Health hazards are created by chemicals that cause acute or chronic health effects in exposed employees. Chemicals that pose health hazards include those that cause cancer; are toxic; harm internal organs or blood; are reproductive toxins; cause sensitivity to later chemical exposures; or burn or irritate the skin, eyes, or mucous membranes. The seriousness of exposure to a hazardous chemical is dependent upon the length and amount of exposure and individual differences (health, physical fitness, etc.).

Possible Entry Routes

Chemicals can enter the body in four different ways:

- **Inhalation**

  Chemicals that become airborne, and are therefore inhalation hazards, include (1) gases, (2) liquids that have high vapor pressures, and (3) very small particulates (e.g., nanoparticles, powders, or fibers). Other chemicals can also be inhalation hazards if they become airborne through mechanical means (e.g., boiling or misting liquids).

To prevent accidental inhalation, certain controls are put in place in the chemical laboratory. The primary means to control these emissions is through engineering controls such as ventilation (i.e., hoods, local exhaust trunks, and gloveboxes). Other control methods include administrative controls, such as method-specific procedures and real-time monitoring systems, and PPE such as respiratory equipment with chemical cartridges or particulate filters.
• **Injection**

Sharps (e.g., needles) and broken glass are often contaminated with chemicals. Being poked or cut with these objects can inject hazardous chemicals directly into the bloodstream or other tissues.

Chemicals can easily enter the body through a cut or open wound. If you have a serious cut or concerns about any wounds, check with your manager or group lead and the medical department before you begin work with hazardous chemicals. Medical will examine the injury to determine whether to allow you to work in the laboratory.

To avoid injection hazards, handle glass and sharps carefully. If necessary, use protective gloves, as recommended by an Industrial Safety professional, to help prevent accidental injections.

Always inspect glassware before use. If you cut yourself while working in the laboratory, seek medical attention immediately. Sharps, including razors and cutting blades, should be disposed of in a special "sharps box" or special glass disposal container.

When handling syringes, particularly uncapping or recapping, use extreme caution to ensure the needle doesn't contact or puncture the skin.

If needles must be recapped, use the one-hand technique: Place cap on flat surface and remove hand from cap; with one hand hold the syringe and use the needle to scoop up the cap; when the cap covers the needle completely, use the other hand to secure the cap on the needle hub.

• **Absorption**

The skin is a barrier to many chemicals—but not all. The physical characteristics of a chemical determine how readily it can be absorbed if it contacts the skin. These characteristics include lipophilicity, molecular weight, and volatility.

If chemicals come in contact with and penetrate the skin, they may be absorbed by the underlying blood vessels and carried through the blood stream. They may then present a hazard to the blood or other internal organs.

Some chemicals, though not absorption hazards, can cause harm to or even destroy the skin and eyes. Corrosive chemicals destroy living tissue by chemical action at the site of contact. Irritants cause inflammation of tissues at the site of contact. Skin that is damaged in this way also presents an increased risk for absorption.

Control measures to prevent chemical absorption include using non-contact handling techniques and wearing PPE. At a minimum, wear the appropriate chemical-resistant gloves that provide an excellent barrier to the chemical of concern and safety glasses with side shields when working with hazardous chemicals in laboratories.

Other control measures include limiting amounts being handled and utilizing closed processes. In addition, looking for safer alternatives (i.e., less hazardous, less of an exposure risk) should be considered.

• **Ingestion**

Ingestion is the least likely route of chemical exposure because eating drinking, chewing tobacco, or gum, applying cosmetics, and handling contact lenses are prohibited in the laboratory. Never take food or drink into laboratory areas. Laboratory refrigerators, freezers, ovens, Bunsen burners, or glassware shall never be used to store or prepare food and drink.

To avoid accidental ingestion, wear gloves and keep your hands and tools (such as pencils and pens) away from your face and mouth. When finished with the chemical handling activity, remove your gloves to prevent the spread of chemical contamination.

In general, gloves should not be worn outside the laboratory. Prior to leaving the laboratory, remove your gloves. Wash your hands with soap and potable water so that chemicals are not carried into break rooms or eating areas. Hand washing facilities available inside laboratories should have an adequate supply of soap and disposable hand towels.