repairs.

7.1.2 Glassware

The following are some basic safety rules for working with glass:

- Before beginning any experimental work, check glassware for flaws such as chips, star cracks, scratches and etching marks, which may result in structural failure. Repaired glassware is subject to thermal shock and subsequent failure, and should be used with caution.
- Choose glassware sizes that can properly accommodate the operation being performed. At a minimum, there should be 20% free space.
- When heating solutions or reactions, use only glassware made of borosilicate glass and designed for this purpose.
- When working with systems under pressure, protect oneself from glass shrapnel should an implosion or explosion occur.
- When cleaning up broken glass, use a broom or brush and pan. Avoid picking up broken glass with your hands, even if you are wearing gloves, because the glass shards could pierce them.

7.1.3 Pressure and vacuum systems

High pressure operations should only be performed in appropriate pressure vessels, properly labelled and installed, and protected by pressure-relief and necessary control devices. The pressure vessels must be strong enough to withstand the stresses encountered at the intended operating temperatures and pressures. All pressure equipment must be inspected and tested at intervals determined by the severity of the equipment‘s usage, and must be operated only by qualified personnel.

Vacuum systems are used in the laboratory to remove air and other vapours from a vessel or manifold. They are found on rotary evaporators, drying manifolds, and aspirators, desiccators and filtration apparatus. Working at reduced pressure carries with it the risk of implosion and the subsequent dangers of flying glass and splashing chemicals.

All potential risks must be evaluated before vacuum systems are set up and operated. To conduct vacuum work safely:

- Operate the system in accordance with the SOPs.
- Use appropriate PPE such as safety glasses or face shields.
- Assemble vacuum apparatus in a manner that avoids strain, particularly to the neck of the flask.

7.1.4 Heating devices

Bunsen burners: Bunsen burners produce an open flame and burn at a high temperature. To use them safely in the laboratory, ensure to:

- Use them away from any combustible materials or chemicals.
- Inspect the hose for defects, and ensure that the hose fits securely on the gas valve and the Bunsen burner. Replace defective hoses.
- Use a sparker/lighter with an extended nozzle to ignite the Bunsen burner; never use a match to ignite the burner.
- Do not leave open flames unattended.

Also see section 5.11: Natural Gas Supply for the procedures for using the natural gas supply.

Heating mantles: Heating mantles enclose a heating element in layer of ceramic material, and are free of shock or fire hazards if used properly. Some precautions that should be taken when using mantles include:

- Avoid spilling water or other chemicals on the mantle as this presents a serious shock hazard and may also present a fire or explosion hazard.
- Always use with a variable transformer to control input voltage. Never plug directly into an electrical outlet. High voltage will cause the mantle to overheat.

Hot plates: Laboratory hot plates are normally used for heating solutions. To safely use hot plates:

- Do not store volatile flammable materials near a hot plate.
- Check for corrosion of thermostats, and arrange for repair if necessary.

Heat guns: Laboratory heat guns use a motor-driven fan to blow air over an electrically-heated filament. They may be used to dry glassware or chromatography plates. The heating element in a heat gun may become red-hot during use. To safely use heat guns:

- Do not use on or near flammable materials.

Ovens: Electric ovens are frequently used in the laboratory to dry glassware, or to remove water or solvents from chemical samples. To safely use laboratory ovens:

- Do not use the oven to dry chemical samples which are toxic.
- Glassware which has been rinsed with an organic solvent must not be immediately placed in an oven.

Microwave ovens: A microwave oven is found in the research laboratory, and when used with chemicals may pose hazards not found in the household. As with most electrical apparatus, there is the risk of generating sparks that can ignite flammable vapours. To minimize the risks in using microwave ovens in laboratories:

- Do not use metal containers and metal-containing objects in the microwave, as they can cause arcing.
- Do not use heat sealed containers in the microwave – explosions may result.
- Do not microwave flammable or combustible material.
- Do not use laboratory microwaves for heating any food or drink.

7.2 General instrument safety

To be provided, if needed.

7.3 Accessing instruments

To be provided, if needed.

7.3.1 Training

To be provided.

7.3.2 Booking time

To be provided.

7.4 NMR spectrometer

Introduction

All users of the nuclear magnetic resonance (NMR) spectrometer must undergo orientation/training by the Instrument Manager before permission to use the instrument unaccompanied is granted. Reading this safety guide is part of the orientation process. Orientation records are held by the Instrument Manager.

The following pages outline the main hazards associated with working with and around the NMR spectrometer in 5-013. For each hazard, the precautions in place to minimise the risks to health (and of damage to the instrument) and the local rules to which users are expected to adhere are given. It should be noted that these hazards are in addition to the standard hazards associated with working in a chemical laboratory environment.

These additional hazards are summarised as follows:

1. High magnetic fields
2. The presence of gaseous and liquid cryogens (helium and nitrogen)
3. Trip hazards
4. High electrical voltages/radiofrequency sources
5. Handling of chemical samples contained within NMR tubes

General rules

Risks are minimised by limiting access to the NMR room to trained instrument users and escorted visitors only. Spectrometer modifications and maintenance, including use of cryogens is limited to the Instrument Manager, or other trained users.

1. High magnetic fields

High magnetic fields are present around the NMR spectrometer cryostats. These can be hazardous indirectly through the forces exerted on ferromagnetic materials or directly via the effect on electronic devices or potentially on the human body. Specific hazards are:

- Medical electronic implants such as cardiac pacemakers may be affected by magnetic fields. Medical implants, e.g. pins, blood vessel clips and prostheses, may contain ferromagnetic materials and could be subject to strong attractive forces near to the NMR magnet system.
- Large attractive forces are exerted on magnetic materials or equipment bought in close proximity to the NMR magnet systems, which are always at field. The force may become large enough to move tools or equipment uncontrollably towards the magnet; the closer to the magnet cryostat the larger the force. Risks come from release of ferromagnetic items/tools or equipment which are brought near the magnets.
- Additionally, magnetic fields may permanently damage mobile phones, watches, calculators, MP3 players and certain types of magnetic devices such as swipe cards, credit cards, USB drives, etc.

Precautions

- A critical exclusion zone around the magnet is indicated by yellow stanchions.
- All people with electronic medical implants such as pacemakers are excluded from the NMR room (appropriate warning signs are displayed).
- Risks of moving metal causing injury/damage are minimised by exclusion of all metallic objects from the NMR room wherever possible.
- Laboratory personnel should spend no longer than reasonably necessary within the immediate proximity of the magnets, i.e. only for sample changing and adjustments.
- Mobile phones, watches, calculators and types of magnetic devices such as swipe cards, credit cards, USB drives, etc. should not be taken into 5-013A.

2. Cryogens

The cryogens used are liquid nitrogen and liquid helium. These are present within the magnet cryostats and during normal operation users are not exposed directly. The magnet cryostats continuously expel a small quantity of gaseous He and N_2 into the air due to liquid boil off. The main risks are:

- Cold burns when handling cryogens.

- Asphyxiation due to boil-off during filling or if a magnet quenches. Magnet quenches can be spontaneous and cause the rapid release of the cryogens within the magnet cryostat into the room, reducing air (and thus oxygen) content.

Precautions

The NMR room has powerful air handling preventing build-up of asphyxiants under normal conditions of boil-off. Asphyxiation risk is additionally minimised by oxygen monitoring within the NMR room, which triggers an evacuation alarm within the room.

Local rules

- Only experienced, trained staff may fill the magnets with cryogens. Users of the facility must not attempt refills or interfere with the vessels used for cryogens.
- Access to the NMR room is strictly limited to the Instrument Manager and experienced users during refills.

Also see section 6.6: Cryogens for more details on how to safely work with cryogens.

3. Trip hazards

The NMR room contains electrical cabling and pipe work which are likely to be unfamiliar to non-experienced users.

Precautions

Reasonable caution should be exercised to prevent risk of personal injury and expensive damage to the NMR equipment.

4. High electrical voltages/radiofrequency sources

NMR machines and their accessories contain a number of devices operating high voltages and currents. No exposed live electrics are present under normal circumstances, so with standard operation of an NMR spectrometer risks are similar to those encountered in the use of other laboratory equipment.

Local rules

- Modification/maintenance of the equipment is restricted to the Instrument Manager and only in consultation with the spectrometer manufacturer (Bruker Biospin Ltd).

5. Handling of hazardous samples contained within NMR tubes

Samples for NMR are relatively small (normally dissolved in < 1 ml of solvent) and are contained within NMR sample tubes sealed with a lid. Liquid-state NMR samples are normally dissolved in water or other standard laboratory solvents such as DMSO or chloroform. The main hazards are therefore most likely to be a result of tube breakage causing:

- Sharps injury.
- Exposure to a hazardous sample compound or additive.

Standard glass NMR tubes are generally robust if cautiously handled, in the same manner as other laboratory glassware, such as Pasteur pipettes. The main risk of breakage is either through dropping the tube or during transfer of the sample into the tube, especially if the NMR tube is old and/or chipped.

Local rules

- Risk of exposure to a hazardous sample through dropping the NMR tube is minimised by carrying it within a secondary container during transport. This also reduces risk of sharps injury.
- Risk of breakage during tube loading and handling is minimised by using only NMR tubes which have no chips, cracks or other flaws by visual inspection.
- Samples should be transferred into the tube using appropriate apparatus, such as extended Pasteur pipettes which allow the solution to be deposited straight into the bottom of the NMR tube.
- All used glassware or other sharps must be either placed in an appropriate container after use or disposed of in a sharps safe bin.
- Risk of exposure during loading of the sample is no different from that during sample preparation and the worker and/or supervisor is responsible for ensuring appropriate risk assessments have been carried out for their work

Emergency procedures

In the event of any of the following scenarios please ensure the Instrument Manager has been informed as soon as it is safe to do so.

In the event of magnet quench/loud alarm sounding within the NMR room

In the event of a quench, apparent by a loud alarm within the chamber and/or the noise of escaping gas and vapour clouds above the magnet:

- Evacuate the NMR room, ensuring those around you also do so.
- Inform the instrument manager.
- Areas outside of 5-013 can be considered safe.
- The room may be entered only when the oxygen alarm has abated.

Damage to the facility equipment indicating fault

Let the Instrument Manager know as soon as possible of any damage to any of the NMR room equipment or if any equipment indicates fault. Especially important are audible alarms.

Metal objects become attached to a magnet

If a metal object accelerates and strikes an NMR magnet cryostat:

- Evacuate the room immediately, ensuring those around you are aware.
- Under no circumstances should an attempt be made to pull a stuck metal object away from an NMR cryostat as this may trigger a quench.
- Inform the Instrument Manager.

Sample breakage inside a spectrometer

If you suspect a tube has broken inside the NMR spectrometer (e.g. no lock solvent signal):

- Do not eject the sample using the lift air.
- Inform those around you to ensure no-one else attempts to eject the sample.
- Inform the instrument manager as soon as possible.
- Do not attempt any remedial work.

Reactive emergency maintenance

In the event of a flood or other problem within the NMR room, no-one is to enter until the Instrument Manager had been contacted and given their authorisation for non-authorised users to enter.

Security incident

Any unauthorised access to the facility must be reported to the Instrument Manager.

Also see section 4.6: *Sapphire fire suppression system*.

7.4.1 Unsupervised access to the NMR room

To be provided

8. Field trips/excursions

Field trips/excursions are those which take place outside the defined boundaries of MacEwan University. While the level of potential risk to be considered will vary, depending on the type and location of the field trip/excursion, a *Hazard assessment and control report* (found in the *Forms Cabinet* at *MyMacEwan.ca*) must be completed for all field trips/excursions.

Field trip supervisors must be competent to run the activity and must provide reasonable supervision to ensure that participants do not endanger themselves or others. Waiver forms may be necessary to draw particular attention to the assumption of recognized risks.

Contingency plans for possible emergencies must be understood by all participants. Field trip activities present unique concerns for personal safety. People can become sick or injured and often care must be provided far away from home and next of kin. Rules about responsible conduct must be understood by all participants in advance of the field trip. All personnel must be alerted about risks to personal safety or security.

If the field trip or excursion includes locations outside City Limits (within Alberta), within Canada or International travel a *Travel Information Collection Form (see appendix 27)* must be filled out by all participants.

8.1 Important considerations for field trips/excursions

Field trip/excursion supervisors are responsible for ensuring that all required safety and risk management concerns have been addressed, appropriate procedures documented, and required training provided to participants prior to the commencement of the field trip/excursion. The following are typically required for approval of field trips/excursions:

- Field site and equipment hazard assessment
- Standard operating procedures to deal with identified risks
- Communications and emergency preparedness plan
- Environmental impact protocols (to deal with any specific environmental issues)
- Insurance and waiver provisions
- Health care protocols (including ensuring the satisfactory health of all participants).

Standing approval may be given for field trips/excursions that are repetitive in nature, providing the excursions are identical and the SOP has proven sufficient.

8.2 Transporting students

Employees of MacEwan University are not able to use their personal vehicles to transport students. The insurance purchased by MacEwan University does not cover loss or damage resulting from a MacEwan University employee's use of his or her own vehicle. It is not possible for MacEwan University to ensure that each employee has adequate insurance coverage, and therefore the transportation of students in personal vehicles is prohibited.

Where a MacEwan University employee is required to travel locally with a student, the use of licensed taxis or public transit should be considered. Where a MacEwan University employee takes his or her own vehicle, the student must not travel with the employee. In a true emergency situation, it is recommended that an ambulance be called.

Members of the Department of Physical Sciences are able to obtain rental cars for the purpose of transporting students, subject to appropriate Departmental approvals. Rental cars may be rented and the expense reimbursable to the employee as provided for in the Allowable Expenses Policy. Vehicles must be rented in the name of MacEwan University. Employees should rent vehicles for the purposes of transporting students using their MacEwan P-card. Where vehicles are rented by employees for University business in the name of the University, MacEwan University's insurance coverage will apply.

MacEwan University students are able to drive their own vehicles to MacEwan University related study or sports events (including field excursions) off campus. However, in the event a student has an accident and suffers a loss, the student's personal insurance policy would need to respond to the loss. The University's insurance policies would not cover the student, passengers or the student's vehicle in this circumstance.

MacEwan University students may rent a vehicle to travel to MacEwan University related study events off campus, but the student must have the consent of the University to rent a vehicle and the vehicle must be rented in the name of the University. In the event a student has an accident and suffers a loss while driving to the off-campus location, if the student is driving a vehicle rented in the student's own name, there will be no insurance coverage under the University's policies for the student or the vehicle. However, coverage may be purchased from the rental company. If the student is driving a vehicle rented in the name of the University with the consent of the University, the University's policies will cover loss to the student and damages to the rental vehicle up to an amount of $50,000.

Any MacEwan University employee who rents a vehicle to transport students must ensure that they are properly licensed to operate the rented vehicle. For example, a valid Class 5 Operator's

Permit is required for vehicles with a capacity of 15 and fewer people while that vehicle is transporting any person in addition to the operator, while a valid Class 4 Operator's Permit is required for vehicles with a capacity of more than 15 but fewer than 25. For specific requirements, see *Service Alberta: Driver's Licence*.

For questions with respect to insurance coverage, contact Jim Ross (780 497-4402).

8.3 Waiver

For fieldwork involving students in the Department of Physical Sciences, faculty can use the *Fieldwork Participant Release of Liability* (see appendix 28) developed by the Department.

9. Appendices

Appendix 1: Volunteer Registration Form

Appendix 2: Department of Physical Sciences Laboratory User Orientation and Safety Record

Appendix 3: Emergency Equipment and Supplies Map

Appendix 4: Fire Extinguisher Monthly Inspection Checklist

Appendix 5: First Aid Monthly Inspection Checklist

Appendix 6: Area First Aid Designates

Appendix 7: Emergency Eyewash Station Weekly Inspection Checklist

Appendix 8: Emergency Safety Shower Station Weekly Inspection Checklist

Appendix 9: Spill Kit Monthly Inspection Checklist

Appendix 10: Muster Points

Appendix 11: Volatile Organic Compounds

Appendix 12: Laboratory Hazard Placards

Appendix 13: Emergency Procedures Poster

Appendix 14: Laboratory Rules Posters- wet laboratories and dry laboratories

Appendix 15: Laboratory Notification Contact List

Appendix 16: Chemical Storage Cabinet Placards

Appendix 17: Laboratory Inspection Checklist- wet laboratories and dry laboratories

Appendix 18: Laboratory Administration Checklist

Appendix 19: Standard Operating Procedures Template

Appendix 20: Accessing H-MIS Employee Instructions

Appendix 21: Working Alone Authorization Form

Appendix 22: Unattended Operations Information Sign

Appendix 23: Unattended Operations Warning Sign

Appendix 24: Waste Management and Waste Minimization in the Department of Physical Sciences

Appendix 25: Solvent Recovery Standard Operating Procedure

Appendix 26: Materials Transfer Form

Appendix 27: Travel Information Collection Form

Appendix 28: Fieldwork Participant Release of Liability

GRANT MACEWAN UNIVERSITY
VOLUNTEER REGISTRATION

NOTE: May only be used for volunteers that are over 18 years old with Canadian Citizenship or Permanent Resident Status

WARNING – BY SIGNING THIS FORM,
YOU GIVE UP IMPORTANT LEGAL RIGHTS INCLUDING THE RIGHT TO SUE! PLEASE READ CAREFULLY!

VOLUNTEER TO COMPLETE THE FOLLOWING SECTION:

(Print only)				
Name of Volunteer	Last Name		First Name	
Street Address				
	City	Province	Country	Postal Code
Phone Number	( )	Email Address		
Birth Date	mm/dd/year	Identification Number (Student or Employee ID) (If applicable)		
Emergency Contact	Last Name		First Name	
Relationship		Phone Number	( )	Ext

DEPARTMENT TO COMPLETE THE FOLLOWING SECTION:

DEPARTMENT/FACULTY: _____

SUPERVISOR: _____ **TELEPHONE NO:**_____

DATES From: _____ To: _____

VOLUNTEER DUTIES (identify briefly duties to be performed and attach a sheet if more room is required):

_____

_____

_____

_____

_____

LOCATION (where duties will be performed): _____

_____

VACCINATIONS REQUIRED (if any) _____

_____

(Department/Faculty: Please contact Environment, Health and Safety for safety training. If this involves foreign travel, allow lead time for immunization.)

ACCEPTANCE OF RESPONSIBILITIES

In consideration of my volunteer work,

1. I understand that I am **not** entering into an employment relationship with the MacEwan University and that I am not entitled to receive a salary or any employee benefits. I acknowledge that my duties and responsibilities have been explained in detail. I understand that either the University or myself may terminate this volunteer relationship at any time without notice.

2. I understand that I have an obligation to respect the confidentiality of any sensitive information or dealings, which may relate to my volunteering at the University and I agree that I will not disclose any information without the prior written authorization. I understand that my obligation of confidentiality continues into perpetuity.

3. I understand that the department will provide me with applicable safety information or training required for these volunteer duties and I agree that I will follow all rules, guidelines and abide by any and all risk assessments, health and safety regulations and instructions received prior to or during the above noted volunteer duties;

4. I acknowledge that I am subject to MacEwan University policies and procedures and that I represent the University. I, therefore, agree to conduct myself accordingly at all times while performing my volunteer duties.

5. If as part of my duties/responsibilities I am required to drive the University vehicles while performing my volunteer duties, I will meet all the necessary driver requirements and follow all policy and procedures related to those requirements as contained in the Fleet Safety Program.

The personal information requested on this form is collected under s. 33(c) of the *Freedom of Information and Protection of Privacy Act*, for the purpose of facilitating your volunteer activities at MacEwan University. Questions concerning this collection should be directed to the: Information Management and Privacy Coordinator, MacEwan University, 10700 - 104 Avenue, Edmonton, AB T5J 4S2; tel.: 780.497.5423; privacy@macewan.ca.

ASSUMPTION OF RISKS AGREEMENT

ASSUMPTION OF RISK

I ACKNOWLEDGE THAT I AM AWARE THAT THERE ARE RISKS ASSOCIATED WITH OR RELATED TO THE VOLUNTEER DUTIES DESCRIBED ABOVE THAT I WILL BE REQUIRED TO PERFORM. THESE RISKS INCLUDE, BUT ARE NOT LIMITED TO:

1. THE RISKS ASSOCIATED WITH TRAVEL TO AND FROM LOCATIONS WHERE MY DUTIES WILL BE PERFORMED INCLUDING TRANSPORT BY PUBLIC OR PRIVATE MOTOR VEHICLE, BUS, TRAIN OR OTHER ALTERNATE TRANSPORTATION SYSTEM;

2. THEFT, VANDALISM OR LOSS OR DAMAGE TO MY PERSONAL PROPERTY;

3. ANY MANNER OF INJURY OR DEATH RESULTING FROM USE OR MISUSE OF EQUIPMENT/TOOLS REQUIRED TO PERFORM MY VOLUNTEER DUTIES;

4. ANY MANNER OF PHYSICAL OR MENTAL INJURY (INCLUDING DEATH) THAT COULD RESULT FROM CARRYING OUT MY VOLUNTEER DUTIES.

I FREELY ACCEPT AND FULLY ASSUME ALL SUCH RISKS AS GIVEN ABOVE, DANGERS AND HAZARDS AND THE POSSIBILITY OF PERSONAL INJURY, DEATH, PERMANENT DISABILITY, PROPERTY DAMAGE OR LOSS RESULTING THEREOF.

Initials: _____

MEDICAL/HEALTH INSURANCE, OTHER PERSONAL INSURANCE

I AM SOLELY RESPONSIBLE to select and purchase adequate medical/health insurance. **No** medical/health insurance will be provided by MacEwan University. In the event of a medical/health problem, the University accepts no responsibility for any costs associated with a medical/health problem nor will they pay for any medical/health expenses which may be incurred by the Volunteer.

The University **does not** insure personal vehicles or property for either employees or volunteers. Volunteers who bring personal property with them or who will be driving their own vehicles for volunteer purposes are urged to contact their insurance broker to ensure that they have adequate personal automobile and property insurance.

As a **"registered volunteer"** while properly carrying out your Volunteer Duties you are insured under the University's general liability insurance policy against legal liability claims from third parties for property damages, bodily injury and personal injury as long as you have not willfully, maliciously or intentionally caused the injuries.

I freely accept and assume all responsibility to provide myself with medical/health insurance, personal insurance and travel insurance coverage, as applicable.

Initials: _____

RELEASE OF LIABILITY, WAIVER OF CLAIMS AND INDEMNITY AGREEMENT

I HEREBY RELEASE THE GOVERNORS OF MACEWAN UNIVERSITY AND ITS MEMBERS, OFFICERS, EMPLOYEES, STUDENTS, AGENTS, VOLUNTEERS AND INDEPENDENT CONTRACTORS FROM LIABILITY FOR ANY LOSS, DAMAGE, INJURY (INCLUDING DEATH) OR EXPENSE, WHICH I OR MY NEXT OF KIN MAY SUFFER AS A RESULT OF MY VOLUNTEER DUTIES AS NOTED ABOVE, INCLUDING ANY LOSS, DAMAGE, INJURY OR EXPENSE UNLESS CAUSED BY THE NEGLIGENCE OF THE GOVERNORS OF THE UNIVERSITY. I AGREE TO BE SOLELY RESPONSIBLE FOR ANY SUCH LOSS, DAMAGE OR INJURY.

Initials: _____

ACKNOWLEDGEMENT

I HAVE READ AND UNDERSTOOD THIS AGREEMENT, in entering into this Agreement, I am not relying upon any oral or written representations or statements made by the Governors of the University other than what is set forth in this Agreement. I am aware that by signing this agreement, I am WAIVING CERTAIN LEGAL RIGHTS, which I or my heirs, next of kin, executors, administrators, assigns and representatives in the event of my death or incapacity may have against the Governors of the University.

This waiver shall be governed and construed in accordance with the laws in force in the Province of Alberta and the federal laws of Canada, as applicable. The courts of Alberta shall have exclusive jurisdiction over all claims, disputes and actions arising out my Volunteer Duties.

Signed this _____ day of _____, 20 _____, at Edmonton, Alberta.

_____	_____
Signature of Volunteer	Signature of Witness
_____	_____
Printed name of Volunteer	Printed name of Witness

MacEwan UNIVERSITY | PHYSICAL SCIENCES

Department of Physical Sciences Laboratory User Orientation & Safety Record

This orientation and safety record, and accompanying instructions, must be completed by all new faculty, staff or students in order to gain access to laboratories within the Department of Physical Sciences. Completed forms must be returned to the Chair, Department of Physical Sciences, in order for laboratory key card access to be set-up.

Section 1: User Information			
Last Name		First Name	
Job Title	☐ Faculty ☐ Staff ☐ Adjunct Faculty ☐ Other		
	☐ Undergraduate research student: for-credit	☐ Undergraduate research student: for-pay	
	☐ Undergraduate research student: volunteer	☐ Student laboratory assistant	
	☐ Graduate research student	☐ Post-doctoral researcher	
Department		Discipline	
E-mail Address		Phone Number	
Office Number			
Supervisor's Name (required for students)		Expected Completion Date (required for students)	

Section 1A: Key Authorization		
The Department of Physical Sciences Laboratory Access Form, and accompanying instructions, must be used for new faculty, staff, or students in order to gain card access to Physical Sciences laboratories, or to increase previously approved access. Approval of all requests is by the Department Chair (or designate). Access cards must be obtained and signed for in person.		
Authorizing Name (print)	**Signature**	**Date**

Section 2A: Required Training

1) All new faculty, staff or students must complete the mandatory WHMIS and Laboratory Safety training program. The training provides an overview of the Department of Physical Sciences safety policies, reviews the location of emergency equipment within the laboratories, egress procedures during an evacuation, chemical storage and transport requirements, hazardous waste, and reporting of injuries and illness.

☐ **WHMIS 2015**
Date completed:_____

☐ **Laboratory Safety**
Date completed:_____

2) Individuals seeking access to Physical Sciences Laboratories where hazardous materials are used or stored (i.e. wet laboratories), must complete the following training:

☐ **Hazardous Materials Inventory System (H-MIS)**
Date Completed:_____

☐ **Chemical Waste Disposal**
Date Completed:_____

☐ **Spill Response**
Date Completed:_____

3) Individuals who will be working in the joint Biological & Physical Sciences Instrument Laboratory (5-013) are required to complete the following training:

☐ **Sapphire Fire Suppression**
Date Completed:_____

4) Individuals who will be working in the NMR room (5-013A) are required to complete the following training:

5) ☐ **NMR Safety and Orientation**
Date Completed:_____

Training verification is by the Department Chair (or designate), or, in the case of students, by their supervisor.

Training verified by (print)	Signature	Date

Section 2B: Laboratory Orientation Checklist

☐Reporting an emergency occurring on campus: **On a MacEwan phone, dial 5555. On a cell phone, dial (780) 497-5555**. MacEwan Security will respond directly and will route the call to local police or fire departments, or ambulance and other services.

☐Emergency Contacts List

Location of Emergency Equipment

☐Safety manual
☐Safety data sheets (SDS)
☐Fire extinguishers
☐Emergency shower(s) and emergency eye wash(es)
☐Emergency telephones or lab phone
☐Spill control kit and first aid kit
☐Nearest fire pull station
☐Safety glasses, lab coats, protective gloves, masks, other unique protective equipment

Egress from Lab/Building During Evacuation

☐Emergency gas shut off
☐Location of the emergency exit(s) from lab
☐Show emergency route from the floor (primary and secondary routes)
☐Explain that after leaving the building, people must proceed to muster points
☐Instruct new members to:

1. Turn off reaction/equipment when possible
2. Close door
3. Leave the lights on

Chemical Storage & Transport

☐Location of gas cylinder storage areas
☐Location of bottle carriers
☐Location of chemical storage facilities (solvent cabinets, acid/ base, oxidizer storage)
☐Advise new member that all chemicals must be labeled with complete workplace labels
☐Transport chemicals via bottle carriers, chemical shipping box or sealed secondary container

Hazardous Materials Inventory System (H-MIS)

☐Use of barcode system
☐Updating inventory for received or transported chemicals
☐Empty bottle disposal book

Hazardous Waste

☐Location of waste collection drums
☐How to separate wastes
☐How to label waste bottles
☐How to record waste

Sharps

☐Disposal containers

Laboratory Specific Procedures (Standard Operating Procedures, biohazard containment, and disposal). Describe:

Authorizing Individual (print)	Signature	Date

Section 2C: Authorization & Training Assessment

Individuals seeking access to the Department of Physical Sciences Laboratories must receive authorization from the Department Chair (or designate). The individual's supervisor must assess the need for additional training (beyond mandatory training) to ensure each person can work safely with the hazards present in their work space. This assessment should be indicated by checking the boxes next to the applicable training requirements in the table below. The authorizing individual must print and sign below.

Training Assessment

Training	Who Needs It	How To Get It	Date Completed
☐ First Aid and CPR	Individuals designated emergency first aiders by the Physical Sciences Safety Committee		
☐ Fire Extinguisher Training	Recommended for all faculty and staff in the Department of Physical Sciences		
☐ Transportation of Dangerous Goods	Mandatory for faculty and staff who transport dangerous goods		
☐ After Hours/Working Alone	Any faculty, staff or student that will be working in a laboratory outside normal university hours (8:30am-4:30pm), or where assistance is not readily available		
☐ Cryogen Safety	Individuals who work with cryogens		
☐ Compressed Gas Safety	Individuals who work with compressed gases		
☐ Laboratory Inspection	Individuals responsible for performing laboratory inspections		
☐ Natural Gas Protocol	Individuals using natural gas		

Authorizing Individual (print)	Title	Signature & Date

Section 3: Personal Protective Equipment (PPE) Assessment			
The Department Chair (or designate), or, in the case of students, their supervisor must determine if hazards are present, or are likely to be present, which necessitate the use of personal protective equipment (PPE). If such hazards are present, or likely to be present, and are not appropriately addressed through the use engineering controls, the Supervisor must select, and have each affected employee use, the types of PPE that will protect the affected employee from the hazards identified.			
Target	**Hazard Category**	**Required Personal Protective Equipment**	**Requirement**
☐Respiratory System	☐Biological ☐Chemical ☐Electrical ☐Physical	☐Particulate removing respirator ☐Vapor/gas removing respirator ☐Combination	When respiratory hazards cannot be safely controlled utilizing engineering or work practice controls, employees may need to use respiratory protection.
☐Skin/Body	☐Biological ☐Chemical ☐Electrical ☐Physical	☐Lab coat ☐Apron ☐Other protective clothing ☐Plexiglass shielding	Protective clothing is used to protect employees from chemical, biological, and physical hazards.
☐Eye/Face	☐Biological ☐Chemical ☐Electrical ☐Physical	☐Safety glasses ☐Prescription safety eyewear ☐Safety goggles ☐Face shield	MacEwan University requires eye and face protection if employees are exposed to eye and face hazards from flying particles, molten metal, liquid chemicals, acids or caustic liquids, chemical gases or vapors, potentially infectious materials or potentially harmful light radiation.
☐Head/Hand	☐Biological ☐Chemical ☐Electrical ☐Physical	☐Hearing protection ☐Chemically resistant gloves/sleeves ☐Thermal protective gloves	Potential hazards include skin absorption of harmful substances, chemical burns, electrical dangers, bruises, abrasions, cuts, punctures, fractures and amputations. Protective equipment includes gloves, finger guards and arm coverings or elbow length gloves. Hearing protective devices such as ear plugs or ear muffs shall be used to protect against hearing loss when employees are exposed to hazardous levels of noise.

☐Foot	☐Biological ☐Chemical ☐Electrical ☐Physical	☐Closed toed shoes ☐Booties	Employees whose work involves exposure to hot substances or corrosive materials must have appropriate gear to cover exposed body parts, including legs and feet. If an employee's feet may be exposed to electrical hazards, non-conductive footwear should be worn.

Employees who are required to use PPE must be trained in its use. PPE training must cover at a minimum:

- When PPE is necessary
- What type of PPE is necessary
- How to properly put on, take off, adjust, and wear the PPE
- The limitations of PPE
- Inspection and maintenance of PPE

Initial PPE training is provided by EH&S. Additional PPE training may be needed if there are changes in the workplace or in the type of required PPE. Retraining shall also be required if an employee is not demonstrating the proper understanding and skill level in the use of PPE.

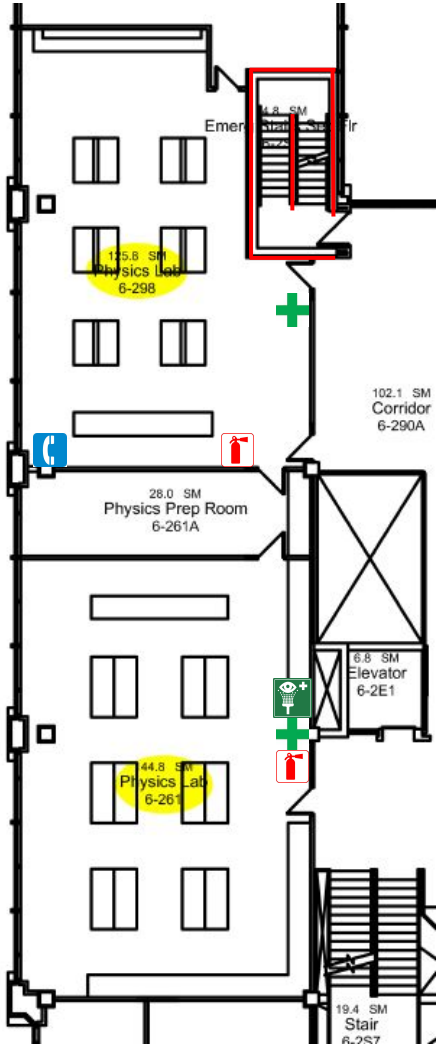
Authorizing Individual (print)	Title	Signature & Date

Section 4: Certification	
Please certify that you understand and agree to the requirements indicated above with your name and signature below. Return this form to the Chair, Department of Physical Sciences.	
Employee Name (print)	**Signature & Date**

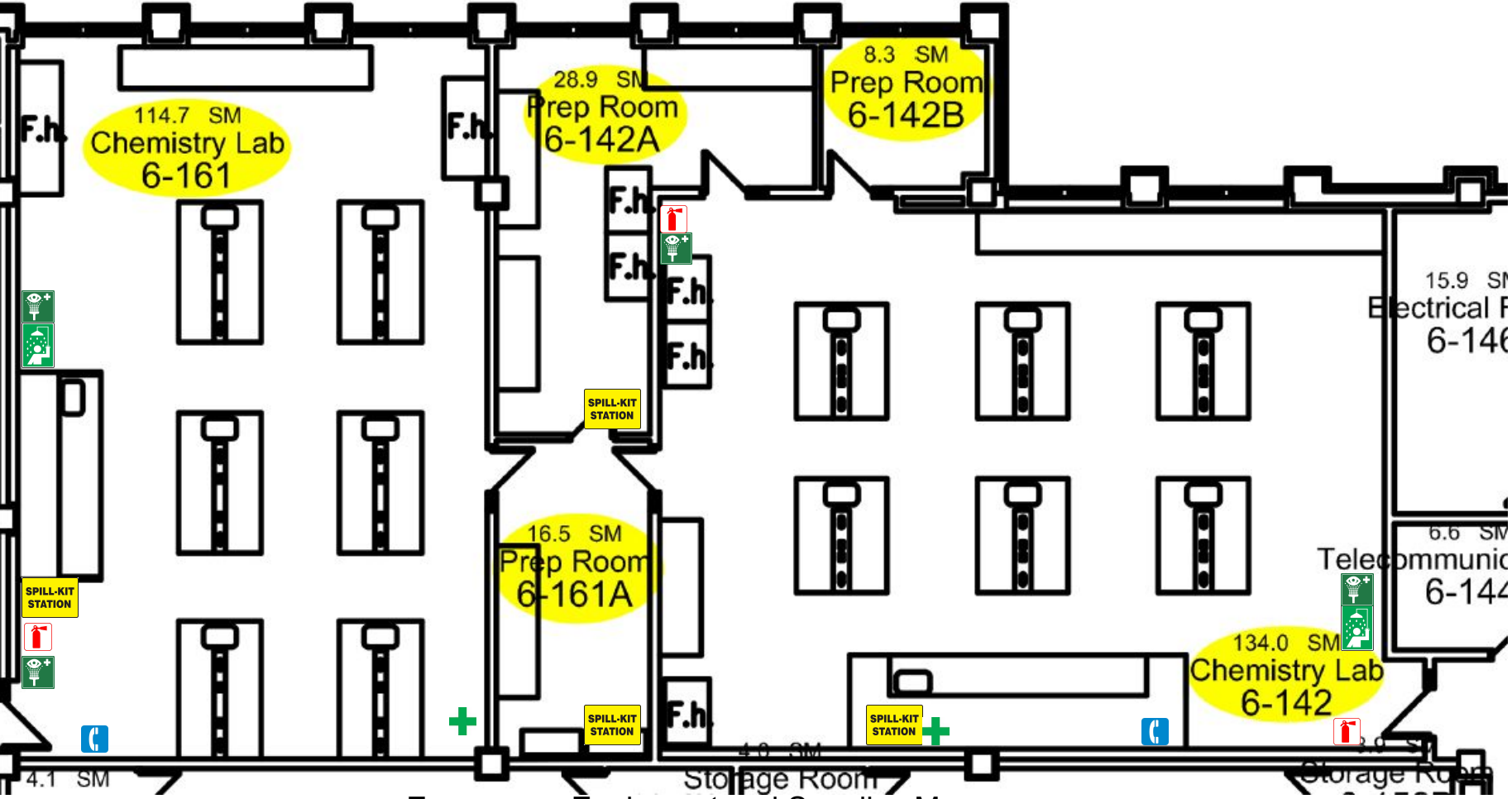
Emergency Equipment and Supplies Maps: Legend

	Eye Wash
	Emergency Shower
	Emergency Phone
	Fire Extinguisher
	Fire Alarm
	First Aid
	Spill Kit
	Emergency Staircase

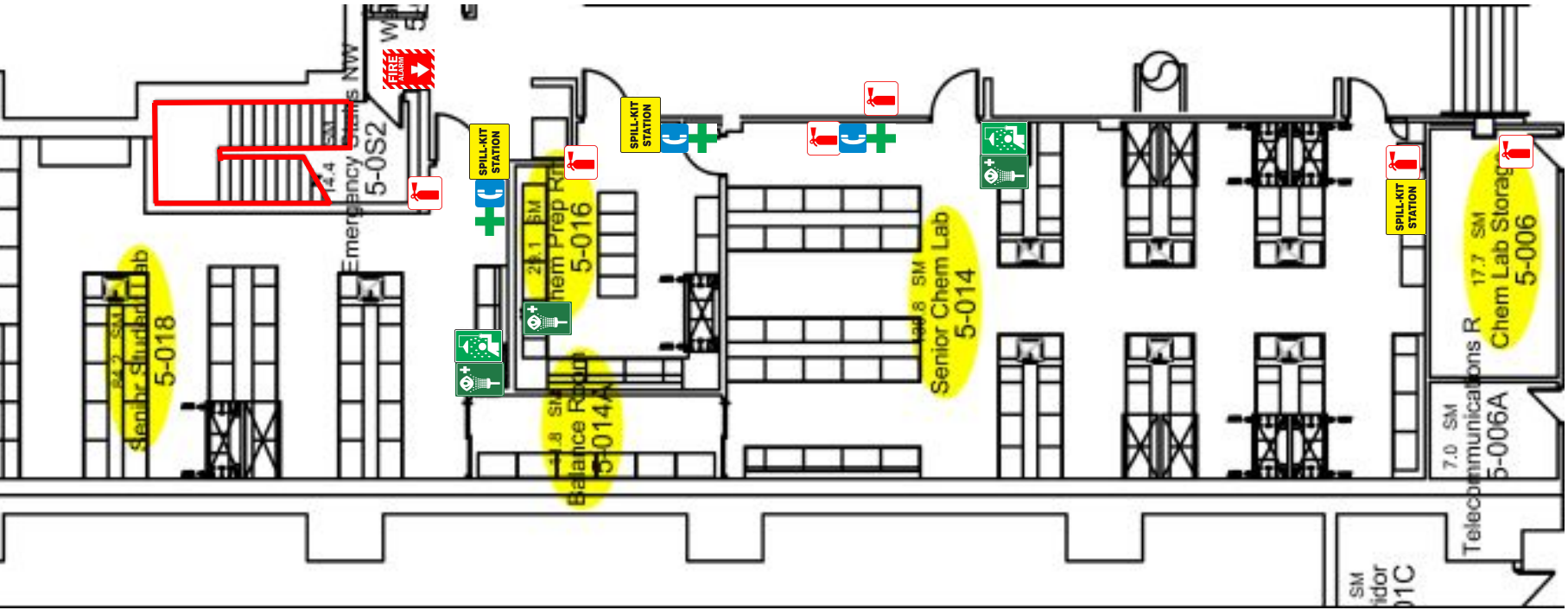
Emergency Equipment and Supplies Map
5-024



Emergency Equipment and Supplies Map
6-261 & 6-298



Emergency Equipment and Supplies Map
6-142 & 6-161



Emergency Equipment and Supplies Map 5-006, 5-014, 5-016 & 5-018

Emergency Equipment and Supplies Map
5-009

MacEwan UNIVERSITY | PHYSICAL SCIENCES

Fire Extinguisher
Monthly Inspection Checklist

Weekly Inspection Procedure:

1. Ensure the area around the fire extinguisher is free of obstructions.
2. Ensure fire extinguisher sign is affixed in plain view above extinguisher.
3. Ensure the indicator arrow on the readout dial is within the green zone.
4. Visually inspect the extinguisher to ensure there are no broken parts, the pin is in place, etc.

Date	Initials	Comment

Date	Initials	Comment

Room:_____

MacEwan UNIVERSITY | HUMAN RESOURCES

Maintenance of First Aid Kit – Number 3 First Aid Kit

Name of Campus:_____ **First Aid Station (building/room number):**_____

All Number 3 First Aid Kit at MacEwan University must contain the following items:

Description	Quality Required	Quality Found	Date of Inspection dd/mm/yyyy	Inspected by
Antiseptic cleansing towelettes, individually packaged	24			
Sterile adhesive dressings, individually packaged	100			
10 centimetres x 10 centimetres sterile gauze pads, individually packaged	50			
10 centimetres x 10 centimetres sterile compress dressings, with ties, individually packaged	6			
15 centimetres x 15 centimetres sterile compress dressings, with ties, individually packaged	6			
20 centimetres x 25 centimetres sterile abdominal dressing, individually packaged	4			
Conform gauze bandages — 75 millimetres wide	6			
Cotton triangular bandage	12			
Safety pins — assorted size	12			
Pair of scissors	1			
Pair of tweezers	1			
25 millimetres x 4.5 metres rolls of adhesive tape	2			
Crepe tension bandages — 75 millimetres wide	4			
Resuscitation barrier device with a one-way valve	1			
Pairs of disposable surgical gloves	12			
Sterile, dry eye dressings, individually packaged	2			
Tubular finger bandage with applicator	1			
First aid instruction manual (condensed)	1			
Inventory of kit contents	1			
waterproof waste bags	2			

MacEwan UNIVERSITY | WORKPLACE HEALTH AND SAFETY

City Centre Campus Building 5

1. **List of First Aiders**

Names	Location	Phone Number
Dr. Jorge Llano	5-132D	780-497-4077
Terri Ann Alton	5-138Q	780-446-5521
Rosie Colangelo	5-173	780-497-4484
Jeremy Gauthier	5-131E	780-633-3443
Sareena Prasad	5-241	780-633-3344
Laura Laszl	5-256	780-497-5106
Cynthia Winterhalt	5-306	780-497-5215

2. **Location of First Aid Kits**

Basement	Room 5-009, 5-014, 5-024, 5-027
First floor, 1st	5-103G, 5-138, 5-174
Second floor, 2nd	5-241
Third floor, 3rd	5-306

3. **Emergency Number – 911**
4. **Campus Security – 780-497-5555**
5. **If First Aid has been opened or used some supplies, please contact building OHS designate below.**

Basement	Dorothy Skepple	780-497-4490
First floor, 1st	Dorothy Skepple	780-497-4490
Second floor, 2nd	Sofiya Jibril	780-633-3398
Third floor, 3rd	Sofiya Jibril	780-633-3398

MacEwan UNIVERSITY | PHYSICAL SCIENCES

Emergency Eyewash Station
Weekly Inspection Checklist

Weekly Inspection Procedure:

1. Ensure the area around the eyewash station is free of obstructions.
2. Ensure the eyewash sign is affixed in plain view above eyewash.
3. Activate the eyewash for 30 second to one minute.
4. Upon activation, nozzle covers should automatically disengage from the nozzle.
5. The water should be tepid and begin to flow from both nozzles within 1 second with equal pressure.
6. The eyewash should remain active until the lever is released or the handle is returned to the shut-off position.
7. Visually inspect the station to ensure there are no broken parts, leakages, etc.

Use of Emergency Eyewash Station:

1. Activate and flush eyes for a minimum of 15 minutes. Hold eyelids open with the hands to fully irrigate the entire eye.
2. Seek assistance from any other lab personnel in flushing the eyes.
3. If an assistant is available, have the SDS reviewed for any further first aid requirements for the hazardous material involved.
4. Call Campus Security (5555). Seek medical attention if required.
5. Once the emergency has subsided, notify the supervisor of the incident.
6. The Supervisor must complete an *Incident Report* Form.

Date	Initials	Comment

Date	Initials	Comment

Date	Initials	Comment

Room: _____

MacEwan UNIVERSITY | PHYSICAL SCIENCES

Emergency Safety Shower Weekly Inspection Checklist

Weekly Inspection Procedure:

1. Ensure area around the safety shower is free of obstructions.
2. Ensure the safety shower sign is affixed in plain view above the shower.
3. Activate the shower for 30 seconds to one minute.
4. The water should be tepid and begin to flow from the head within 1 second with adequate pressure.
5. The shower should remain active until the lever is released or the handle is returned to the shut-off position.
6. Visually inspect the station to ensure there are no broken parts, leakages, etc.

Use of Emergency Safety Shower:

1. Activate and flush skin for a minimum of 15 minutes. Remove contaminated clothing
2. Seek assistance from any other lab personnel in flushing the affected area or removing clothing.
3. If an assistant is available, have the SDS reviewed for any further first aid requirements for the hazardous material involved.
4. Call Campus Security (5555). Seek medical attention if required.
5. Once the emergency has subsided, notify the supervisor of the incident.
6. The Supervisor must complete an *Incident Report* Form.

Date	Initials	Comment	Date	Initials	Comment	Date	Initials	Comment

Room:_______________

MacEwan UNIVERSITY | PHYSICAL SCIENCES

Spill Kit
Monthly Inspection Checklist

Monthly Inspection Procedure:

1. Ensure area around the spill kit is free of obstructions.
2. Ensure spill kit sign is affixed in plain view above the kit.
3. Ensure supplies listed below are present and in good condition:
   - 2x SPILL-X-A (acids)
   - 2x SPILL-X-C (caustics)
   - 2x SPILL-X-S (solvent)
   - pH paper
   - safety glasses/goggles
   - Nitrile gloves
   - Broom and pan
   - Scraper
   - Chemical spill waste bags
   - Spill kit treatment guide

Spill Clean-up Procedure:

1. Obtain the required spill supplies, put on appropriate protective equipment.
2. Contain the spill by pouring a ring of absorbent around it.
3. Using forceps or tongs remove broken glass or sharp objects.
4. Pour additional absorbent on the spill. Always starting at the edges and moving toward the center of the spill site.
5. Using a broom or scraper work the absorbent into the spill sweeping from the outer edge toward the center.
6. Add absorbent until it does not appear wet and there is no free liquid.
7. Checking the pH is between 4-10 using pH paper.
8. Scoop up all absorbed material and place in a plastic bag.
9. Wipe the spill area with a damp paper towel and place in a plastic bag.
10. Dispose of all cleanup materials as hazardous waste.
11. Report the spill to your supervisor and complete an *Incident Report Form*.

Date	Initials	Comment

Date	Initials	Comment

Room:_____

MacEwan UNIVERSITY

City Centre Campus

- **AED's**
- **Blue Phones**
- **Muster Points**

Legend

Security Services Office: 8-215

Campus Blue Phone

Note: Campus blue phones are generally found on the main level, just outside building entrances. They are also located on every level of the parkade by each exit (stairwell).

AED (Automated External Defibrillator)

1 - Building 5 by room 5-013
2 - Building 6 by room 6-153
3 - Building 6 by room 6-201V, Library
4 - Building 7 by room 7-110
5 - Building 7 in room 7-153, Child Care Centre
6 - Building 8 by room 8-110
7 - Building 8, Pool Deck
8 - Building 8, in room 8-215, Security Services
9 - Building 9, by room 9-212, near washroom
10 - Building 9, by room 9-313
11 - Building 10, USC near room 10-655H
12 - Residence, by room 1-110, West Entrance

Muster Points (Emergency Assembly Point) are generally City sidewalks.

5 Building 5

6 Building 6

7 Building 7

8 Building 8, Christenson Family Centre for Sport and Wellness

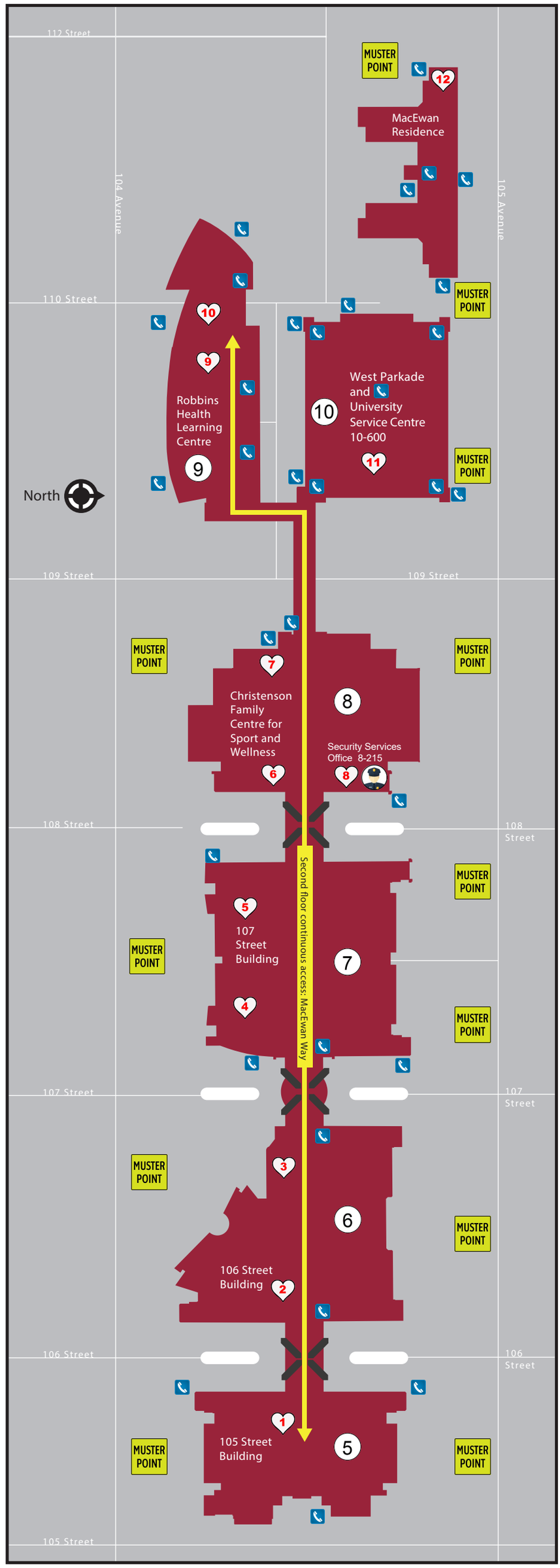
9 Building 9, Robbins Health Learning Centre

10 Building 10, University Service Centre (USC)

Room Numbering

6-123

Building # Floor # Room #



April 2016

Volatile Organic Compounds (VOCs)

1.0 Purpose of this document

Chemistry laboratories have intrinsic potential for indoor air quality issues. This document is intended to provide guidance on the acceptable exposure levels to commonly used VOCs in a laboratory setting.

2.0 Exposure Limits

VOCs can cause eye, nose and throat irritation, shortness of breath, headaches, fatigue, nausea, dizziness, and skin problems. Higher concentrations may cause irritation of the lungs, as well as damage to the liver, kidney, or central nervous system. The health effects caused by VOCs depend on the concentration and length of exposure to the chemicals as well as sensitivity of the exposed individual.

Common laboratory VOCs

Name of VOC	8-hour occupational exposure limit (OEL)	
	ppm	mg/m^3
Acetone	500	1200
Benzene	0.5	1.6
Ethanol	1000	1880
Ethylbenzene	100	434
Formaldehyde	0.75	0.9
Isobutyl Acetate	150	713
Methanol	200	262
Styrene	20	85
Toluene	50	188
Xylene	100	434

Alberta Occupational Health and Safety Code, Schedule 1, Table 2 (2009)

Ex. Individual chemical exposure using recorded TVOC exposure of 6 ppm and assuming 100% exposure to the following:

True [VOC] = Correction Factor$^{IBE/VOC}$ x PID Reading

Acetone = 1.2 CF x 6 ppm = 7.2 ppm
7.2 ppm = 17.1 mg/m^3

Methanol = 2.5 CF x 6 ppm = 15 ppm
15 ppm = 19.66 mg/m^3

3.0 Total Volatile Organic Compounds (TVOCs)

It is common practice to report total VOC concentration as opposed to individual values which allows for more efficient interpretation of VOC exposure. In non-industrial indoor environments most TVOC concentrations are below 1 mg/m^3 and few exceed 25 mg/m^3. Over this range the likelihood of sensory effects (irritation, fatigue) increases. At TVOC concentration above 25 mg/m^3 more severe health effects become a concern.

4.0 Recommendation

The maximum reported concentration for TVOC was 6 ppm (15 mg/m^3, isobutylene equivalent). Even at maximum exposure, if we evaluate for the most commonly used VOCs, acetone and methanol the exposure would not exceed the OELs. However, the recommended comfort target level for TVOC indoors is 1 mg/m^3, therefore all precautions should be made to ensure that exposure is as low as reasonably achievable.

Available fume hoods, laboratory procedures and personal protective equipment make the laboratory a relatively controlled environment. In the event of failure of any of the above controls, the nature of the chemicals in use and quantity should be further assessed to determine the effects.

5.0 References

Barn P. 2013. Indoor air quality assessments: Volatile organic compounds. Retrieved from http://www.ncceh.ca/sites/default/files/CIPHI_National_2013_VOCs-Barn.pdf

Berglund B. 1997. Total volatile organic compounds (TVOC) in indoor air quality investigations. Luxembourg: European Commission Joint Research Centre – Environment Institute.

Canadian Health Measures Survey: Indoor air volatile organic compound data, 2012 and 2013. Retrieved from http://www.statcan.gc.ca/daily-quotidien/150916/dq150916d-eng.htm

AUTHORIZED PERSONNEL ONLY

For Emergencies Call 911

Biosafety Level 2

Required PPE

Lab coat
Safety glasses

Floor-length pants
Gloves

Closed-toe shoes
(no foot/heel/toes exposed)

CONTACTS:

Primary Contact	(780) 123-4567 / (780) 000-0000
Secondary Contact	(780) 123-8910 / (780) 111-1111

For additional assistance contact Campus Security (780-497-5554)

AUTHORIZED PERSONNEL ONLY

For Emergency Responders

Explosives

Non-flammable/Non-toxic Gas

Flammable Gas

Flammable Liquid

Spontaneously Combustible

Flammable Solid

Dangerous When Wet

Oxidizer

Organic Peroxide

Toxic Substance

Infectious Substance

Corrosive

Miscellaneous Products

SAFETY DATA SHEET (SDS) information can be accessed by contacting security (780) 497-5554

For a complete listing of all chemicals stored in laboratory see the inventory list located inside lab door.

MacEwan UNIVERSITY | PHYSICAL SCIENCES

Department of Physical Sciences
Wet Laboratory Rules

- **Wear appropriate personal clothing for the laboratory to protect exposed skin. Wear shoes that provide full coverage of the feet. Tie back long hair.**

- **Eye protection and laboratory coats are mandatory when in the laboratory. If you wear contact lenses in the laboratory, you are prohibited from removing, adjusting, or inserting them.**

- **Be aware of the location of the first aid kit, spill kit, fire extinguisher, nearest alarm pull stations, fire exit, and other emergency response equipment.**

- **Do not eat or drink in the lab. No water bottles! Do not bring or store food, drinks, and related eating utensils in a laboratory.**

- **Wear additional personal protective equipment (gloves, face shield, etc.) as appropriate when in the laboratory.**

- **Perform procedures that involve the liberation of volatile, flammable, strong smelling or toxic materials in a fumehood.**

- **Remove gloves before leaving the laboratory or before using non-hazardous equipment such as computers or instruments inside the laboratory.**

- **Wash hands after removing gloves, and before leaving the laboratory.**

- **Identify all containers, chemical storage areas, and waste appropriately.**

- **Dispose of waste frequently and in accordance with instructions.**

- **Only allow authorized individuals in the laboratory.**

- **Keep laboratory doors closed at all times when the laboratory is unoccupied.**

Department of Physical Sciences
Laboratory Rules

MacEwan UNIVERSITY | PHYSICAL SCIENCES

MacEwan UNIVERSITY | PHYSICAL SCIENCES

Department of Physical Sciences
Dry Laboratory Rules

- **Wear appropriate personal clothing for the laboratory to protect exposed skin. Wear shoes that provide full coverage of the feet. Tie back long hair.**

- **Be aware of the location of the first aid kit, spill kit, fire extinguisher, nearest alarm pull stations, fire exit, and other emergency response equipment.**

- **Do not eat in the laboratory. Do not bring or store food or related eating utensils in the laboratory.**

- **Wear additional personal protective equipment (eye protection, heat resistant gloves, etc.) as appropriate when in the laboratory.**

- **Keep all high voltage electrical equipment turned off and unplugged when not in use. Always turn off power supplies before changing connections to a circuit.**

- **When using spark generators (extremely high voltage) make sure that all participants are clear of the conducting rails before activating the spark.**

- **When using projectile launchers, ensure a clear path. Aim projectiles away from main aisles wherever possible.**

- **Do not look directly into lasers. Turn off lasers (or close apertures) before moving them around on the lab bench.**

- **Identify all containers, chemical storage areas, and waste appropriately.**

- **Dispose of waste frequently and in accordance with instructions.**

- **Only allow authorized individuals in the laboratory.**

- **Keep laboratory doors closed at all times when the laboratory is unoccupied.**

Department of Physical Sciences
Dry Laboratory Rules

MacEwan UNIVERSITY | PHYSICAL SCIENCES

Laboratory Notification Contact List

Last updated: May 06, 2016

Room No.	Priority	Name	Phone No.	Cell	Email
Physical Sciences					
Department Chair		Dr. Jonathan Withey	(780)497-4039	(780)913-9373	witheyj@macewan.ca
5-004/5-006	1	Jeffery Witty	(780)633-3819	(780)863-7194	wittyj0@macewan.ca
	2	Terri-Ann Alton	(780)633-3749	(780)965-1736	altont@macewan.ca
	Alt.	Jonathan Withey	(780)497-4039	(780)913-9373	witheyj@macewan.ca
5-009/5-011	1	Terri-Ann Alton	(780)633-3749	(780)965-1736	altont@macewan.ca
	2	Jeffery Witty	(780)633-3819	(780)863-7194	wittyj0@macewan.ca
	Alt.	Jonathan Withey	(780)497-4039	(780)913-9373	witheyj@macewan.ca
5-013 *Shared with Bio	1	Aaron Skelhorne	(780)497-5243	(780)224-8508	skelhornea@macewan.ca
	2	Terri-Ann Alton	(780)633-3749	(780)965-1736	altont@macewan.ca
	Alt.	Jonathan Withey	(780)497-4039	(780)913-9373	witheyj@macewan.ca
5-014/5-016	1	Jeffery Witty	(780)633-3819	(780)863-7194	wittyj0@macewan.ca
	2	Terri-Ann Alton	(780)633-3749	(780)965-1736	altont@macewan.ca
	Alt.	Jonathan Withey	(780)497-4039	(780)913-9373	witheyj@macewan.ca
5-018 *Shared with	1	Jeffery Witty	(780)633-3819	(780)863-7194	wittyj0@macewan.ca
	2	Terri-Ann Alton	(780)633-3749	(780)965-1736	altont@macewan.ca
	Alt.	Jonathan Withey	(780)497-4039	(780)913-9373	witheyj@macewan.ca
5-024	1	Terri-Ann Alton	(780)633-3749	(780)965-1736	altont@macewan.ca
	2	Jeffery Witty	(780)633-3819	(780)863-7194	wittyj0@macewan.ca
	Alt.	Jonathan Withey	(780)497-4039	(780)913-9373	witheyj@macewan.ca
6-142/6-161	1	Terri-Ann Alton	(780)633-3749	(780)965-1736	altont@macewan.ca
	2	Jeffery Witty	(780)633-3819	(780)863-7194	wittyj0@macewan.ca
	Alt.	Jonathan Withey	(780)497-4039	(780)913-9373	witheyj@macewan.ca
6-261/6-298	1	Michelle Hanlon	(780)497-4690	(780)716-3486	hanlonm2@macewan.ca
	2	Terri-Ann Alton	(780)633-3749	(780)965-1736	altont@macewan.ca
	Alt.	Jonathan Withey	(780)497-4039	(780)913-9373	witheyj@macewan.ca

Wet Laboratory Inspection Checklist

Department: Room Number:

Inspection Type: Self Inspection or Departmental Inspection

Date of inspection:

Inspected by: Laboratory Representative Present:

A	General Laboratory Safety	Yes	No	N/A	Inspector Comments	Laboratory representative comment/date corrected
1	Are emergency phone numbers posted on the laboratory door?					
2	Have laboratory door signs been updated in the last year?					
3	Are warning signs (no food/beverage) posted?					
4	Are food and/or beverages consumed in the lab?					
5	Are lab coats, glasses, gloves, booties and masks available?					
6	Are lab coats, glasses, appropriate clothing and closed-toe shoes worn and long hair tied back?					
7	Is there a first aid kit available?					
8	Is the first aid kit monthly inspection checklist posted?					
9	Is the first aid kit monthly inspection checklist current?					
10	Is the first aid kit adequately stocked?					
11	Are fire extinguisher(s) readily available?					
12	Is the fire extinguisher(s) monthly inspection checklist posted?					
13	Are the fire extinguisher(s) monthly inspections current?					
14	Is there a chemical spill kit available?					
15	Is the chemical spill kit monthly inspection checklist posted?					
16	Is the chemcial spill kit monthly inspection checklist current?					
17	Is the chemcial spill kits adequately stocked?					
18	Are emergency eye wash stations unobstructed?					
19	Is the emergency eye wash weekly inspection checklist posted?					
20	Are the emergency eye wash weekly inspections current?					
21	Is the safety shower unobstructed?					
22	Is the safety shower weekly inspection checklist posted?					
23	Is the safety shower weekly inspection current?					

24	Are chemical fumehoods free from excessive storage?					
25	Are equipment and apparatus located at least 6" back from the face of the fumehood? (with the exception of the double-sided hoods in 5-009/5-011)					
26	Are chemcial fumehood sashes closed when fumehoods are not in use?					
27	Are chemcial fumehood sashes kept at 12-18" when in use?					
28	Are compressed gas cylinders secured properly?					
29	Are protective caps in place when compressed gas cylinders are not in use?					
30	Are all floors clean, dry and in good repair?					
31	Are all ceiling tiles in good condition?					
32	Is housekeeping maintained? (e.g. are aisles uncluttered? are bench tops tidy?)					
33	Are exits free of any trip hazards or obstruction?					
34	Are stable stepstools available for reaching materials on high shelves?					
35	Are cleaning materials (e.g. soap, towels, broom, dust pan) available?					

B	Chemical Safety	Yes	No	N/A	Inspector Comments	Laboratory representative comment/date corrected
1	Are all highly flammable and toxic procedures being performed in a fumehood?					
2	Are approved explosion-proof refrigerators used for the cold storage of flammable liquids, when required?					
3	Are incompatible chemicals segregated in storage? (e.g. flammables and oxidizers; acids and bases)					
4	Are air and moisture sensitive chemcials properly stored? (e.g. sodium metal, hydrides like LiAlH4)					
5	Are peroxide forming chemicals labeled with opening date and tested?					
6	Are chemcial storage areas identified with signs? (e.g. flammable/combustible, corrosives, reactive & oxidizing, health hazard, air & moisture sensitive, peroxide formers)					
7	Are all chemcials properly labeled according to WHMIS legislation?					
8	Are all chemical containers in good condition? (e.g. not leaking)					
9	Do all chemicals have H-MIS bar codes?					
10	Is the laboratory chemical inventory available in the laboratory?					

11	Has the chemical inventory been updated in the last year?					
12	Are the storage locations of all chemicals listed on the chemical inventory?					
13	Is there less than 25L of flammable liquid open on the bench top?					

C	Equipment and Instrumentation Safety	Yes	No	N/A	Inspector Comments	Laboratory representative comment/date corrected
1	Are all electrical cords used properly? (e.g. no piggy-backing or surge protectors; not near a sink; clear of aisles)					

D	Hazardous Waste Safety	Yes	No	N/A	Inspector Comments	Laboratory representative comment/date corrected
1	Are disposal containers for "sharps" available?					
2	Are all sharps containers filled to an appropriate level (not more then 80% full)?					
3	Are disposal containers for "broken glass" available?					
4	Are all broken glass containers filled to an appropriate level (not more then 80% full)?					
5	Are red contaminated garbage bins available?					
6	Are all contaminated garbage bins filled to an appropriate level (not more then 80% full)?					
7	Are all chemical waste containers properly labeled as to their contents? (e.g. type of waste and readable labels)					
8	Are all chemical waste containers filled to an appropriate level (not more then 80% full)?					

E	Training and Awareness	Yes	No	N/A	Inspector Comments	Laboratory representative comment/date corrected
1	Does laboratory door have safety placards?					
2	Have safety placards been updated within the last year?					
3	Are emergency procedures posted in the laboratory?					
4	Are emergency exits routes and muster points posted in laboratory?					
5	Are laboratory rules and guidelines posted in laboatory?					
6	Is a laboratory notification contact list posted in the laboratory?					
7	Are the appropriate manuals available? (e.g. laboratory safety, chemical spill response guide, operating guides)					

F	Additional Inspector Comments

Next inspection Due:

Once each identified problem has been corrected, fill out the "Laboratory representative comment/date corrected" column. The Laboratory representative has 30 days upon receipt of this list to respond to the Departmental Safety Committee with corrective action(s). A follow-up inspection may be conducted to ensure corrections were made.

I certify that the information provided is true and accurate.	Laboratory Representative:	Date:

Dry Laboratory Inspection Checklist

Department: Room Number:

Inspection Type: Self Inspection or Departmental Inspection

Date of inspection:

Inspected by: Laboratory Representative Present:

A	General Laboratory Safety	Yes	No	N/A	Inspector Comments	Laboratory representative comment/date corrected
1	Are emergency phone numbers posted on the laboratory door?					
2	Have laboratory door signs been updated in the last year?					
3	Are warning signs (no food) posted?					
4	Is food consumed in the lab?					
5	Is there a first aid kit available?					
6	Is the first aid kits monthly inspection checklist posted?					
7	Are the first aid kit month inspections current?					
8	Is the first aid kit adequatley stocked?					
9	Are fire extinguisher(s) readily available?					
10	Is the fire extinguisher(s) monthly inspection checklist posted?					
11	Are the fire extinguisher(s) monthly inspections current?					
12	Is there a chemical spill kit available?					
13	Is the chemical spill kit monthly inspection checklist posted?					
14	Are the chemcial spill kit monthly inspections current?					
15	Is the chemical spill kit adequately stocked?					
16	Are emergency eye wash stations unobstructed?					
17	Is the emergency eye wash weekly inspection checklist posted?					
18	Are the emergency eye wash weekly inspections current?					
19	Are all floors clean, dry and in good repair?					
20	Are all ceiling tiles in good condition?					
21	Is housekeeping maintained? (e.g. are aisles uncluttered? are bench tops tidy?)					
22	Are exits free of any trip hazards or obstruction?					
23	Are stable stepstools available for reaching materials on high shelves?					

24	Are cleaning materials (e.g. soap, towels, broom, dust pan) available?					

B	Chemical Safety	Yes	No	N/A	Inspector Comments	Laboratory representative comment/date corrected
1	Are chemcial storage areas identified with signs?					
2	Are all chemcials properly labeled according to WHMIS legislation?					
3	Are all chemical containers in good condition? (e.g. not leaking)					
4	Do all chemicals have H-MIS bar codes?					
5	Is the laboratory chemical inventory available in the laboratory?					
6	Has the chemical inventory been updated in the last year?					
7	Are the storage locations of all chemicals listed on the chemical inventory?					

C	Equipment and Instrumentation Safety	Yes	No	N/A	Inspector Comments	Laboratory representative comment/date corrected
1	Are all electrical cords used properly? (e.g. no piggy-backing or surge protectors; not near a sink; clear of aisles)					
2	Are electrical lines on permanently installed equipment in good condition (not frayed or cracked)?					

D	Training and Awareness	Yes	No	N/A	Inspector Comments	Laboratory representative comment/date corrected
1	Does laboratory door have safety placards?					
2	Have safety placards been updated within the last year?					
3	Are emergency procedures posted in the laboratory?					
4	Are emergency exits routes and muster points posted in laboratory?					
5	Are laboratory rules and guidelines posted in laboatory?					
6	Is a laboratory notification contact list posted in the laboratory?					
7	Are the appropriate manuals available? (e.g. laboratory safety, chemical spill response guide, operating guides)					

E	Additional Inspector Comments

Next inspection Due:						
Once each identified problem has been corrected, fill out the "Laboratory representative comment/date corrected" column. The Laboratory representative has 30 days upon receipt of this list to respond to the Departmental Safety Committee with corrective action(s). A follow-up inspection may be conducted to ensure corrections were made.						
I certify that the information provided is true and accurate.		Laboratory Representative:				Date:

Laboratory Administration Inspection Checklist - Annual

Department:

Inspection Type: Departmental Inspection or H&S Inspection

Date of inspection:

Inspected by:

A	Departmental Safety Supply/Equipment Inspections	Yes	No	N/A	Inspector Comments	Laboratory representative comment/date corrected
1	Have emergency eye wash stations been flushed weekly? (inspection records at station)					
2	Have safety showers been flushed weekly? (inspection records at shower)					
3	Have fire extinguishers been visually inspected monthly? (inspection records at extinguisher)					
4	Have first aid kits been inspected monthly? (inspection checklist)					
5	Have chemical spill kits been inspected monthly? (inspection checklist)					

B	Annual Safety Equipment Inspections (Facilities)	Yes	No	N/A	Inspector Comments	Laboratory representative comment/date corrected
1	Have emergency eye wash stations been inspected in the last year?					
2	Have safety showers been inspected in the last year?					
3	Have fire extinguishers been inspected in the last year?					
4	Have vented cabinets been inspected in the last year?					
5	Has the Sapphire fire suppression system been inspected biannually?					
6	Have oxygen sensors been inspected biannually?					
7	Have vented fumehoods been inspected biannually?					

C	Chemical Safety	Yes	No	N/A	Inspector Comments	Laboratory representative comment/date corrected
1	Has the laboratory chemical inventory been checked against H-MIS within the last year?					
2	Are SDS available for all chemicals listed in H-MIS?					

D	Equipment and Instrumentation Safety	Yes	No	N/A	Inspector Comments	Laboratory representative comment/date corrected

1	Are the electrical cords of all equipment in good condition?					
2	Are instruments/equipment checked regularly and operating as designed?					

E	Training and Awareness	Yes	No	N/A	Inspector Comments	Laboratory representative comment/date corrected
1	Do all personnel with key access to physical sciences laboratories have a completed Physical Sciences Laboratory Orientation and Safety form on file?					
2	Are all WHMIS certificates on file?					
3	Are all Laboratory Safety training certificates on file?					
4	Have designated emergency responders received first aid and CPR training?					
5	Are laboratory self inspection records current?*					
6	Are laboratory departmental inspection records current?*					
7	Is the H&S laboratory inspection record current?*					

* Laboratory self inspections are to be conducted monthly, departmental inspections are to be conducted every three months, H&S inspections are to be conducted yearly.

E	Additional Inspector Comments

Next inspection Due:

Once each identified problem has been corrected, fill out the "Laboratory representative comment/date corrected" column. The Laboratory representative has 30 days upon receipt of this list to respond to the Departmental Safety Committee with corrective action(s). A follow-up inspection may be conducted to ensure corrections were made.

I certify that the information provided is true and accurate. Laboratory Representative: Date:

MacEwan UNIVERSITY | WORKPLACE HEALTH AND SAFETY

Occupational Health and Safety Program

SAFE WORK PROCEDURE TEMPLATE

INSTRUCTIONS

Employees and Supervisor completes the procedure in consultation with employees and submits the completed procedure to the manager.

Supervisor reviews and signs the completed procedure and communicates it to employees

FACULTY/DEPARTMENT
CAMPUS
WORK SITE LOCATION(S)
EMPLOYEES CONSULTED

TASK

(Start with an action verb and indicate if the task is specific to a workplace i.e. Entering the chlorine room)

TASK REQUIREMENTS

Purpose (Provide a general description of the task and why it is performed)
Responsibilities: (List the responsibilities of the manager, supervisor and employees in relation to the performance of the task)
Qualifications and Training Requirements: (Indicate specific type of training, certificates, licenses, diploma's)
Equipment Required: (Describe type, make and model of equipment)
Permits/Lockouts Required: (i.e. confined space entry, isolating energy for machinery and piping, blasting, etc.)

MacEwan UNIVERSITY | WORKPLACE HEALTH AND SAFETY

Occupational Health and Safety Program

Personal Protective Equipment Required: (Include applicable standards i.e. CSA, CGSB, NIOSH, NFPA, etc.)
Emergency Procedure: (Include activating alarms, evacuation, rescue, first aid and emergency services required to respond or reference and attach applicable Emergency Response Plans)

TASK STEPS (Describe the sequential steps to perform the task, from start to finish. Include the equipment and material used in each step.)
1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

If more lines are required, copy the last line of the table and change the number.

Legislated Requirements and References (Include names of specific regulations, codes, standards, guidelines and best practices.)

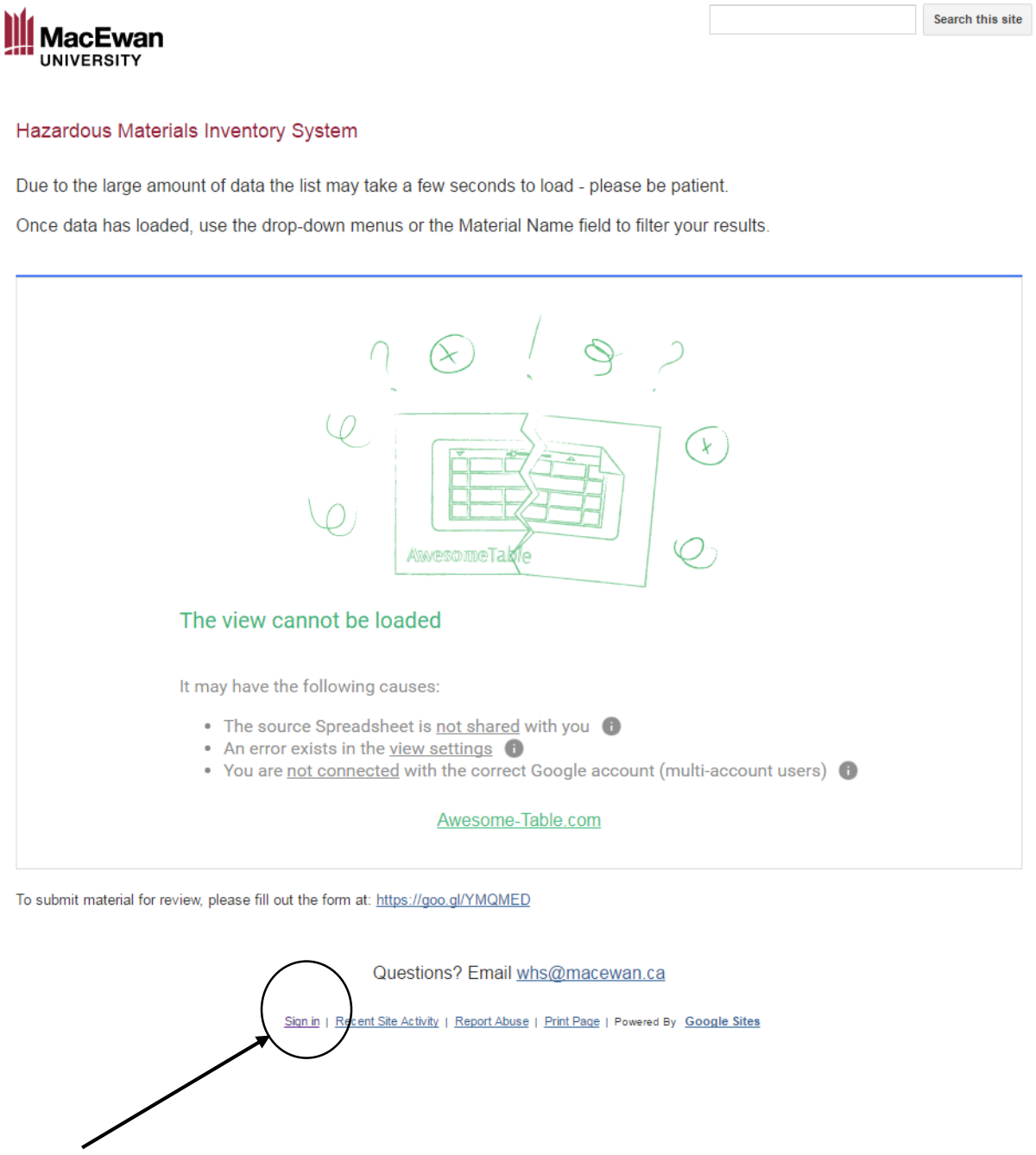
Procedure Communicated to Employees Performing the Task? ☐ Yes ☐ No

Signature of Supervisor	Name of Supervisor (PRINT)	Date (yyyy/mm/dd)

Accessing H-MIS Employee Instructions

1. Go to the following link: Hazardous Materials Inventory System (H-MIS)

www.macewan.ca/hmis



2. Sign in using your MacEwan Network ID & Password
Note: depending on your settings, you may have to enter your Macewan email in the google prompt prior to being directed to the MacEwan portal.

MacEwan UNIVERSITY

Search this site

Hazardous Materials Inventory System

Due to the large amount of data the list may take a few seconds to load - please be patient.

Once data has loaded, use the drop-down menus or the Material Name field to filter your results.

Department / Division + | Campus + | Room(s) + | Material Name

1 - 15 / 1882

Department / Division	Campus	Room(s)	Material Name	Synonym(s)	Supplier	SDS/MSDS/PSDS	Print Label
Anthropology	City Centre	10-611A	Coffee		Other.	--	Get label
Biological Sciences	City Centre	10-611A	HeLa Cells		ATCC	--	Get label
Biological Sciences	City Centre	5-013	Pierce 660nm Protein Assay (0022660...)		Thermo Scientific (formerly Thermo Electron)	Get info	
Biological Sciences	City Centre	5-015	Cargille Immersion Oil Types A & B Code 1248 (16482 - Type A...)		Cargille Laboratories, Inc	Get info	
Biological Sciences	City Centre	5-017	Acid Detergent (417)		Getinge	Get info	
Biological Sciences	City Centre	5-017	GLASS CAGE & RACK WASH (792)		Getinge	Get info	
Biological Sciences	City Centre	5-017	Stainless Steel Chamber Cleaner (425C)		Getinge	Get info	
Biological Sciences	City Centre	5-018	(+)-Sodium L-ascorbate (A7631)		SIGMA ALDRICH	Get info	
Biological Sciences	City Centre	5-018	Adenine (A8626)		SIGMA ALDRICH	Get info	
Biological Sciences	City Centre	5-018	Boric acid (A73-1...)		Fisher Scientific (Acros Organics)	Get info	
Biological Sciences	City Centre	5-018	Boric acid (AC327130000) (AC327130000...)		Fisher Scientific (Acros Organics)	Get info	
Biological Sciences	City Centre	5-018	Buffer RLT		QIAGEN Inc	Get info	
Biological Sciences	City Centre	5-018	Buffer RW1		QIAGEN Inc	Get info	

3. Search via drop downs (Department/Division, Campus, Room(s)) and/or by material name.

MacEwan UNIVERSITY

Search this site

Hazardous Materials Inventory System

Due to the large amount of data the list may take a few seconds to load - please be patient.

Once data has loaded, use the drop-down menus or the Material Name field to filter your results.

Department / Division + | Campus + | Room(s) + | Material Name

× 10-611A

1 - 4 / 4

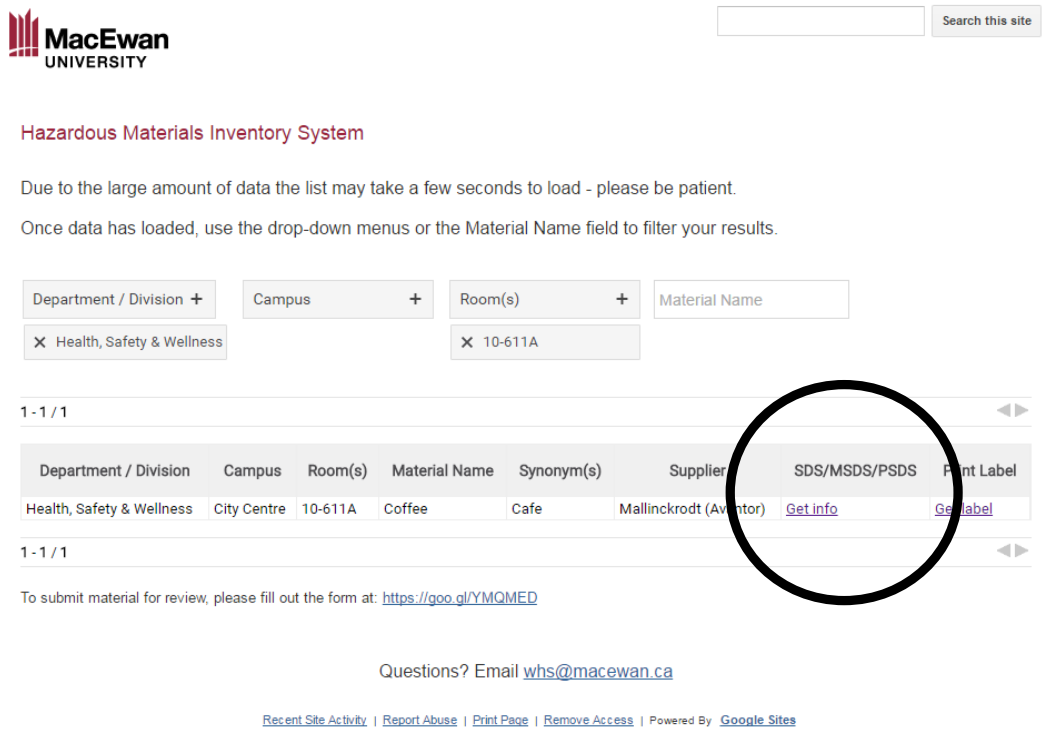
Department / Division	Campus	Room(s)	Material Name	Synonym(s)	Supplier	SDS/MSDS/PSDS	Print Label
Anthropology	City Centre	10-611A	Coffee		Other.	--	Get label
Biological Sciences	City Centre	10-611A	HeLa Cells		ATCC	--	Get label
Health, Safety & Wellness	City Centre	10-611A	Coffee	Cafe	Mallinckrodt (Avantor)	Get info	Get label
Nursing	City Centre	10-611A	Tea	delish	Other.	--	Get label

1 - 4 / 4

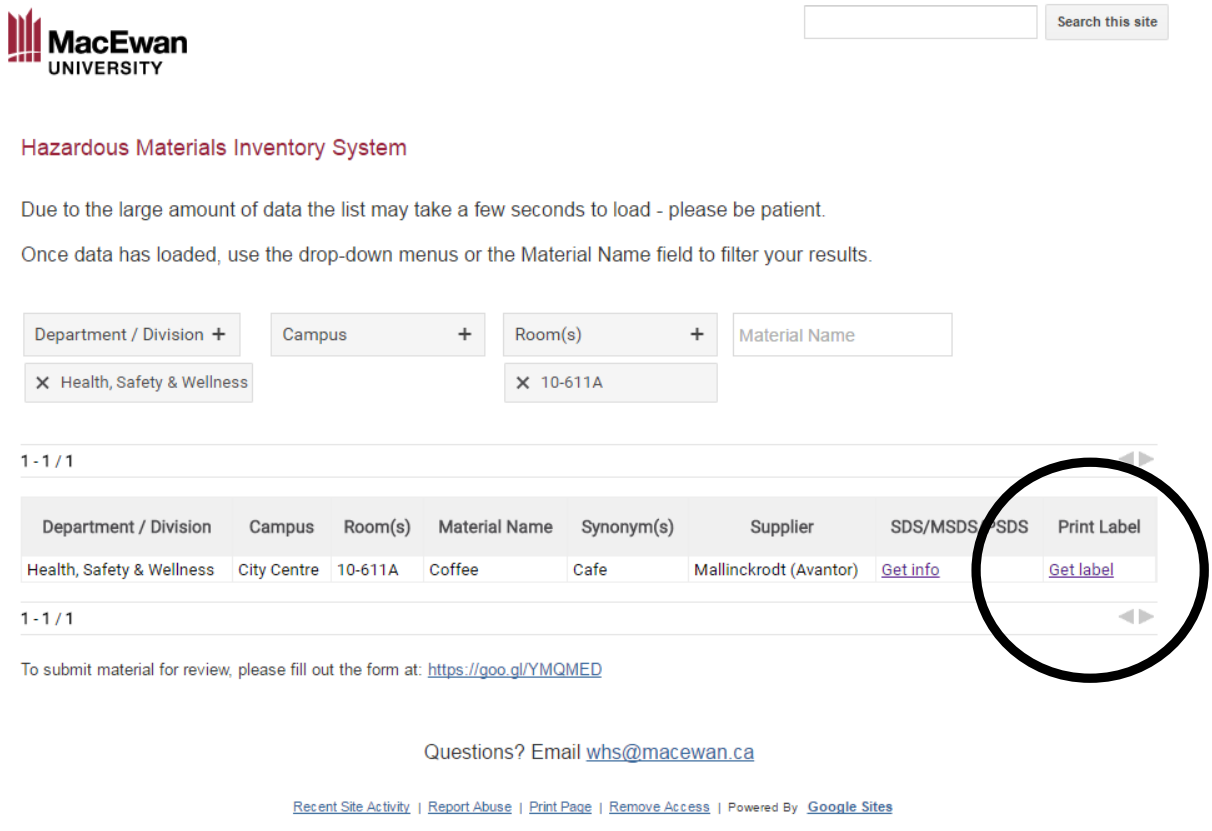
To submit material for review, please fill out the form at: https://goo.gl/YMQMED

Questions? Email whs@macewan.ca

4. Click “Get info” to access SDS/MSDS/PSDS



5. Click “Get Label” to access google sheet label that includes the following: unique ID, material name, room, location in room, additional requirements. Feel free to modify the labels to suit your needs.



MacEwan UNIVERSITY | PHYSICAL SCIENCES

Working Alone Authorization Form

Name	
Position	
Duration of working alone access	
Time(s) working alone is permitted	
Location (room number where work will be conducted)	
Supervisor's name	
Supervisor's contact number	
Emergency contact system	
After-hours training completion date	

Nature of work permitted while working alone:

The following operation/experiments are **prohibited** while working alone:

Potential hazards associated with work (where applicable, a hazard assessment must be completed prior to working alone):

Procedures for hazard elimination or control (where applicable):

The authorization form must be completed and filed in the Department of Physical Sciences. Laboratory personnel are required to have a copy of the form with them when working alone in the laboratory. Campus Security will require an individual to leave the laboratory outside of regular hours if the individual does not have a completed form in the laboratory.

MacEwan UNIVERSITY | PHYSICAL SCIENCES

Unattended Operation Information Sign

Caution!
Unattended operation in progress

Unattended operation description	
Start time	
Estimated completion time	
Location (room number)	
Person responsible	
Overnight contact number	
Supervisor's name	
Supervisor's overnight contact number	

Reaction scheme and conditions:

Hazards present (ie. toxic, flammable, corrosive, etc.): use full names for chemicals present

Emergency shutdown procedures:

This notice must be posted at eye-level and affixed directly to the unattended experiment or, if not appropriate, to the fumehood sash or bench near the unattended experiment.

MacEwan UNIVERSITY | PHYSICAL SCIENCES

Unattended Operation Warning Sign

Unattended operation description	
Start time	
Estimated completion time	
Location (room number)	
Person responsible	
Overnight contact number	
Supervisor's name	
Supervisor's overnight contact number	

This warning must be posted on the door to the laboratory where the unattended experiment is being conducted.

MacEwan UNIVERSITY | PHYSICAL SCIENCES

Waste management and waste minimization in the Department of Physical Sciences

I. Hazardous waste: guiding definition

Any substance that – because of its quantity or concentration; or physical, chemical, or infectious characteristics – poses a threat to the environment and/or to human health.

II. Hazardous waste disposal and treatment protocols

Hazardous waste requires specific disposal and treatment protocols to mitigate the threat to the environment and/or human health. These protocols are driven by **City**, **Provincial**, **and Federal regulations**:

- City of Edmonton Drainage Bylaw (Bylaw 16200)
- Alberta Environment Protection and Enhancement Act
- Canadian Environmental Protection Act
- Transportation of Dangerous Goods Act

III. Hazardous waste management in the Department of Physical Sciences

Hazardous waste is segregated from all other (non-hazardous or non-regulated) waste. Errors or failure to appropriately segregate hazardous waste requires the total to be treated as hazardous waste. Hazardous waste is source-separated as follows:

- Separate liquid and solid waste.
- Separate liquid organic waste from liquid aqueous waste.
- Separate strong acids and bases from other aqueous waste.
- Separate halogenated waste from non-halogenated waste.
- Segregate by chemical compatibility.

Sharps (syringes and needles) are cleaned of the majority of any chemical contaminants before being disposed of in special sharps containers. All contents of sharps containers are treated as biohazardous waste.

IV. Hazardous waste disposal in the Department of Physical Sciences

Hazardous waste is periodically collected and disposed of by **Tervita Environmental Services**. Tervita manages the disposal protocols based on the nature of the waste provided. The type of hazardous laboratory waste must be clearly identified for acceptance by Tervita (e.g. halogenated solvents, non-halogenated solvents, heavy metal solutions, gas cylinder, sharps, etc.) and drives both transportation of the waste, and its disposal. Tervita conducts confirmatory testing of all waste

provided to ensure that appropriate disposal protocols are followed. The Department is billed accordingly based on the results of Tervita's testing and the associated disposal process.

- Volume of waste disposed of by the Department of Physical Sciences in 2013/14: **1845 litres**. This waste was composed as follows (cost of disposal indicated in brackets):

  615 litres classified as "flammable liquid" ($735)
  410 litres classified as "flammable liquid – toxic" ($1,040)
  205 litres classified as "corrosive liquid, inorganic acid" ($650)
  615 litres classified as "water, low-weight hydrocarbons/other contaminants" ($552)
  9 × 205 litre waste drums ($969)
  Total cost of waste disposal: **$3,946**

  Notes: Toxic and corrosive wastes carry significantly higher disposal costs than other liquid wastes. The Department of Biological Sciences contributes waste to the above, but the volume is nominal, representing approximately 1% of total. Sharps waste has been collected continually since the Department began using syringes and needles. To-date, insufficient volume of sharps waste has been generated to warrant disposal.

V. Non-hazardous waste management and disposal in the Department of Physical Sciences

Chemicals that are not regulated because they do not exhibit any hazardous waste characteristics or that are not WHMIS controlled represent **non-hazardous waste**. These included certain salts, natural products, and inert materials. Such waste can be disposed of via regular municipal waste and/or drainage services.

Glass waste (pipettes, vials, reagent bottles, broken glassware, etc.) is cleaned of any chemical contaminants before being collected in designated cardboard boxes with a plastic liner that are clearly labelled *broken glass*. Such glass waste cannot be recycled and is disposed of via regular municipal waste.

Empty (metallic) **solvent drums** are cleaned of chemical contaminants, any labels are removed or defaced, and the drums are disposed of in the regular municipal waste.

VI. Sustainable practices in the Department of Physical Sciences

The Department currently engages in a number of **sustainable waste management practices** designed to mitigate fiscal and environmental impacts. These include:

- On-site conversion (using established protocols) of hazardous chemical waste to non-hazardous waste that can be disposed of via municipal waste and/or drainage services.
- Organized and efficient collection and segregation of hazardous and non-hazardous waste.
- Recovery and recycling (either through re-use or repurposing) of waste.

The Department currently uses 240 litres of acetone per year as a cleaning solvent. Once used, this solvent is disposed of as hazardous waste. Effective Winter 2015, the Department will be trialing an acetone recovery project, where used acetone waste is collected and redistilled, allowing for its re-use. It is hoped this will reduce both acetone expenditure and hazardous waste volumes. Waste production, in more general terms, will also undergo a comprehensive review with the intent of reducing annual disposal amounts.

The Department currently engages in a number of **use minimization and pollution prevention practices** also designed to mitigate fiscal and environmental impacts. These include:

- Ensuring all waste delivered to the municipal drainage system has neutral pH prior to its release into the municipal drainage system by plumbing all laboratory sinks and drains to an acid neutralization tank.
- Utilizing oil traps and filters on all high vacuum pumps to prevent oil contamination (and thus need for oil replacement).
- Utilizing cold traps in-sequence on central vacuum systems to prevent release of solvents.
- Utilizing secondary traps on rotary evaporators to prevent release of solvents.
- Utilizing recirculating chillers on rotary evaporators to remove the need for a continuous water supply when condensing solvents.
- Sourcing and accepting chemical donations from industry.

MacEwan UNIVERSITY | FINANCIAL SERVICES

MATERIAL TRANSFER

1. This transfer is: ☐ TEMPORARY TRANSFER ☐ PERMANENT TRANSFER ☐ SURPLUS ☐ OTHER (Specify)

2. TRANSFERRED FROM:

Campus: _____

Dept: _____

Room: _____

By: _____

3. TRANSFERRED TO:

Campus: _____

Dept: _____

Room: _____

By: _____

FOR SURPLUS ONLY

REASON FOR SURPLUS:

AUTHORIZATION (DEAN/DIRECTOR)

DATE:

4. QUANTITY	5. TAG NUMBER	6. DESCRIPTION	7. SIZE/MODEL	8. SERIAL NUMBER

9. MATERIAL TRANSFERRED BY: _____ 10. DATE: _____

11. MATERIAL RECEIVED BY: _____ 12. DATE: _____

13. SHIPPED BY: _____ 14. CARRIER _____ 15. INITIALS _____

FORM DISTRIBUTION:

SURPLUS: **ORIGINAL** – FINANCE, INVENTORY CONTROL, **COPY** – SURPLUS ORIGINATOR, **COPY** – SUPERVISOR OF MATERIAL HANDLING (SHIPPING/RECEIVING)

TRANSFER: **ORIGINAL** – FINANCE, INVENTORY CONTROL, **COPY** – TRANSFER INITIATOR, **COPY** – TRANSFER RECEIVER

MacEwan UNIVERSITY | PHYSICAL SCIENCES

Fieldwork Participant Release of Liability

FIELDWORK DETAILS

Field Trip: MacEwan University Physical Sciences Geomorphology of the Rocky Mountains & Foothills, optional field excursion

Dates: Friday September 19th –Sunday September 20th 2015

RELEASE OF LIABILITY

In consideration of being allowed to participate in any way in the Field Trip identified above, its related events and activities, I, _____, the undersigned, acknowledge, appreciate and agree that:

The risk of injury from the activities involved in this field trip is significant, including the potential for permanent paralysis and death, and while particular skills, equipment, and personal discipline may reduce this risk, the risk of serious injury does exist; and,

I KNOWINGLY AND FREELY ASSUME ALL SUCH RISKS, BOTH KNOWN AND UNKNOWN, EVEN IF ARISING THE NEGLIGENCE OF THE RELEASEES OR OTHERS, AND ASSUME FULL RESPONSIBILITY FOR MY PARTICIPATION; *and,*

I willingly agree to comply with the stated and customary terms and conditions for participation. I agree to follow the instructions and precautions as written in the Field Trip Guidebook, Risk Assessment, and/or stated by the Field Trip Leaders. I assume responsibility for attending all safety briefings. If I observe any unusual significant hazard during my presence or participation in this Field Trip, I will remove myself from participation and bring such to the attention of the field trip leader immediately, and,

I, for myself and on behalf of my heirs, assigns, personal representatives and next of kin, HEREBY RELEASE, INDEMNIFY AND HOLD HARMLESS MACEWAN UNIVERSITY, THE FACULTY OF ARTS & SCIENCE, THE DEPARTMENT OF PHYSICAL SCIENCE, their officers, agents, and/or employees, volunteers, other participants, sponsoring agencies, sponsors, advertisers, and, if applicable, owners and lessors of premises used for activity ("Releasees"), with respect to any and all injury, disability, death, or loss or damage to person or property, whether arising from the negligence of the Releasees or otherwise, to the fullest extent permitted by law.

I have read this release of liability and assumption of risk agreement, fully understand its terms, understand that I have given up substantial rights by signing it, and sign it freely and voluntarily without any inducement.

Participant's name: _____ *Participant's signature:* _____

Date and Place: _____

Witness's name: _____ *Witness's signature:* _____

Emergency Contact Information (optional):

Emergency Contact's name: _____ Telephone Number: _____

Emergency Contact's relationship to participant : _____