SAFETY BULLETIN
ACCESS & EGRESS

(FIRE SAFETY REQUIREMENTS)

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To outline life safety requirements for the maintenance of laboratory access & egress (fire safety requirements).

Policy Statement:

All existing doorways will be maintained free and clear of obstructions.

The applicable Codes (Building & Fire) in effect at the time of construction will provide the necessary width and clearance requirements for access & egress for laboratory spaces. This will remain in effect until the laboratory space under goes renovation or alteration. At the time of renovation or alteration, the current Code will dictate access & egress requirements.

1. Flammable storage cabinets must not be located in hallways, offices, adjacent to exits, elevators or principal routes that provide access to exits.
2. Freight elevators will be used for the transportation of flammable liquids.
3. Persons who handle flammable and combustible materials must be WHMIS-trained, (WHMIS – Workplace Hazardous Materials Information System).
4. Containers must be dated upon receipt and on opening. These materials must be disposed of upon the expiry date. Supervisors and workers must assess the need for fire-retardant protective clothing.
5. Shipping containers are not to be used for storage in the laboratories.
6. When dispensing large quantities of flammable liquids with containers made of conductive material the dispensing equipment and containers must be bonded and grounded.
7. All containers in solvent storage vaults must be labeled with the owner's name and the date of acquisition.
8. The storage, handling and or use of flammable or combustible liquids in glass or plastic containers must only be permitted if the liquid purity would be affected by the approved safety container or if the liquid would cause excessive corrosion of the approved safety container.
9. All laboratory processing and dispensing of flammable liquids is required to be performed in a fumehood. Such operations must be terminated upon failure of the ventilation/exhaust system.
10. Fire emergency and spills response plans must be developed in all laboratories where flammable and combustible materials are used or stored. Spill kits must be available in the immediate area.
11. Unattended operations involving heating of flammable or combustible liquids must have override controls and automatic shutdown procedures to prevent system failure, fire, or explosion.
12. Organic solvents that are prone to peroxidation in the presence of light and air must be tested before use.
13. Solvent storage vaults and spark-proof refrigerators must be TDG and WHMIS labeled and used exclusively for the purposes intended. Volumes stored in these devices will conform to equipment specifications and are included in the total laboratory volume.

Requirements from the *Alberta Fire Code*

The storage and handling of flammable and combustible materials in public and industrial buildings is regulated under the *Alberta Fire Code*. Requirements relevant for University laboratories include:

- An appropriate WHMIS sign must be posted at the entrance to any area where flammable liquids are used or stored.
- Laboratory Emergency Cards must indicate the presence of flammable liquids and MSDS material for each product will be stored in a highly visible location.
- The quantity of dangerous goods kept in a laboratory must be kept to a minimum and must not exceed the supply necessary for normal operation.
- Containers larger than 5 liters must be approved safety containers (see definition below).
- Containers larger than 25 liters are not allowed in the laboratory.
- No more than 300 liters of flammable and combustible liquids are allowed in a fire compartment (see definition below). Of the 300 liters of liquids, only 50 liters of flammable liquid is allowed.
- Storage of flammable and combustible liquids outside of an approved flammable storage cabinet (see definition below) or storage room is permitted provided such storage does not exceed 10 L, including not more than 5 L of Class 1 liquid in a single room.
- Storage must be in approved safety containers. If the purity of the liquid would be compromised by storage in an approved safety container, glass containers less than 5 liters must be permitted.
- Containers for flammable and combustible liquids must be labeled to indicate the content and must show WHMIS markings and owner identification.
- Containers must be kept closed when not in use, i.e. when within approved flammable storage cabinets or refrigerators, and when transported in the laboratory.
- Storage of hazardous materials in fume hoods beyond that required for normal daily operations is prohibited.
- Electrical equipment used in fume hoods where flammable liquids are handled must be CSA-approved for hazardous locations. (i.e., spark-proof equipment for Class 1, Division 2 areas). Examples include blenders and stirring motors.
- Quantities that are transported in glass vessels must be carried in an appropriately moulded rubber, plastic or Styrofoam container to prevent accidental breakage.
- One approved flammable storage cabinet is allowed per fire compartment. More than one approved flammable storage cabinet may be permitted per fire compartment provided the Chief Fire Official approves the installation and the laboratory quantity limits are not exceeded.
- The quantity limits above include any flammable or combustible wastes in the laboratory.
- Chemical waste containers must be identified according to University of Calgary policy.

Please contact the Environmental Health & Safety if you have any questions or concerns.

What are Flammable and Combustible Liquids?

The Alberta Fire Code places flammable and combustible liquids in the following classes:

	Flash Point	**Boiling Point**
Flammable Liquids		
Class IA	Below 22.8°C (73°F)	Below 37.8°C (100°F)
Class IB	Below 22.8°C (73°F)	At or above 37.8°C (100°F)
Class IC	At or above 22.8°C (73°F) and below 37.8°C (100°F)	N/A
Combustible		
Class II	At or above 37.8°C (100°F) and below 60°C (140°F)	N/A
Class III A	At or above 60°C (140°F) and below 93°C (200°F)	N/A
Class III B	At or above 93°C (200°F)	N/A

Note: the flash point is defined as the minimum temperature at which a liquid gives off vapour in sufficient concentration to form an ignitable mixture with air near the surface of the liquid.

For handling Flammable/Combustible materials, observe the following guidelines:

A) Eliminate ignition sources such as open flames, hot surfaces, sparks from welding or cutting, operation of electrical equipment, and static electricity.
B) Store in approved flammable liquid containers or storage cabinets, in an area isolated from ignition sources or in a special storage room designed for flammable materials.
C) Ensure there is proper bonding and grounding when it is required, such as when transferring or dispensing a flammable liquid from a large container or drum. Ensure that bonding and grounding is checked periodically.
D) Ensure appropriate fire equipment for example, extinguishers and/or sprinkler systems, gas detection systems are in the area.

The following tables list some common flammable and combustible chemicals, their flash points and boiling points, and associated flammability classes: Various sources of information lowest values used for flash point and boiling point.

Ethanol and Water mixtures Flash Point and Class			
Ethanol Concentrations by weight	Ethanol Concentrations by volume	Flash Point °C	Class
100%	100 %	12.8	IB
96 %	97.5 %	16.5	IB
95 %	96.8 %	17.2	IB
80 %	85.5 %	20.0	IB
70 %	76.9 %	21.1	IB
60 %	67.7 %	22.2	IB
50 %	57.8 %	23.9	IB
40 %	47.3 %	26.1	IB
30 %	36.2 %	29.4	IB
20 %	24.5 %	36.1	IB
10 %	12.4 %	49.0	II
5 %	6.2 %	62.2	II

Chemical Name	CAS Number	Chemical Formula	Flash Point °C	Boiling Point °C	Class
Acetaldehyde	75-07-0	C_2H_4O	-27	21	IA
2-Butyne	503-17-3	C_4H_6	-31	24	IA
Dimethyl sulfide	75-18-3	C_2H_6S	-37	36	IA
Diethyl ether	60-29-7	$C_4H_{10}O$	-45	35	IA
Ethylamine	75-04-7	C_2H_7N	-18	16	IA
Ethyl chloride	75-00-3	C_2H_5Cl	-50	12	IA
Ethyl Acetate	141-78-6	$C_4H_8O_2$	-3	76	IA
Ethylene oxide	75-21-8	C_2H_4O	-29	11	IA
Furan	110-00-9	C_4H_4O	-50	31	IA
Isopentane	78-78-4	C_5H_{12}	-51	27	IA
Isopropylamine	75-31-0	C_3H_9N	-37	33	IA
Isopropyl chloride	75-29-6	C_3H_7Cl	-32	35	IA
Methyl Formate	107-31-3	$C_2H_4O_2$	-19	32	IA
Methyl ethyl ether	540-67-0	C_3H_8O	-37	10.8	IA
Pentane	109-66-0	C_5H_{12}	-49	36	IA
Propane	74-98-6	C_3H_8	-105	-42	IA
Propylene oxide	75-56-9	C_3H_6O	-37	34	IA
Vinyl ethyl ether	109-92-2	C_4H_8O	-50	36	IA
Acetone – 2 Propanone	67-64-1	C_3H_6O	-20	56	IB
Acetonitrile	75-05-8	C_2H_3N	2	81	IB
Benzene	71-43-2	C_6H_6	-11	80	IB
Butyl acetate	123-86-4	$C_6H_{12}O_2$	22	124	IB
Carbon disulfide	75-15-0	CS_2	-33	46	IB
Cyclohexane	110-82-7	C_6H_{12}	-20	81	IB

Chemical Name	CAS Number	Chemical Formula	Flash Point °C	Boiling Point °C	Class
Ethyl alcohol – Ethanol	64-17-5	C_2H_6O	12.8	78	IB
n-Heptane	142-82-5	C_7H_{16}	-4	98	IB
n-Hexane	110-54-3	C_6H_{14}	-22	69	IB
Isopropyl alcohol – 2 Propanol	67-63-0	C_3H_8O	11	82	IB
Propanol	71-23-8	C_3H_8O	15	97	IB
Methyl alcohol – Methanol	67-56-1	CH_4O	11	65	IB
Methyl Acetate	79-20-9	$C_3H_6O_2$	-10	57	IB
Methyl ethyl ketone - 2 Butanone	78-93-3	C_4H_8O	-9	80	IB
Petroleum ether- Ligroin	8032-32-4	Mixtures	-30	35 - 160	IB
Pyridine	110-86-1	C_5H_5N	17	115	IB
Tert- Butyl Methyl Ether	1634-04-4	$C_5H_{12}O$	-28	55.3	IB
Tetrahydrofuran	109-99-9	C_4H_8O	-21	67	IB
Toluene	108-88-3	C_7H_8	4	111	IB
Triethylamine	121-44-8	$C_6H_{15}N$	-11	85	IB
tert Butyl isocyanate - 2-isocyanato-2-methyl-Propane	1609-86-5	C_5H_9NO	27	85	IC
Chlorobenzene	108-90-7	C_6H_5Cl	24	132	IC
Epichlorohydrin	106-89-8	C_3H_5ClO	28	115-117	IC
2-Nitropropane	79-46-9	$C_3H_7NO_2$	24	118	IC
m-xylene, o-xylene, p-xylene	1330-20-7	C_8H_{10}	25	137-144	IC
Morpholine	110-91-8	C_4H_9NO	35	128	IC
Acetic Acid, glacial	64-19-7	$C_2H_4O_2$	39	117	II
Bromobenzene	108-86-1	C_6H_5Br	48	153-158	II
Formic Acid	64-18-6	CH_2O_2	69	100	II
Benzaldehyde	100-52-7	C_7H_6O	62	178	IIIA
Cyclohexanol	108-93-0	$C_6H_{12}O$	67	160	IIIA
Methacrylic Acid	79-41-4	$C_4H_6O_2$	76	158	IIIA
Nitrobenzene	98-95-3	$C_6H_5NO_2$	87	210	IIIA
Tetrahydronaphthalene	119-64-2	$C_{10}H_{12}$	77	207	IIIA
Benzyl Alcohol	100-51-6	C_7H_8O	94	205	IIIB
Caproic Acid	142-62-1	$C_6H_{12}O_2$	102	203	IIIB
Ethylene Glycol	107-21-1	$C_2H_6O_2$	109	195	IIIB

DEFINITIONS:

approved safety container	a metal or plastic container that conforms to the ULC/ORD-C30, 1995 standard
approved flammable storage cabinet	a cabinet constructed to limit the internal temperature rise to not more than 139 °C above ambient temperature for a period of 10 minutes when the entire cabinet is subjected to a temperature equal to that set forth in ULC Standard ORD-C1275-1984
bonding	eliminates the difference in electrical potential between two or more objects; accomplished by attaching a conductive wire between the objects to allow the free flow of charge
combustible liquid	a liquid that has a flashpoint greater than or equal to 37.8 °C but less than 93.3 °C. *(Class II and III)*
flammable liquid	a liquid with a flashpoint below 37.8 °C. *(Class I)*
flammable solid	a substance that causes fire through friction or retained heat from manufacturing or processing; can be ignited readily and when ignited burns so vigorously and persistently as to create a hazard; ignites readily and burns with a self-sustained flame at a rate of more than 0.254 cm per second along its major axis
pyrophoric material	materials that ignite spontaneously in air below 54 °C
reactive flammable materials	any substance that is spontaneously combustible and liable to spontaneous heating under normal conditions of use or liable to heat in contact with air to the point where it begins to burn or emits a flammable gas or becomes spontaneously combustible on contact with water or water vapour
fire compartment	a laboratory or suite of laboratories whose walls have been constructed with a one-hour fire rating
flash point	the lowest temperature at which a liquid or solvent gives off vapour sufficient to form an ignitable mixture with the air near the surface of the liquid or within the vessel used
grounding	provides the means for continuously discharging a charged conducting body to earth
solvent	a substance used to dissolve another substance; vapours in air can create an explosion hazard and cause health problems for the unprotected user (dizziness, nausea, headache, contact dermatitis, and damage to internal organs).
spark-proof	intrinsically safe; no sources of ignition
static electricity	results from friction between dissimilar materials (e.g. when a liquid passes though a spigot into another container) and builds up when the free flow of charge is prevented