

ASSESSING CHEMICAL RISK IN RESEARCH ENVIRONMENTS

Introduction

Best practice for managing chemical risk in research is to:

1. Identify all hazards associated with the chemical – using WHMIS hazard classes, hazard statements, and precautionary statements
2. Analyze the risks of the hazards
3. Implement controls to reduce risk

Identifying Hazards Associated with a Chemical

Review SDS for the chemical(s) in question. Begin by reviewing Section 2 of the SDS and summarizing the information found there. Specifically consider:

1. **Pictograms:** WHMIS pictograms are designed to clearly indicate the hazard, even to those unfamiliar with the labels. The CCOHS provides an [explanation of each pictogram](#).
2. **Hazard classification:** WHMIS 2015 applies two major groups of hazards, Health and Physical. Health hazards present dangers to human health (e.g., breathing or vision) while physical hazards cause damage to the body (e.g., skin corrosion). There are 16 physical hazards and 10 health hazards. Each hazard is then further divided according to different severity levels. This CCOHS provides [more detail on the hazard classifications](#).
3. **Hazard statements:** a hazard statement describes the nature of the hazard posed by the hazardous product. The purpose is to further simplify the identification of hazards. See the [GHS Hazard Statement List](#) for more information. Some potential hazard statements include:
 - a. Causes serious eye damage
 - b. Skin irritation
 - c. Acute toxicity
 - d. Extremely flammable gas
 - e. May cause cancer
4. **Precautionary statements:** a precautionary statement pulls from a list of standardized phrases. It describes measures to minimize or prevent adverse effects from exposure to the hazardous product. The precautionary statement can also be applied to warn about improper handling or storage of the hazardous product. [Review the GHS Precautionary Statement and P Codes](#) for more details. Examples of precautionary statements include:
 - a. Keep container tightly closed
 - b. Wear protective gloves
 - c. If exposed, get medical attention



d. Protect from sunlight

As an example, consider the following chemicals:

- [Nitric Acid SDS](#)
- [Ethanol SDS](#)

Pulling out the pictograms, hazard classifications, hazard statements and precautionary statements yields the following information:

Nitric Acid		Ethanol	
GHS Classification in accordance with Hazardous Products Regulations (HPR) (SOR/2015-17)		GHS Classification in accordance with Hazardous Products Regulations (HPR) (SOR/2015-17)	
Oxidizing liquids (Category 3), H272 Corrosive to Metals (Category 1), H290 Acute toxicity, Inhalation (Category 3), H331 Skin corrosion (Category 1A), H314 Serious eye damage (Category 1), H318 Pictogram		Flammable liquids (Category 2), H225 Eye irritation (Category 2A), H319 For the full text of the H-Statements mentioned in this Section, see Section 16. GHS Label elements, including precautionary statements Pictogram	
Signal Word	Danger	Signal word	Danger
Hazard statement(s)	May intensify fire; oxidizer. May be corrosive to metals. Causes severe skin burns and eye damage. Toxic if inhaled.	Hazard statement(s)	Highly flammable liquid and vapor. Causes serious eye irritation.
Precautionary statement(s)	P210 Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. P220 Keep away from clothing and other combustible materials. P234 Keep only in original packaging. P261 Avoid breathing mist or vapors. P264 Wash skin thoroughly after handling. P271 Use only outdoors or in a well-ventilated area. P280 Wear protective gloves/ protective clothing/ eye protection/ face protection. P301 + P330 + P331 IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. P303 + P361 + P353 IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water. P304 + P340 + P310 IF INHALED: Remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CENTER/ doctor. P305 + P351 + P338 + P310 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER/ doctor. P363 Wash contaminated clothing before reuse. P370 + P378 In case of fire: Use dry sand, dry chemical or alcohol-resistant foam to extinguish. P390 Absorb spillage to prevent material damage. P403 + P233 Store in a well-ventilated place. Keep container tightly closed. P405 Store locked up. P501 Dispose of contents/ container to an approved waste disposal plant.	Precautionary statement(s)	P210 Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. P233 Keep container tightly closed. P240 Ground and bond container and receiving equipment. P241 Use explosion-proof electrical/ ventilating/ lighting/ equipment. P242 Use non-sparking tools. P243 Take action to prevent static discharges. P264 Wash skin thoroughly after handling. P280 Wear protective gloves/ protective clothing/ eye protection/ face protection. P303 + P361 + P353 IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water. P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. P337 + P313 If eye irritation persists: Get medical advice/ attention. P370 + P378 In case of fire: Use dry sand, dry chemical or alcohol-resistant foam to extinguish. P403 + P235 Store in a well-ventilated place. Keep cool. P501 Dispose of contents/ container to an approved waste disposal plant.

Information was taken from current SDS's published by Sigma Aldrich

Assessing Hazards

Reviewing the WHMIS classification for nitric acid, we can see that it is an oxidizing substance that corrodes metals is hazardous to the skin (Cat 1A), eyes (Cat 1), and acutely toxic (Cat 3). This means the substance will substantially damage skin and eyes and may not kill you upon ingestion/inhalation/contact, but will cause harm relatively quickly.

From this information, one can very quickly determine that skin protection, eye protection, and ventilation should be used when working with nitric acid. Avoiding all contact is also important. Since it has also been indicated that the material is corrosive to metals, and it's an oxidizer, one should be cognizant to not mix with organic or combustible materials and should ensure that the construction of any equipment being used is compatible with this information.

Reviewing the WHMIS classification for ethanol, it is evident that this substance is very flammable and will cause eye irritation upon exposure. Again, this information allows one to understand the main hazard potential of the chemical. It means that ethanol should be handled under ventilation, with eye protection, and the substance should be kept away from ignition sources.

The precautionary statements for nitric acid and ethanol provide even more detail on what controls could be used to mitigate against known hazards. For example, reviewing the P-statements for ethanol, in particular P210, P238, P240, P241, and P242, it becomes evident that fire protection may also involve controlling static electrical discharges from various sources. It makes one aware of just how flammable the substance is.

With this knowledge, the user can make better judgements on how to handle, store, use, and dispose of the chemical with decreased risk.

Implementing Controls

The above risk analysis is used to identify general hazards and risks associated with a chemical. To really understand chemical risk, one must examine these hazards and precautions in the context of how the chemical is being used in an actual research setting, project, or process.

At the University, the easiest method to do this is by using the [Laboratory Risk Assessment Template](#). This form combines the hazards associated with the chemical itself and examines what additional hazards exist with the equipment being used, the process conditions, and how worker exposure may occur.

As a reference, review the following resources found on the [Safety Office's Risk Assessment and Standard Operating Procedure page](#):

- Example 1: [Using a Parr Reaction Vessel for hydrothermal reactions](#)
- Example 2: [Using hydrochloric acid to etch metal](#)