

## Introduction

Standard operating procedures (SOP) are intended to provide you with general guidance on how to safely work with a specific class of chemical or hazard. This SOP is generic in nature. It addresses the use and handling of substances by hazard class only. In some instances, multiple SOPs may be applicable for a specific chemical (i.e., both the SOPs for flammable liquids and carcinogens would apply to benzene).

If compliance with all the requirements of this standard operating procedure is not possible, the principal investigator must develop a written procedure that will be used in its place. This alternate procedure must provide the same level of protection as the SOP it replaces.

### Glove Boxes

A glove box is an enclosure that provides a positive barrier from liquids, solids, aerosols, and chemical vapors. The box maintains personnel protection through solid barriers.

Gloveboxes can be used to protect the items inside, the people outside or both. It is important to monitor whether the box is leaking and to keep records so you can spot trends. No one check may be enough. Check with the glovebox manufacturer for specific checklists and operating requirements.



Disposal Glove box

Glove boxes are used when extreme containment is needed for Biological and highly toxic chemicals, especially for substances that can be swept out of containers by the airflow in hoods.

Glove boxes may be used under either positive or negative pressure. Glove boxes operated under positive pressure usually contain materials sensitive to outside contaminants such as air or water vapor. Exposure to outside contaminants can lead to degradation or a violent reaction with these compounds. Negative pressure glove boxes are used to protect workers and are used for hazardous materials such as toxic gases or pathogens.

Glove boxes must not be used with volatile flammable materials and should not be used for volatile toxic materials unless dilution ventilation is provided. Glove boxes come in several configurations;

- isolation chambers
- single pass airflow filtered designs,
- contained loop systems,
- negative pressure systems and

- vacuum glove boxes.

### **Daily Inspections**

When using glove boxes, perform daily inspections prior to use.

#### Gloves

##### Glove Box Glove Inspections

A visual inspection and dexterity check must be performed each before gloves are used.

##### Glove Box Glove Changes

Changing of a glove must be documented (date, manufacturer and model of glove and person performing change).

##### Glove Box Glove date lifetime limits

Maximum life for a glove is 10 years from the date of manufacture (stamped on the inside surface of each glove).

##### Glove protection

Disposable nitrile gloves should be used over the glovebox gloves to protect from contamination and wear and tear.

##### Inactive glove ports

Plugging ports that are never or infrequently used is allowed and encouraged. A properly plugged port should have a stub glove and a glove port cap installed.

##### Glove breaches and failures

Document who was working, the material they were working with and potentially contaminated with and the tasks that may have contributed to the failure.

##### Chemical Contact with disposal gloves

Make certain that the gloves that come into contact with the chemical are designed for that chemical or chemicals. Know the breakthrough times of the gloves for the chemical being used. For multiple chemicals, use the most conservative breakthrough times. If chemical spill on the gloves, change them out.

#### Pressure Check

The glovebox pressure must be checked every day, before use and immediately after gloves are changed. The pressure check must be documented. There are several ways the pressure can be checked:

- Visual: if the glovebox is kept under positive pressure, the gloves should be extended outside of the box.
- Gauges: There may be built in oxygen, water and pressure sensors.
- Hand-held air flow meter used on all the seams.
- Soap test the gloves, seals and fittings for a qualitative test.
- Pull a vacuum on the airlock each night. If the seal on the airlock was compromised, the vacuum will be gone.
- Monitor gas consumption: Gas consumed much faster than expected is an indication of a leak.
- Smoke test: use dry ice or liquid smoke inside the box, purge the box with inert gas and once under pressure watch to see if any of the smoke escapes from the box.
- Be sure soft connections for articles attached to the box (e.g. drums, gloves, HEPA filters), are completely sealed. Even small leaks allow contaminants to escape or enter. Test whether the gas tanks were leaking.

### Work Practices

- Individuals must be trained in the use of the glovebox prior to using it. They must understand the design features and limitations of a glovebox before using it, including:
  - Physical limitations of components, gloves and support systems (e.g. barriers that maintain contamination control).
  - Ventilation and vacuum controls that maintain a pressure differential between the glovebox and outside.
  - Atmospheric controls (e.g., controlling oxygen concentrations and moisture).
  - Features that prevent over-pressurizations, flooding and fire. Over-pressurization can cause a breach in the glovebox, endangering the user, damaging other equipment, spreading hazardous contaminants, and letting air with oxygen and moisture into the box. This design criterion especially applies to existing systems when they are being connected to a pressurized support system for the first time. Pressure relief systems should be retrofitted into existing systems that do not have adequate pressure relief.
- All personal protective equipment (PPE) needed for the hazardous material (e.g. protective eyewear, gloves and lab coat) must be worn when using the glovebox.
- Avoid abruptly extending gloves in the glovebox. This "pumping" can cause a pressure pulse that will result in contamination. Multiple users need to coordinate their movement to prevent their actions from having a compounding effect.
- Respond to off-normal indications or alarms with established procedures. Promptly convey problems and abnormal conditions to your supervisor. Stop work until the cause and consequence of an alarm have been identified and safe working conditions have been restored.
- Keep sharps in an approved container. Use tools with points on sharps ground down if appropriate.
- Do not work in the glovebox unless the lighting is working.
- Follow all safe work practices for using and handling compressed gas that may be associated with working in the glovebox. Review Compressed Gas Cylinders SOP.
- Remove waste in a timely manner. Do not allow it to accumulate. Hazardous waste containers in the glovebox must be appropriately labeled at all times.

### Documentation

Document the following:

- Condition of gloves and glove seals
- Daily pressure differential (gauge readings)
- Condition and configuration of other systems installed on the box (e.g. valves and readings on pressure and flow gauges fall within acceptable ranges).
- Condition of box and fittings (e.g., rust or other conditions)
- Compressed gas cylinder: record date changed, tank serial number (if available), and daily pressure reading.

### Responsible Individuals:

1. Periodically assess glove boxes to determine if ventilation design and monitoring requirements are adequate for authorized operations. Record the results of these assessments using a logbook (or other durable, easily retrievable record) for each glovebox. The record should to include:
  - A characterization of the type and intended use of the glove box,
  - Ventilation monitoring and design information,
  - Glovebox use history, and

- Applicable operating procedures, alarm response procedures, and safety plans.
2. Conspicuously label gloveboxes with the following:
    - The identifying information about the glove box and authorized types of work activities;
    - Appropriate hazard warning labels; and
    - The names and phone numbers of the responsible individual and other knowledgeable persons to contact about the glovebox.
  3. Ensure documentation listed above is completed.