



Section:	Hazard Assessment and Control	Date of Issue:	2007.12.10
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1.0 Introduction

The University is committed to promoting the health, safety and well-being of its workers, students, visitors and contractors, in accordance with the [University of Calgary Occupational Health & Safety Policy](#).

The University will meet or exceed the legislated requirements made under the Alberta Occupational Health and Safety Act, Regulation and Code. Additionally, the University will strive to develop and implement best practices in occupational and environmental hygiene principles.

The University has developed and implemented a comprehensive Occupational Hygiene Program (OHP) devoted to the recognition, evaluation and control of those environmental factors, arising in or from the work place that may cause illness, injury, or discomfort. To help reduce the risk of hazardous exposures, ensure regulatory compliance, and improve working conditions, appropriate occupational hygiene practices will be applied to the University operations in accordance with the University of Calgary Occupational Health & Safety Policy. The Occupational Hygiene Program clearly defines and stipulates the responsibilities of all workplace parties involved in its development, administration and implementation of the program.

The Occupational Hygiene Program includes the following elements:

- Organizational Commitment;
- Occupational Hygiene Process;
- Roles and Responsibilities;
- Training and Education;
- Annual Program Review;
- Definitions; and,
- References.

1.1 Purpose and Scope

The Occupational Hygiene Program provides information to departments, supervisors and workers to allow for informed decision-making regarding exposure to hazardous agents in the workplace.

This program outlines how worker exposures hazards will be addressed in the workplace including the interpretation of technical data, conducting research, and assist in the development of guidelines and procedures that support workplace health and wellness. A hazard may be chemical, biological or physical in nature:

- Chemical hazard - is any chemical capable of causing bodily injury or illness;
- Biological hazard - is any biological organism that is infectious or pathological to humans; and

- Physical hazard - arises from the interaction of matter and energy related to the science of physics such as sounds, light, vibration, and radiation that could result in an occupational injury or illness.

This program is not intended to deal with potential public exposure issues or ecological concerns.

1.2 Supporting Programs & Standards

There are a number of occupational hygiene related hazards that have specific university or regulatory requirements. For these hazards, additional programs or standards have been developed and will work in conjunction with this program. These programs or standards include, but are not limited to the:

- Asbestos Management Program;
- Respiratory Protection Program;
- Hearing Conservation Program;
- Laser Safety Program;
- Radiation Safety Program;
- Biosafety Program;
- Laboratory Safety Program;
- Indoor Environmental Quality Program;
- Lock Out - Control of Hazardous Energy;
- Mercury Abatement Program;
- Personal Protective Equipment Program; and,
- WHMIS.

2.0 Occupational Hygiene Process

To ensure occupational hygiene issues are addressed in a consistent manner, concerns will be handled according to the process outlined in Figure 1 (Progression of Occupational Hygiene Issues Flowchart). An explanation of this process is found in the following sub-sections.

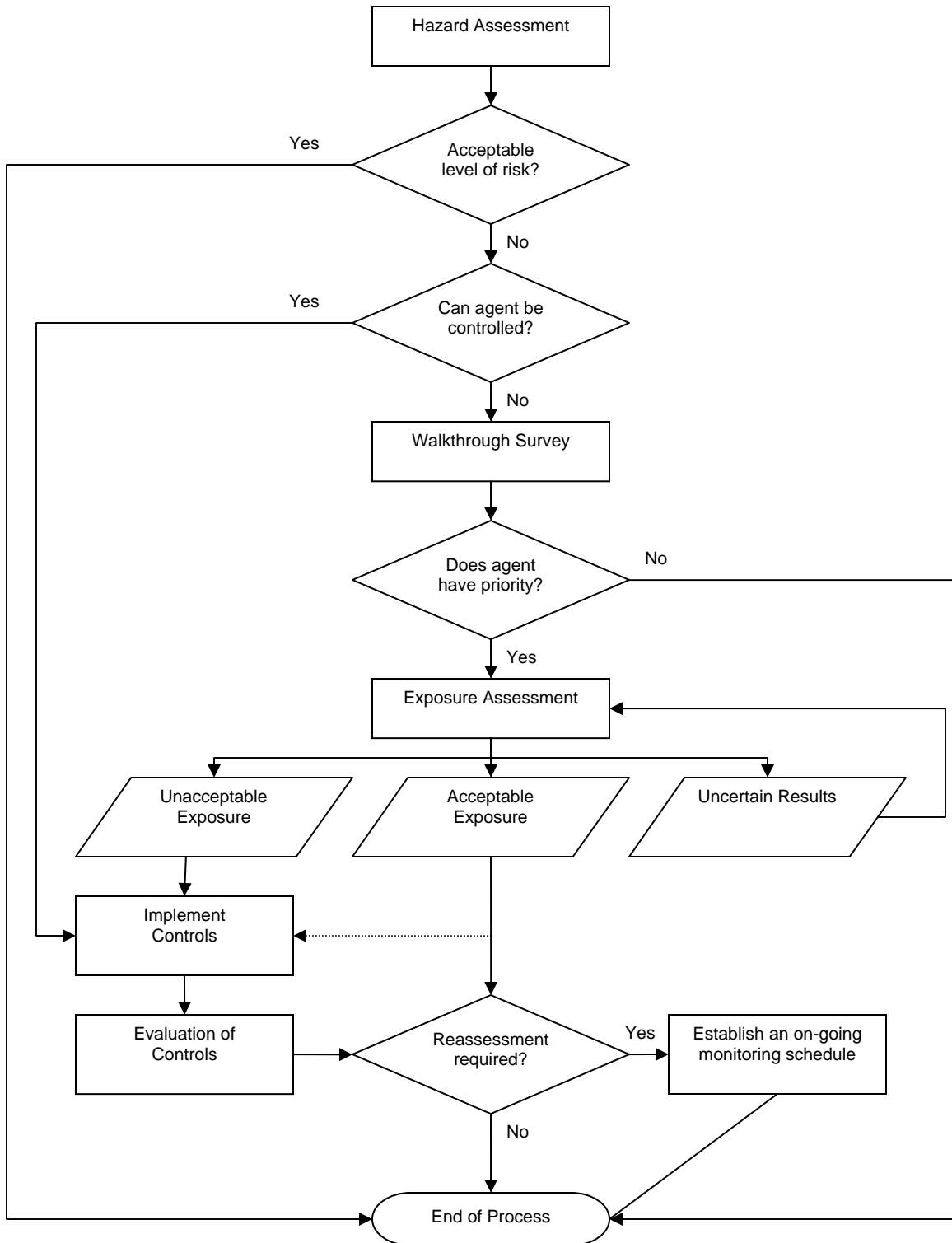


Figure 1: Progression of Occupational Hygiene Issues Flowchart

2.1 Hazard Assessment

2.1.1 Formal Hazard Assessment & Control Process

The University of Calgary Hazard Assessment and Control Process document specifies the responsibilities, procedures, and requirements for proactively completing job hazard assessments. The occupational hygiene process is engaged when a chemical, biological, or physical hazard is identified on this hazard assessment. Hazards that are not chemical, biological, or physical in nature are outside the scope of this process and will be addressed through the University of Calgary Occupational Health & Safety Policy and its accompanying programs and standards.

2.1.2 Reporting a Hazard

There may be reactive issues that arise outside of the hazard assessments process. This could include complaints or concerns brought forward by supervisors and workers. Issues could also arise as a response to advancements in technology, workplace incidents/accidents, regulatory change, emerging trends, or a change in industry best practices. In these situations, the relevant sections of the flowchart will still be applied and the following basic steps included:

1. Hazard Identification
2. Hazard Recognition
3. Hazard Evaluation
4. Hazard Control

2.2 Level of Risk

A competent person must conduct the hazard assessment and include a qualitative evaluation of the risk associated with the identified occupational hygiene hazard. Hazards that pose an acceptable level of risk will not be addressed further. The criterion for determining if the risk level is acceptable is based on the potential health effects that would result from the quantities being used and the duration of exposure. If the substance/agent poses an unacceptable risk, or the risk level is unknown, further action is required.

2.3 Can Hazard be controlled?

If the hazard can be readily minimized or eliminated through the implementation of a control, the control should be implemented according to the hierarchy of controls in accordance with University and legislation requirements. If controls are implemented, their effectiveness needs to be verified or monitored to complete the process.

Note: In certain situations, regulatory requirements may exclude this step. For example, there are specific regulations governing the disturbance of asbestos-containing materials.

A walkthrough survey is required when:

- A hazard cannot be controlled;
- Regulatory requirements dictate; or
- If the implemented controls are not effective in minimizing and controlling the hazard.

2.4 Walkthrough Survey

Once it has been established that the hazard requires further investigation, Environment, Health and Safety (EH&S) will conduct a walkthrough survey with the supervisor of the area. The walkthrough survey is not a site inspection but rather a technical review of the operations, workers, and materials in a workplace used to more clearly identify potential health hazards and help guide a qualitative assessment

of their severity. The supervisor and Environment, Health and Safety must agree to the scope of the survey before it is conducted.

The walkthrough survey should document the following:

- Name of department or process;
- Nature of operation;
- Raw materials and quantities used;
- Equipment and machinery used;
- Health hazards identified and routes of exposure;
- Controls present;
- Number of workers exposed and their position; and,
- Items for follow-up after survey.

See [Appendix A: Sample Walkthrough Survey Checklist and Form](#)

The walkthrough survey should also include a review of any prior walkthrough surveys, incident/accident reports, past monitoring data, and materials safety data sheets (MSDSs). Where relevant, interviews with workers and spot samples may also be included.

2.5 Establishing Priority

Where there are multiple hazards to be dealt with in the work area being assessed, it is important to assign priority in how they will be addressed so that those that pose the greatest risk or hazard are addressed first. The priority of addressing identified substances/agents will be based on the severity of health effects if exposure occurs, qualitative evaluation of exposure, number of workers affected, and level of existing controls. A diagram illustrating the continuum of priority level for the four characteristics is provided in Figure 2. Agents identified as having a high priority should be addressed first.

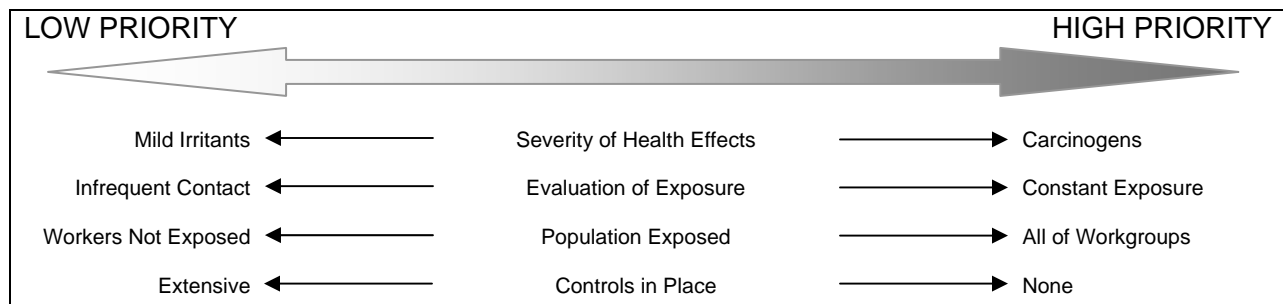


Figure 2: Illustration of Priority Level

See [Appendix B: Prioritization of Agents](#) for an expanded description of this continuum used in the decision-making process.

During the walkthrough survey, substances/agents deemed to pose an acceptable level of risk due to a lack of health effects, lack of employee exposure, or the effectiveness of controls already in place will not be addressed further. Some monitoring may be required to determine or prove effectiveness of existing controls.

2.6 Exposure Assessment

2.6.1 Sampling Strategy

The information collected during the walkthrough survey will be used to determine what action is required to quantitatively determine worker exposure. A quantitative evaluation of exposure will require some degree of monitoring. The exact type of monitoring conducted will be determined by evaluating the:

- Duration of worker exposure;
- Number of exposed workers;
- Sampling methods available and their limits of detection;
- Degree of accuracy required in the results;
- Number of samples required to achieve representative results;
- Cost; and,
- Regulatory requirements.

Using these factors, Environment, Health and Safety will develop a sampling strategy outlining how, where, and the number of samples that will be collected. Environment, Health and Safety will work collaboratively with the supervisor to determine the best method for conducting the sampling. Where appropriate resources and equipment are available, internal resources may be used to conduct the sampling. External occupational hygiene contractors and resources may be required as determined on a case-by-case basis.

2.6.2 Sampling Methodology

Before sampling is conducted, the supervisor is required to notify their workers of the pending monitoring. If personal sampling is required, the workers must also be made aware that they will be required to wear sampling equipment. The workers are required to cooperate with monitoring and not intentionally contaminate collected samples.

Sampling methods shall be conducted in accordance with the National Institute for Occupational Safety and Health (NIOSH) Manual of Analytical Methods or in accordance with a procedure acceptable to the Director of Occupational Hygiene, Alberta Workplace Health and Safety. For sampling techniques that require the use of an external laboratory for analysis, only laboratories accredited through the American Industrial Hygiene Association (AIHA) or the Canadian Association for Environmental Analytical Laboratories Inc. may be used.

2.6.3 Sampling Results and Assessment

Where Environment, Health and Safety has conducted monitoring, the consultant will evaluate the sample results. Where the monitoring was conducted by another internal resource, Environment, Health and Safety will assist that resource in evaluating the results. When a third party is used to conduct the monitoring, the external occupational hygiene contractor will evaluate the sampling results. Environment, Health and Safety may perform a technical review and provide supplemental interpretation of reports prepared by outside contractors where warranted.

Sampling results will be made available to the supervisor within 30 days of receiving the final laboratory analysis results. The results will be made immediately available if there is an excursion of an Occupational Exposure Limit (OEL).

2.6.4 Written Documentation

The final sampling results may be made available in report or memo format depending on the extent of sampling conducted. Where Environment, Health and Safety conducted the sampling, the consultant will interpret the analysis results and provide the written report or memo.

Where another internal resource conducted the sampling, Environment, Health and Safety will assist in interpreting the results and in preparing the written report or memo. Where a contractor was used, the contractor will submit a formal report on the sampling results. Environment, Health and Safety may review reports prepared by contractor to ensure their accuracy and quality.

The occupational hygiene monitoring results must be issued to both the supervisor and the Occupational Hygiene Consultant. Additional stakeholders may be included in the distribution as required. It is the supervisor's responsibility to ensure the results have been shared with the exposed workers in their area.

2.7 Determination of Exposure Level

Determining whether results from monitoring indicate an acceptable exposure level will be based on the Occupational Exposure Limits (OELs), accepted occupational hygiene practices, and professional judgement. To help guide this determination, an action level will be used. The action level is the point at which hazard controls will be recommended and will be set at 50% of the applicable OEL, where there is little historical data present. Where sufficient historical data is available, the action level will be calculated using accepted occupational hygiene practices. Where occupational exposure limits do not exist, other recognized standards and professional judgement will be used to determine at which point hazard controls are required.

Where the exposure results are below the action level, the exposure level will be deemed acceptable. However, recommendations for controls may still be made to address worker comfort or due diligence issues.

Where the exposure results are above the action level, the implementation of, or modification to, hazard controls must be made. Where an OEL has been exceeded, the affected worker is to be informed of the nature and extent of the excess exposure and immediately protected from further excess exposures.

Where the exposure results cannot be clearly interpreted, further exposure assessment will be required.

2.8 Implementation of Controls

When recommending controls for identified and assessed hazards, the hierarchy of controls will be used; preference will first be given to engineering controls, then administrative controls, and lastly personal protective equipment. It is the responsibility of the affected supervisor to implement hazard controls and to ensure their effectiveness in accordance with University policies, procedures and legislation requirements. Each supervisor is responsible for notifying the Occupational Hygiene Consultant, in writing, when the recommended controls have been implemented. The hazard assessment form must also be updated to reflect any changes in control measures.

2.9 Additional Exposure Assessments

To evaluate the effectiveness of a control, additional exposure assessments of the substance/agent may be required. If additional assessments are required, Environment, Health and Safety will develop a monitoring strategy and schedule.

Additional exposure assessment may also be required after new processes, equipment, or products are introduced.

Where additional exposure assessment is not required, no further action is necessary.

2.10 Monitoring Schedules

Monitoring schedules must be developed for substances/agents that cannot be eliminated and require additional exposure assessments. A monitoring schedule will specify the substance/agent(s) to be monitored, the frequency of monitoring, and how the monitoring is to be conducted. This schedule may specify continuous monitoring or periodic follow-up monitoring as a means to evaluate the applicable operation. The affected department/supervisor and Environment, Health and Safety will keep a copy of the monitoring schedule. The schedule may be adjusted if changes are made to the operation, resulting in a change in the hazard assessment.

3.0 Roles and Responsibilities

In order for the occupational hygiene process to work effectively, the roles and responsibilities of each stakeholder (i.e. department, supervisor, worker, Occupational Hygiene Consultant, etc.) must be clearly defined:

3.1 Deans, Directors and Department Heads

- Ensure that the Occupational Hygiene Program and all its components are implemented, administered and enforced;
- Ensure resources are available for the implementation of this program and,
- Ensure that all potentially exposed workers are provided with appropriate controls, including personal protective equipment.

3.2 Supervisors (includes Faculty Members)

- Conduct hazard assessments in accordance with the University of Calgary Occupational Health & Safety Policy and associated Hazard Assessment and Control Process;
- Implement controls in accordance with University and legislation requirements;
- Be knowledgeable in the appropriate government regulations, safety standards, and prudent safety practices to protect workers;
- Notify Environment, Health & Safety (EH&S) of occupational hygiene issues;
- Follow any monitoring schedules that have been established;
- Provide access to their areas for walkthrough surveys and monitoring, where required;
- Forward monitoring data to the Occupational Hygiene Consultant; and,
- Inform Environment, Health and Safety when recommended hygiene controls have been implemented.

3.3 Workers

- Attend required training sessions on workplace hazards;
- Participate in personnel monitoring, audiometric testing and respiratory fit testing, where required;
- Wear personal protection equipment, where required (also applies to students, visitors and guests);
- Ensure that personal protection equipment is in a sanitary condition and proper working order by following proper maintenance procedures and inspections; and,
- Report workplace hazards and defective or damaged personal protective equipment to the appropriate supervisor.

3.4 Environment, Health and Safety

- Conduct initial inquiry of hygiene issues;
- Collect spot samples;
- Conduct walkthrough surveys;
- Develop monitoring strategies and schedules;
- Arrange for and coordinate competent occupational hygiene contractors, where required;
- Complete, review, or provide interpretation of reports where required;
- Conduct monitoring where feasible;
- Maintain a database of monitoring results;
- Perform statistical analysis of data;
- Work with supervisors through the exposure assessment process;
- Provide department/supervisors with monitoring schedules;
- Review quality assurance measures for sample collection;
- Monitor regulations, research data, etc. for emerging issues;
- Provide training on the use of monitoring equipment where necessary;
- Maintain occupational hygiene equipment belonging to EH&S; and,
- Maintain an exposure assessment plan.

4.0 Education and Training

Education and training, although similar, are different:

1. Education refers to the theoretical instruction of workers in general information such as the different types of hazards and how to control those hazards.
2. Training refers to the practical application of site-specific information such as safe work instructions, standard operating procedures, and emergency response protocols.

Both education and training are an important part of understanding and controlling the hazards that may be present.

Environment, Health and Safety offers multiple courses to support the education component of occupational hygiene concerns. Please refer to the EH&S website for current course offerings.

5.0 Preventative Maintenance and Inspection

5.1 Maintenance of a Hygiene Database

Environment, Health & Safety will maintain a central database of sampling records. The database will be used to address future exposure assessment issues, develop monitoring schedules, and prioritize exposure monitoring. The database will include location, date, conditions under which sampling was conducted, sampling method used, and sampling results. The records will be retained in the database for a minimum of 30 years.

It is the responsibility of each department/supervisor to forward sampling records to Environment, Health & Safety for maintenance of the database.

5.2 Maintenance of Hygiene Equipment

5.2.1 Department Responsibility

Each department is responsible for maintaining and inspecting their own hygiene equipment, such as gas monitors. Guidance on maintaining the equipment can be obtained by referencing the manufacturer's instructions or contacting Environment, Health & Safety.

Environment, Health and Safety will maintain and inspect their own equipment.

5.2.2 Equipment Storage

Hygiene equipment will be stored in a manner that keeps it free from damage and contamination. A competent worker may perform minor repairs and preventative maintenance. The equipment's manufacturer or an approved vendor will complete major repairs and regular factory calibrations as needed.

5.2.3 Calibration & Documentation

Records of maintenance, repairs, and calibration must be kept on file for the life of the instrument. For gas monitors, residual calibration values should also be recorded to track the useful life of the sensor. The residual calibration values may be discarded once the sensor has been replaced. Equipment will be calibrated according to the following schedule:

Equipment Type	Schedule
Sampling Pumps	Before and after each use
Sound Level Meter, Dosimeters	Before each use
Monitors with Gas Sensors	Monthly
Secondary Calibrators	Yearly

Equipment may be calibrated more frequently if the condition under which the equipment is being used raises concerns over the accuracy of the equipment, or the above scheduled calibrations are felt to be too infrequent. This could include situations where a gas monitor has been overloaded with the gas and the monitor's sensor may no longer be accurately reading gas levels. It could also include situations where equipment is suspected of being damaged.

6.0 Annual Program Review

The Occupational Hygiene Program will be reviewed annually by Environment, Health & Safety e:

- To ensure its contents continue to meet regulatory and University requirements;
- To evaluate the effectiveness of the process/program; and,
- To evaluate the roles and responsibilities of the program.

Environment, Health & Safety must retain the current copy of the Occupational Hygiene Program.

7.0 Definitions

ACGIH: American Conference of Governmental Industrial Hygienists who publish annual recommendations regarding safe limits for exposure to chemical and physical agents.

Action Level: the concentration of a substance/agent which, if exceeded, is the point at which hazard controls will be recommended. The action level will be set at 50% of the applicable OEL, or based on calculations using accepted occupational hygiene practices or other recognized standards and professional judgment.

Administrative Control: Encompasses the use of management involvement, training, job rotation, reduction of exposure time, preventive maintenance, and housekeeping in an effort to control worker exposures. Examples include safety rules and enforced safe work procedures, training, lock-out tag out processes to de-energize equipment prior to working on it, immunizations, etc.

Biological Hazard: is any biological organism that is infectious or pathological to humans.

Chemical Hazard: is any chemical capable of causing bodily injury or illness.

Engineering Control: Encompasses the use of process change, substitution, isolation, ventilation and source modification in order to control worker exposures by reducing the quantity of contaminants released into the workplace. Examples used in the University include chemical fume hoods, biological safety cabinets, interlock systems, automated systems, etc.

Hazard: is a situation, condition, process, material or thing that may cause an injury or illness to a worker.

Material Safety Data Sheets (MSDSs): are technical bulletins which provide detailed hazard and precautionary information on a controlled product.

Occupational Exposure Limit (OEL): Refer to the definition of Threshold Limit Value (TLV).

Personal Protective Equipment (PPE): Involves the use of devices designed to protect individuals from hazards in the workplace. Examples include gloves, goggles or safety glasses, hearing protection, steel-toed shoes, lab coats, etc.

Physical Hazard: arises from the interaction of matter and energy related to the science of physics such as sounds, light, vibration, and radiation that could result in an occupational injury or illness.

Route of Exposure: the way in which a substance/agent enters the body. The four primary routes of exposure/entry are inhalation, absorption (through skin and eyes), ingestion and injection.

Supervisor: an individual that directs or oversees a person, group, department, organization, or operation.

Threshold Limit Value (TLV): a term used by ACGIH to express the airborne concentration of a material to which *nearly all* persons can be exposed day after day, without adverse effects. A maximum limit of exposure to an air contaminant. Three types of limits in common use are:

- **Exposure Limit - TWA** - The Time-Weighted Average concentration for a normal 8-hour work day or 40-hour work week to which nearly all workers can be repeatedly exposed without adverse effect.
- **Exposure Limit - STEL** - The Short-Term Exposure Limit, i.e. the maximum concentration to which workers can be periodically exposed for a period up to 15 minutes without suffering from irritation, chronic or irreversible tissue change, or narcosis of sufficient degree to increase accident proneness, or impair ability for self-rescue.
- **Exposure Limit - C** - The Ceiling concentration of an airborne substance that must not be exceeded at *any* time. This limit is applied to substances that are predominantly irritant or fast-acting and for which the TWA is inappropriate.

Walkthrough Survey: a technical review of the operations, workers, and materials in a workplace used to more clearly identify potential health hazards and help guide a qualitative assessment of their severity.

Worker: any person engaged in work at the University of Calgary, including workers, contracted workers, volunteers, and graduate students.

8.0 References & Resources

Alberta Occupational Health & Safety Act, Regulations & Code
<http://employment.alberta.ca/cps/rde/xchg/hre/hs.xsl/295.html>

City of Edmonton Occupational Hygiene Exposure Assessment Plan, File # 3.4.3, January 29, 2003.

University of Calgary Hazard Assessment and Control Process

University of Calgary Occupational Health & Safety Policy



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Walkthrough Survey Checklist

The following is a general list of items that may be investigated during a walkthrough survey:

Investigated Items	Available (Y/N)	Reviewed (Y/N)	Comments
Work related absence data			
Floor plan			
Frequency and duration of each operation			
Fugitive emissions created during the process			
Incident data			
Layout of equipment			
Lighting levels			
Maintenance procedures			
Manual handling techniques			
MSDS			
Number of male and female employees			
Occurrence of odours, tastes, irritation			
PPE in use			
Previous monitoring results and conditions of monitoring			
Process flowchart			
Raw materials, intermediates, and by-products			
Season variations in process			
Sequence of operation			
Signage			
Ventilation			
Worker habits			
Other			

Walkthrough Survey Form

Department: _____
 Date: _____

Location: _____
 Site Contact: _____

Name of Department, process, or workstation:						
Nature of Operation (brief description)	Materials and Quantities Used	Equipment and Machinery	Identified Hazards, Exposure Duration and Routes	Personal Protective Equipment Used	Administrative and Engineering Controls	No. of Employees Exposed (+ Professionals)
Evaluation or Follow-up Required:						



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Prioritization of Agents

To help prioritize the need for addressing substance/agent(s), four factors are taken into consideration. They are (1) severity of health effects if exposure occurs, (2) qualitative evaluation of exposure, (3) number of workers affected, and (4) controls that are already in place. The following information is provided to help define each of the factors. The information is to be used as a guideline only. Professional judgement should be used when assessing the priority of a substance/agent.

1. Severity of Health Effects

Priority	Description	Examples
Low	No health effects at worst-case exposure or reversible local health effects of little or no concern	Mild irritants, humidity
	Health effects are reversible, or acute exposure produces a local effect but repeated exposure causes a cumulative effect	Moderate irritants, sensitizers, vibration
	Health effects are irreversible but not lethal, or potentially lethal but reversible if death does not occur	Noise, asphyxiants
High	Health effects are irreversible and endanger the life of the worker or their offspring	Carcinogens, teratogens, ionizing radiation

2. Evaluation of Exposure

Priority	Description
Low	No exposure or no contact with substance/agent
	Infrequent contact or occasional low exposure
	Regular or evident exposure
High	Heavy exposure with no control over exposure

3. Population Exposed

Priority	Description
Low	Workers are not exposed
	Less than 25% of workgroup are exposed
	25-75% of workgroup are exposed
High	Over 75% of workgroup are exposed

4. Controls in Place

Priority	Description
Low	Adequate engineering controls are in place
	Administrative controls are in place but engineering controls are absent or ineffective
	PPE is in place but adequate engineering or administrative controls are absent
High	No controls are in place or controls are ineffective