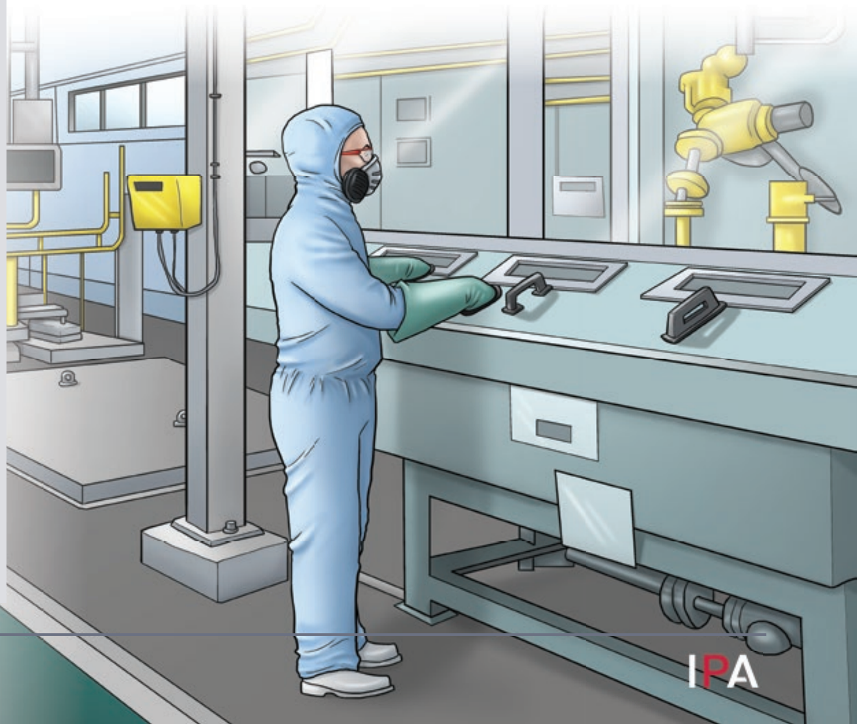
Controlling exposure to chemicals that cause platinum sensitisation

A visual guide

Content

1. Introduction

While working with chemicals, such as in a PGM refining environment, you need to be aware of the risks of exposure and how to protect yourself, and others, against the risks. In this booklet, we will show you what exposure controls are available and how they work, as well as some general safe practices to perform so that you can work as safely as possible.

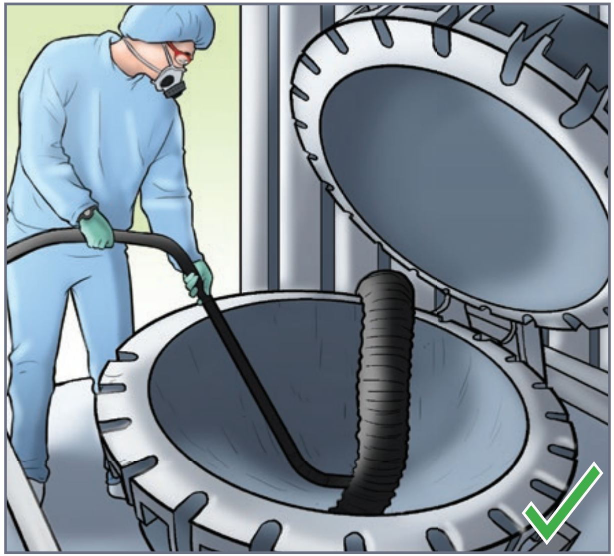


2. Risk of Exposure

Platinum Group Metals (PGM) are generally harmless, but refining or recycling them or producing products from them can involve some harmful chemicals. This booklet focuses on controlling exposure to the chemicals that can cause platinum sensitisation (allergy). These chemicals can enter your body through your respiratory system (breathing them in) or through your skin and may cause diseases such as occupational asthma.

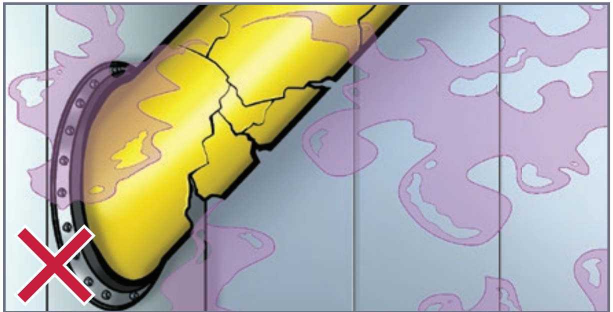
The **risk of exposure** to harmful PGM substances usually occurs **during the following workplace scenarios**, which need particular attention.

1. Sampling input material or sampling material in process.
2. Charging materials to equipment from a container; or discharging materials into a container.



3 Dispensing materials.

4 Exposure control failure or unforeseen conditions.



5 Disposing of waste or contaminated materials.

6 Routine maintenance operations.

7 Venting/emergency venting of equipment.

8 Housekeeping or cleaning.

3. The Hierarchy of Controls

To reduce exposure, we use the hierarchy of controls. This helps us to select the most effective controls first, before we consider less effective controls. The hierarchy groups controls as follows.

a. ELIMINATION (most effective)

Elimination involves physically removing or designing out the hazard. However, it is not possible to refine and recycle PGMs without chemicals that cause sensitisation.

We will not focus on elimination controls in this booklet.

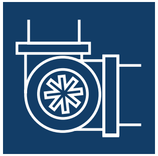
b. SUBSTITUTION

Substitution involves replacing a harmful chemical or process with a less harmful one.

Although it is not possible to substitute the chemicals that cause platinum sensitisation, we can consider using processes that have fewer transfer steps or even a closed transfer.

Alternatively, we could also select equipment that generates less PGM dust.

We will not focus on substitution controls in this booklet.



c. ENGINEERING CONTROLS

Engineering controls include containment options to isolate the hazards by placing a barrier between the hazard and the operator, and extraction ventilation to remove hazardous chemicals from workplace air.

d. ADMINISTRATIVE

Administrative controls change the way operators work. For example: reducing the number of workers in an exposure area; reducing the amount of time operators are in an exposure area; or increasing distances between operators and exposure sources. Administrative controls rely on following specific work instructions and are usually used in conjunction with other controls.

e. **PPE** (least effective)

Personal Protective Equipment (PPE) should be considered after all other types of control have been investigated. PPE is used when the other controls are insufficient to control the risk.

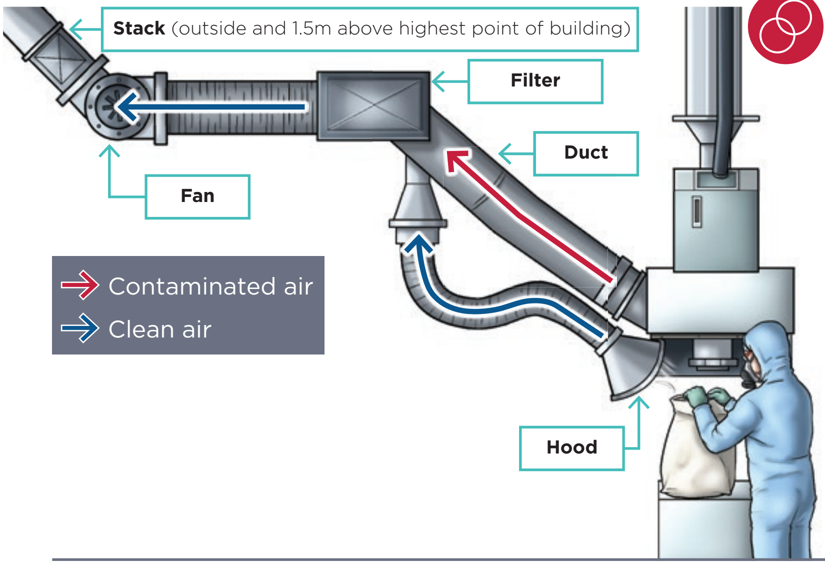
4. Engineering Controls

Engineering controls need to be correctly used, cleaned, and maintained. You must have the proper training before operating, cleaning, or performing maintenance on these types of controls.

Some of the controls mentioned below are more commonly used than others in our environments.

common control

less common



4.1 Local exhaust ventilation (LEV)

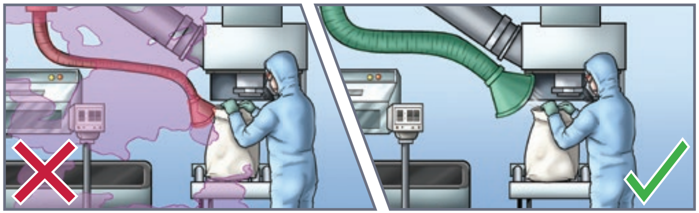
When it is not possible to enclose the hazardous chemicals, an LEV system can be used to remove the chemicals from the air. An LEV system draws in contaminated air through the capture hood, transports it along a duct and through a filtration system where the air is cleaned before it is exhausted out again. The LEV's capture hood must be positioned to remove the contaminated air before it reaches the operator's breathing zone.

Important considerations when using LEV include:

- **Position of the capture hood -** always position the capture hood in the capture zone of the LEV system. The contaminant must be extracted before it reaches the operator's breathing zone.

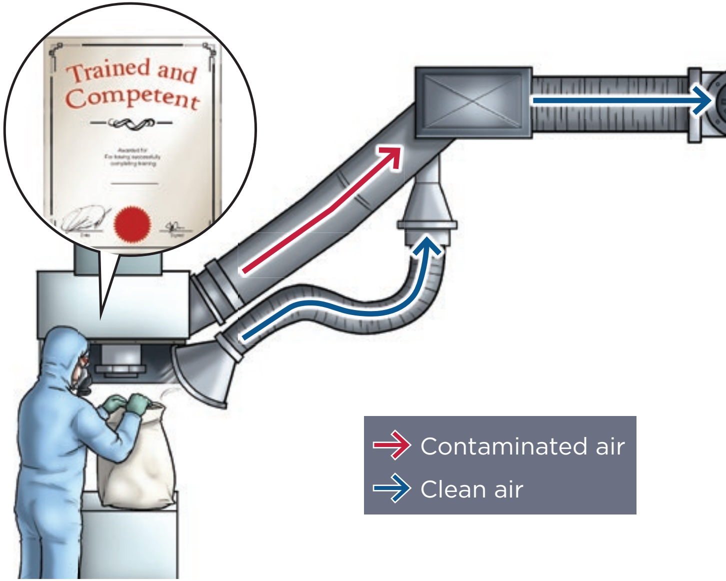
Do not place the capture hood away from the contaminant as it will not capture the contaminant.

If the task is one that includes movement, then move the capture hood appropriately.



Use the correct type of LEV for the process you're working with.

- **Maintenance of an LEV system** should only be carried out by trained and competent people.

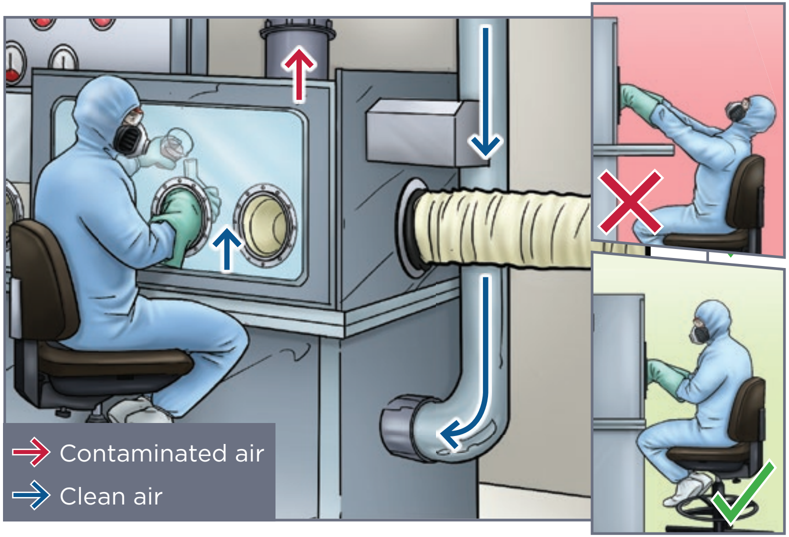


4.2 Glovebox/isolator

Gloveboxes/isolators can offer the highest levels of containment, which makes them good for operations involving high hazard or highly potent chemicals. However, glovebox performances depend on the method for transferring materials into and out of it. Using the rapid transfer port, pass-in/pass-out chambers and continuous liners can help to boost the glovebox's performance.

The air inside the glovebox has a negative internal pressure (vacuum) which reduces contaminants from escaping through any openings or joints. If handling any flammable solvents, gases or powders in the glovebox, then the air can be made inert using nitrogen.

Air being extracted out of the box (contaminated air) is filtered using High-Efficiency Particulate Air (HEPA) filters. The contaminated air can also be cleaned through chemical scrubbers before being discharged through an external stack.



Gloveboxes should be installed so they are safe and comfortable (ergonomic) for the operator to use. Operators should be properly trained on checking, using and cleaning the glovebox.

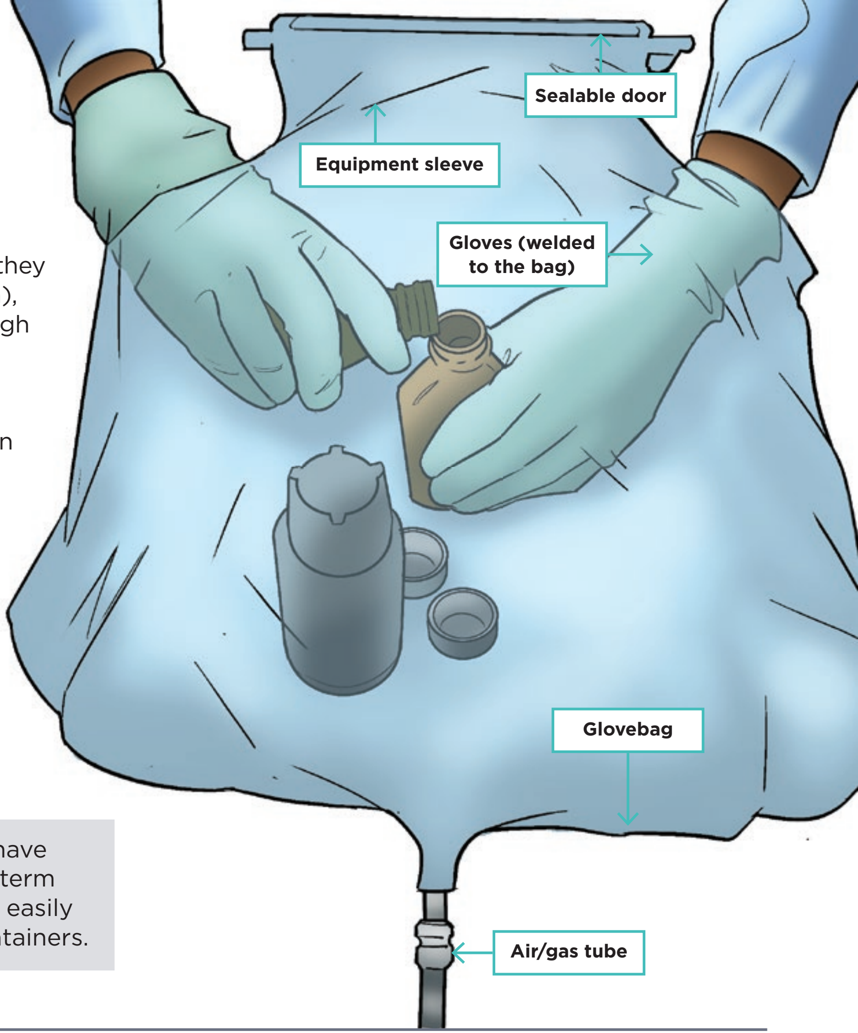
4.3 Glovebags

Glovebags are less effective than gloveboxes because they are not used with a negative internal pressure (vacuum), but if fitted correctly, can be still suitable to use with high hazard category materials.

The glovebag is usually taped to drums, pipes, etc. and can still offer a tight enough seal for gas or liquid. Pass-in chambers are made using a zip or sealable door and you access the glovebag by putting your hands into the gloves welded to the bag.

Be careful when removing the bag as this is when loss of containment usually occurs. Once the glovebag has been used, you must dispose of it.

Glovebags are not commonly used and have limited use, but can be used to fix short-term containment issues because they can be easily used on different-sized or odd-sized containers.



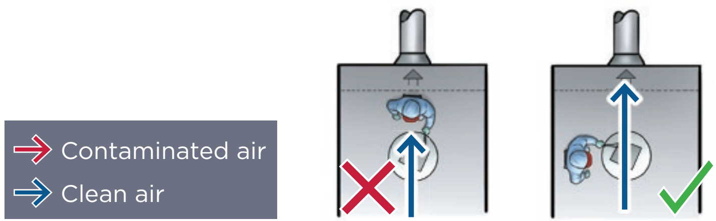
4.4 Booths

Gloveboxes and glovebags enclose the chemicals and separate them from the operator. Booths may enclose just the chemicals or the chemicals and the operator. Booths use air flow to minimise the operator's exposure.

Booths must have markings of where the protected area is for you to safely work from and you must be trained in order to work in booths.

Booths can have air pumped into them, but that part can also be passive. First the air needs to go past you and then the chemicals you're working with - effectively sucking any gases or dust away from you. The air is then sucked into and through a fine dust filter and a HEPA filter. The filtered air can either be recirculated back into the booth or pumped into the exhaust.

Booths can provide enough protection for working with high hazard category materials, but only if designed and used correctly.



Reference image from: Controlling airborne contaminants at work: A guide to local exhaust ventilation (LEV) Page 36 of 111.

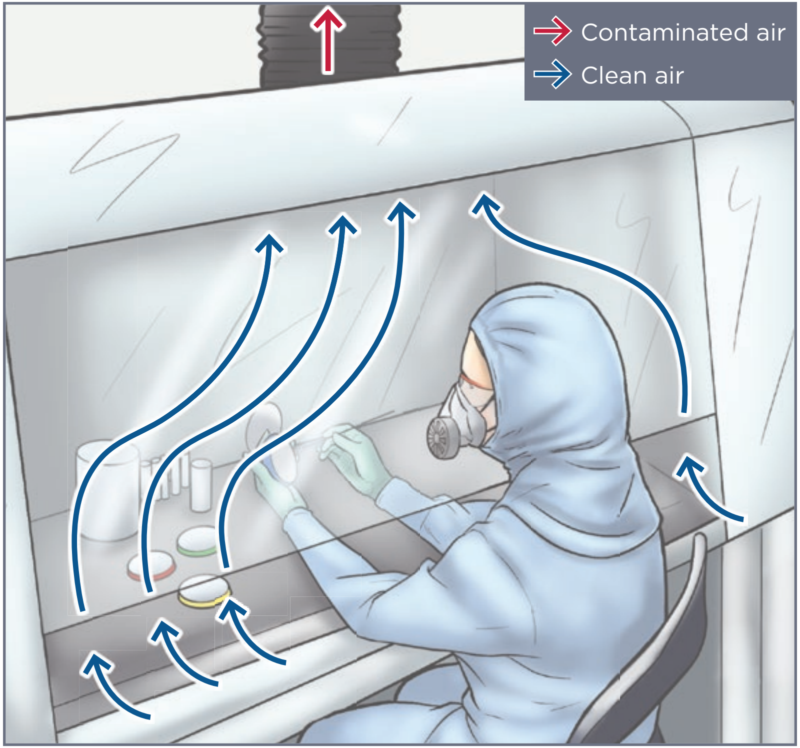
4.5 Cabinets

Cabinets work similar to booths, but only allow your hands to be inside instead of your whole body. For this reason, cabinets are used for small to mid-scale operations.

Cabinets work by air passively entering the cabinet under the sash and then the contaminated air being actively extracted. The extracted air is passed through a filtering device and discharged through a stack.

You can access the cabinet and pass materials into and out of the cabinet through the front. Some cabinets may have a bag-out port for taking materials out.

Some cabinets (fitted with a gloved screen or low sash) are suitable to be used with high hazard category materials, but rely on users to use gloves, slow movements and to decontaminate items before taking them out of the cabinet.

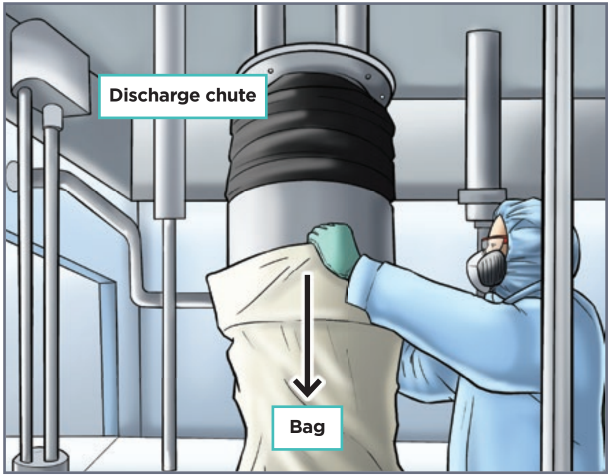


4.6 Contained Transfer Systems

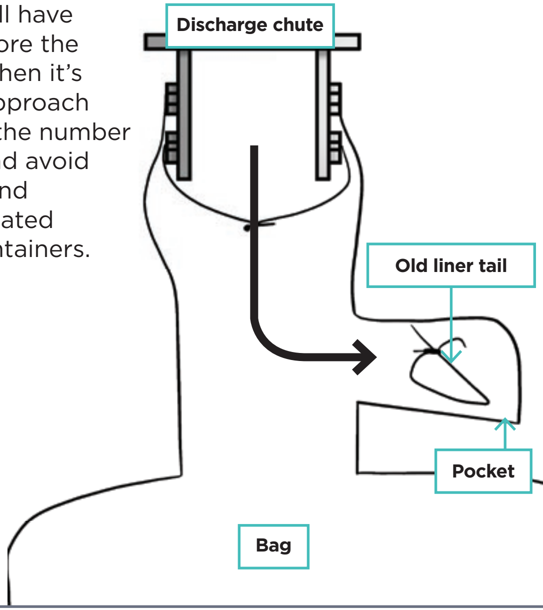
Contained transfer systems are used to connect two items and transfer material (e.g. from a dryer to a container) to allow for a more contained and safer transfer. However, these are not commonly used in our environments.

4.6.1 Bag-over-bags

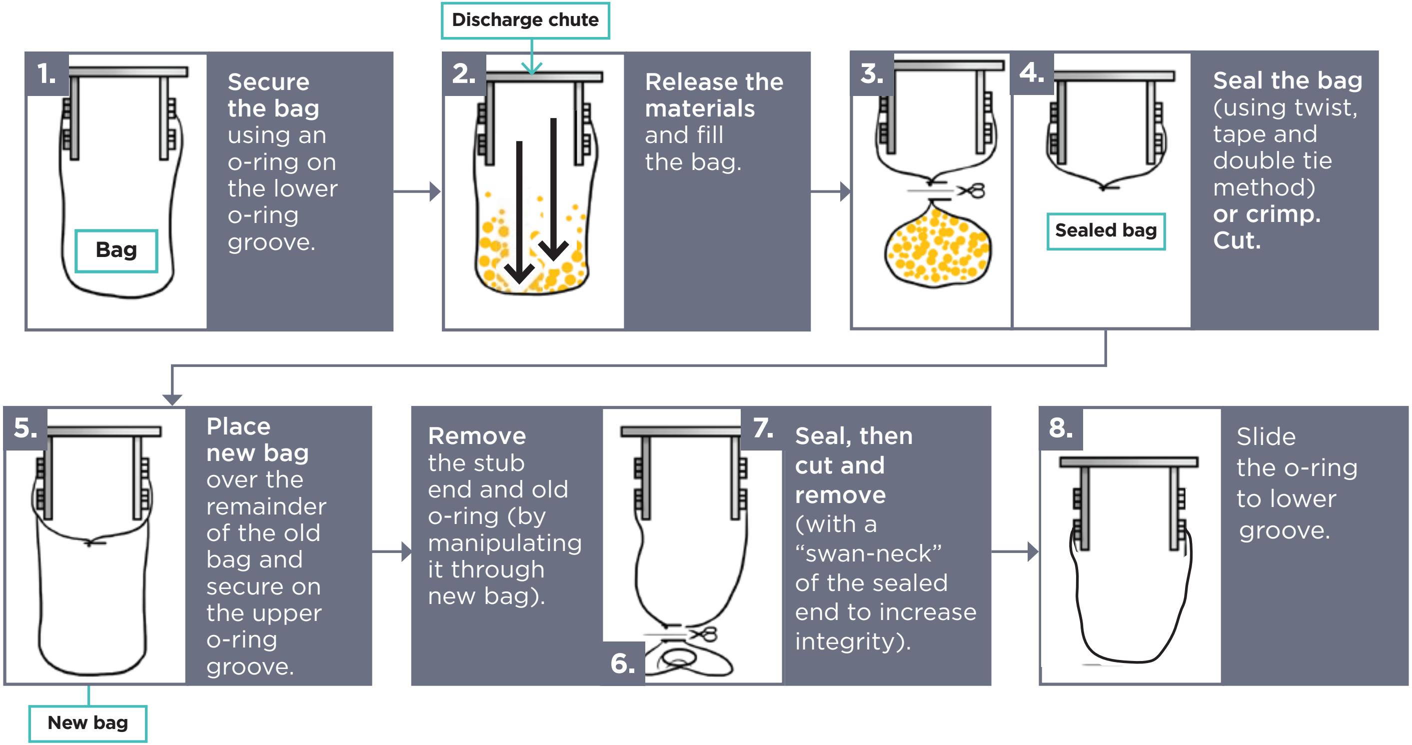
The bag-over-bag method involves taping a bag around the opening of a discharge chute where the material will come out.



Some bags will have a pocket to store the old liner tail when it's cut off. This approach can minimise the number of transfers and avoid the cleaning and storage associated with other containers.



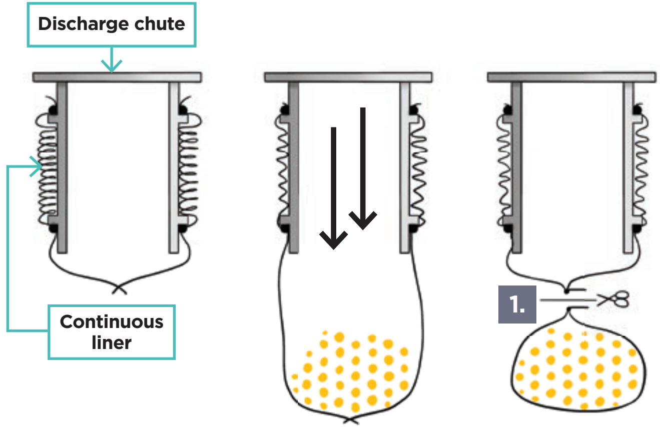
The bag-over-bag method relies on operators to know how to safely perform the following steps between transfers:



4.6.2 Continuous liner

A continuous liner is a long length of plastic liner that has an opening at both ends. The top end is attached to the opening of the chute where the material will come out. The bottom of the liner is sealed using the same method as the bag-over-bag method (see step 3 of bag-over-bag method) or a crimping tool that seals the bag.

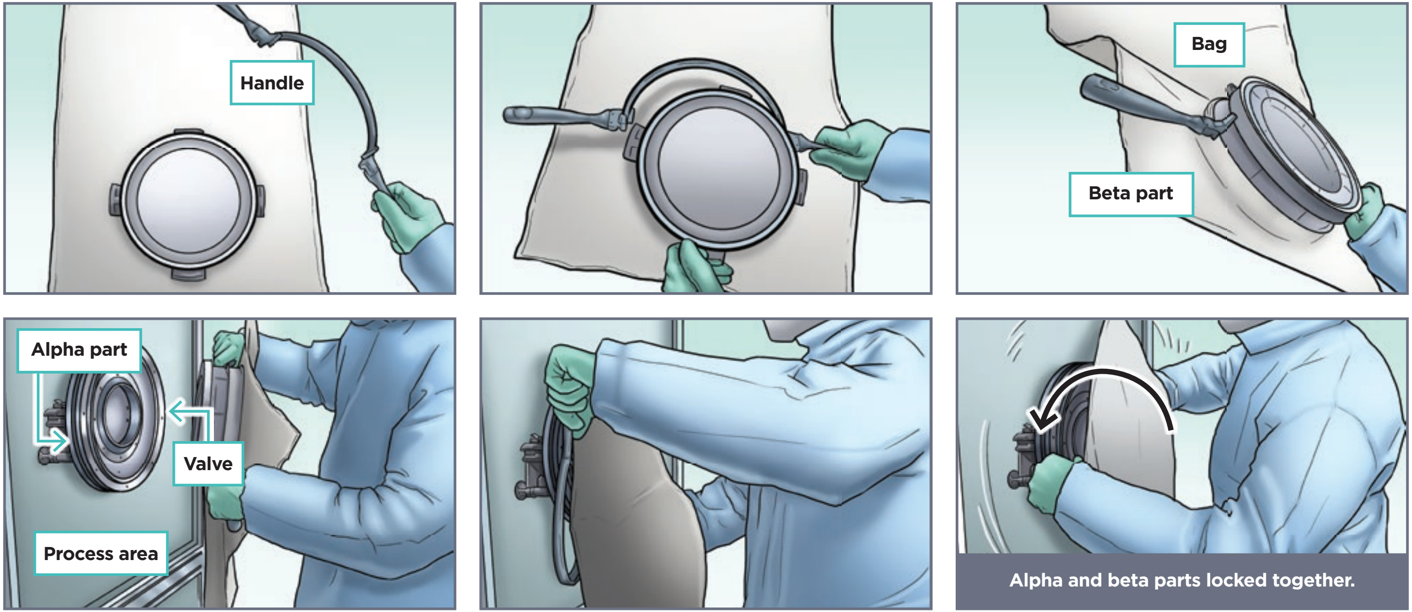
Material is then discharged into the liner and when it's enough, the bag is sealed again at the top as in step 3 of the bag-over-bag method again.



1 Seal (using twist, tape and double tie method) or crimp.

4.6.3 Flexible containment solutions

There are a number of flexible containment options, but in general these mostly involve having one part (alpha) connected to the process and another part (beta) welded to the bag. The alpha and beta parts interlock with each other and then using a handle, the valve is opened to release the contents of the bag into the process container/ equipment without releasing dust into the air. When the valve is closed and the alpha and beta parts unlocked/ undocked from each other, there is very little mess left behind.

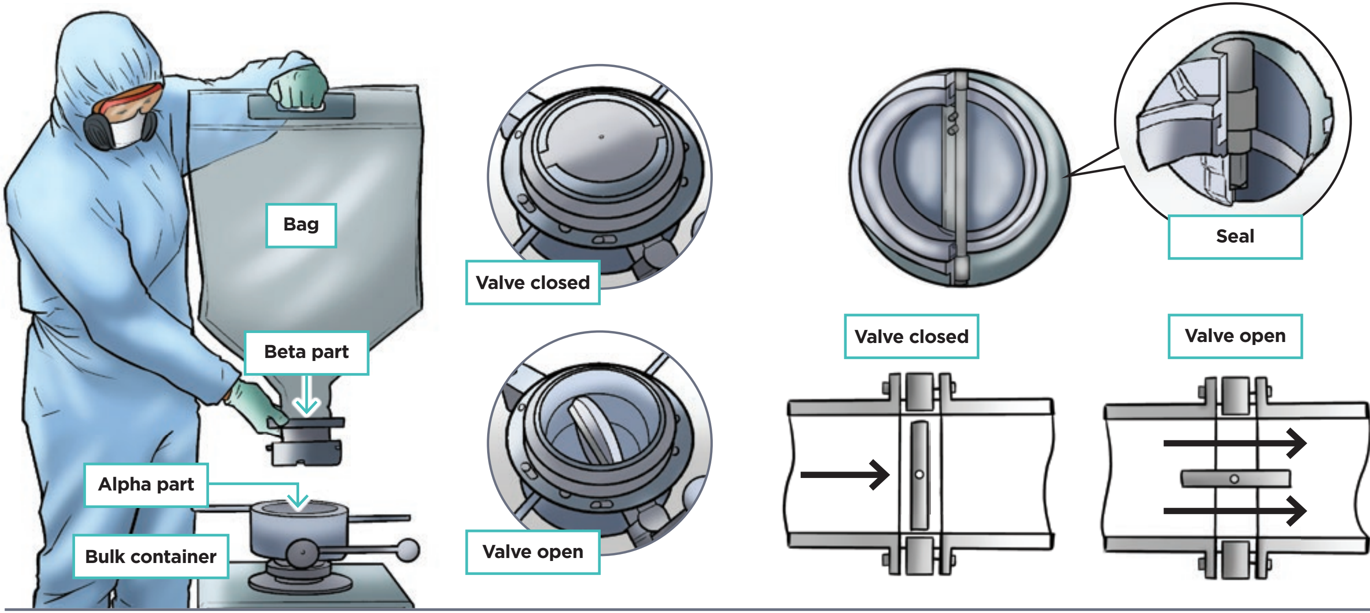


Alpha and beta parts locked together.

4.6.4 Butterfly valve

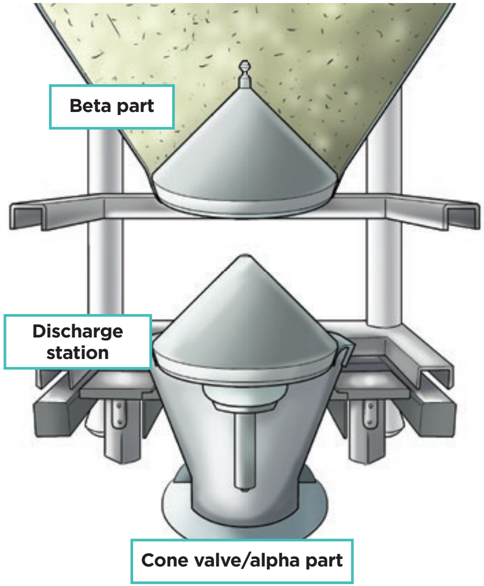
An example of an alpha part connected to a process is a split butterfly valve. Split valves are widely used to connect containers of all sizes to process systems, both for filling and discharge, especially for rigid intermediate bulk containers (IBCs).

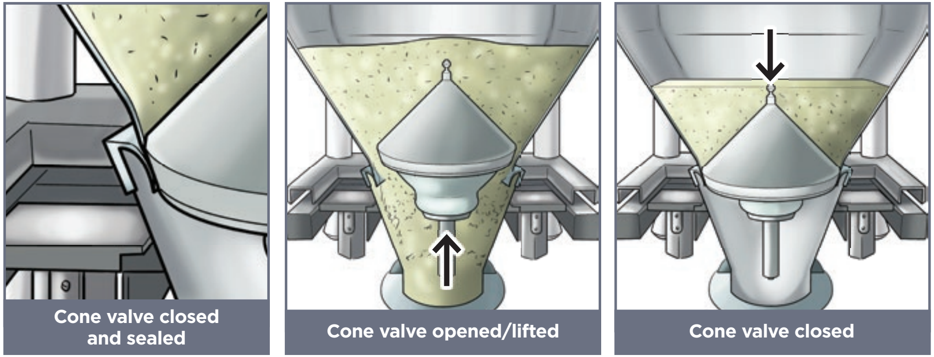
Split butterfly valves are suitable for high hazard category materials, but training is required to ensure they are used, cleaned, and maintained correctly.



4.6.5 Cone valve

Another example of a safe transfer system is a cone valve. The cone is mounted in the base of an IBC and the active part is located in the discharge station. When the two parts are docked, the cone lifts up and allows the contents of the IBC to flow into the vessel below. Seals help to keep it clean.





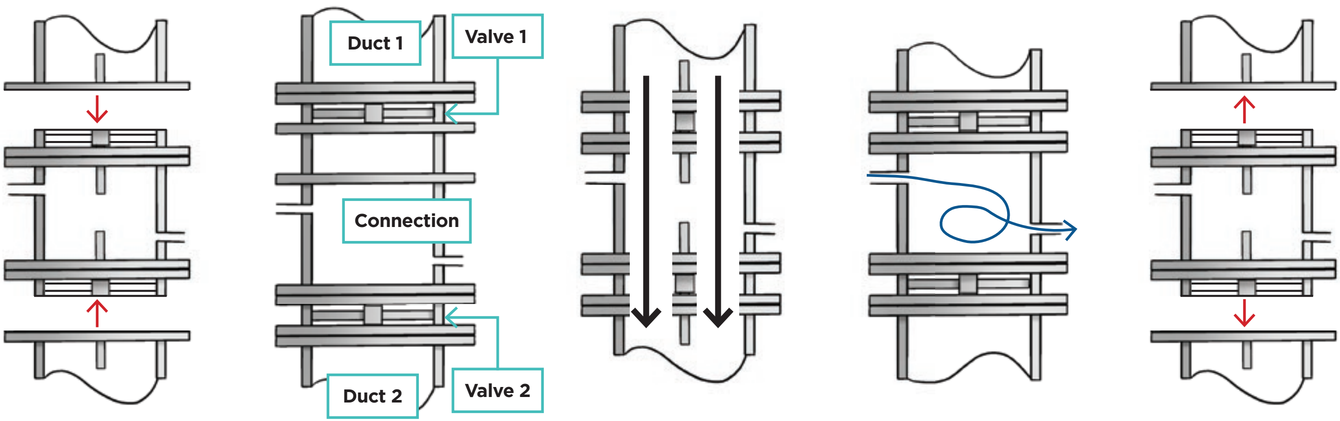
Cone valves are widely used with IBC systems where powder flow characteristics may be poor, where pre-set weights of powder may be required, or where rapid feeding is required.

Cone valves are suitable for high hazard category materials and can be used remotely (via automation), which makes it even safer for operators to use.

Double valve air- or liquid-wash in a chute

If two valves are located in close proximity in a chute, then breaking the connection between them will release dust into the air. This can be prevented if a liquid-wash or airwash is performed before uncoupling the valves.

Liquid-washes are not common because of the difficulty in positioning pipework to form an effective drain, the time it takes to dry the pipework, and the possibility of having moisture left in the system. So, another method is using air instead of a liquid. Before breaking the connection, both valves are closed and an air-wash is introduced that creates a swirling effect to remove material from the duct surfaces.



Valves closed. | **Connecting the ducts. Valves closed.** | **Transfer material.** | **Closing the valves and air-wash.** | **Disconnect the ducts. Valves closed.**

4.6.7 Rapid transfer ports

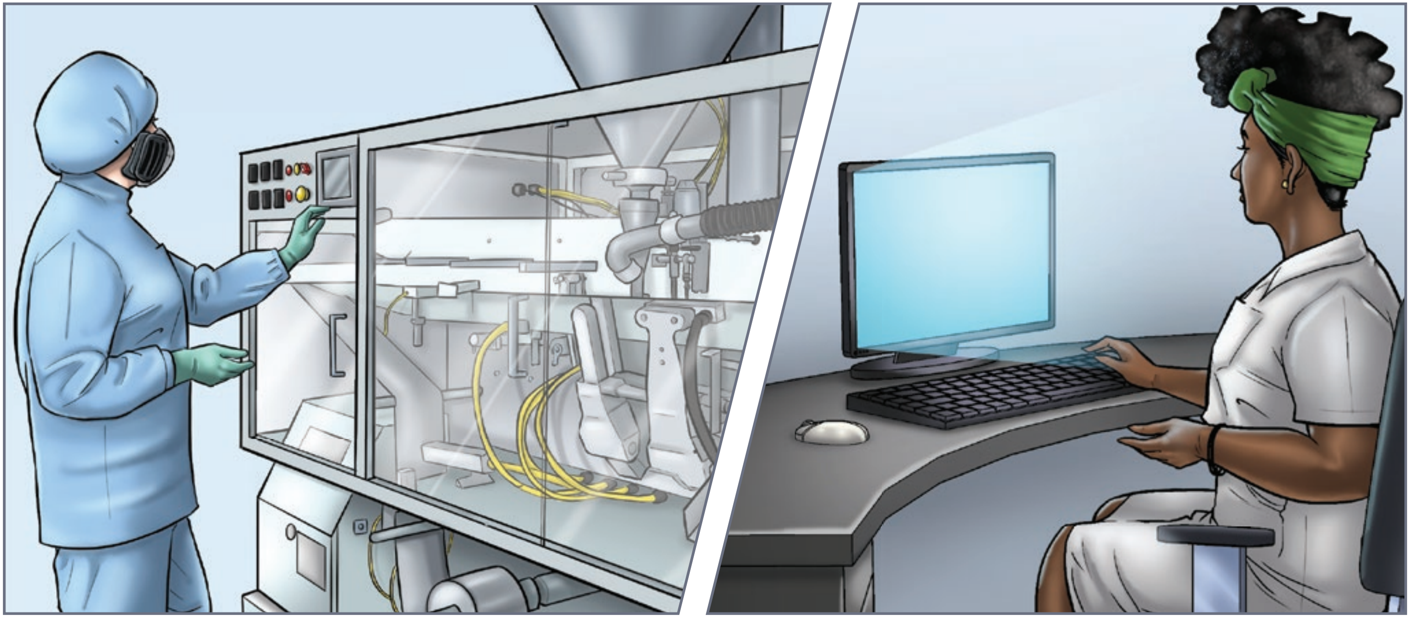
Rapid transfer ports (RTPs) are small openings, usually on the side of gloveboxes, used to transfer hazardous materials in or out. Like the butterfly valve, rapid transfer ports have an alpha part and a beta part. The alpha part consists of a frame and a door that's mounted to an isolator wall (e.g. of a glovebox). The beta part also consists of a frame and a door and is mounted to a container.

The alpha and beta parts are connected to each other and the doors can then be opened as one to allow the passing through of materials.

If powder is loosely fed through the opening, the seal of the doors will become contaminated and make it less effective. If this happens, it will need to be cleaned properly.

4.7 Automation and robotics

Automation and robotics allows operators to work in control rooms, away from process areas. This greatly reduces the risk of operators being exposed.

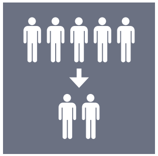


5. Administrative Controls

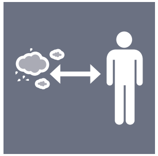
Administrative controls may also be used to reduce exposure.

Administrative controls include using such methods as:

1. Using access control/card entry systems to limit which workers can access an exposure area.



2. Limiting the number of operators in an exposure area (e.g. by scheduling tasks with high exposure potential when areas are unmanned or have fewer operators in them, such as overnight).



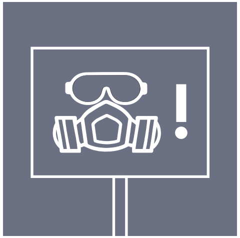
3. Increasing distances between operators and exposure sources (e.g. by automation and robotics).

4. Limiting the amount of time operators spend in an exposure area.

Administrative controls are usually used together with other controls.

Practices that help ensure that administrative controls are effective include:

Developing standard operating procedures (SOPs).



Workplace signage (especially for hazardous areas or equipment).

Regular workplace inspections.

Having clear labeling on containers.

Training programmes.

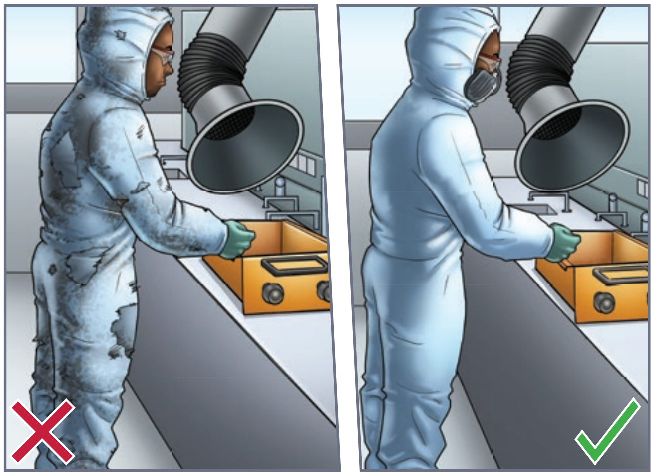
Periodic procedural audits (with improvement action follow ups).

6. Personal Protective Equipment (PPE)

PPE should be used when other controls are insufficient to control the risk, or as an additional protective measure. PPE includes:

When using PPE, consider if:

- It's compatible with the chemicals you'll be working with, and offers sufficient protection.
- You are medically fit to use the PPE (e.g. respirator).
- It fits you properly and does not affect you performing your job safely.
- You are trained on how to put it on, take off, decontaminate and clean, and store the PPE correctly.



6.1 Respiratory Protective Equipment (RPE)

Most exposure to sensitising platinum substances is by inhalation of particulates, fumes, or liquid aerosol. Properly used and fitting RPE will reduce this exposure. There are many different types of RPE designed to protect against different levels and types of chemical hazards. It is important that the correct type of RPE is selected.

Each RPE type/class has an Assigned Protection Factor (APF) rating to show what level of protection it offers.

RPE should have an APF rating equal to or higher than what is required to reduce exposure to an acceptable level for the task you are doing. This is identified through a risk assessment of the task being performed and the expected levels of chemicals in the air. Please talk to your supervisor or your Industrial Hygiene or EHS team if you are unsure of the level of risk you'll be exposed to and what level of protection is needed.

Most RPE relies on a tight seal with the wearer's face, so you should be face-fit-tested to ensure the respirator's seal is maintained while working. During your face-fit test, you should also wear other PPE that you'll be wearing during a normal day, such as safety glasses and hearing protection, to ensure you still get a tight fit.

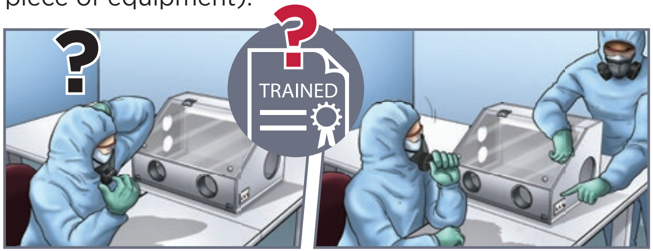
To help ensure a tight fit, a clean shaven face is recommended.

Remember:
Check the fit of your respirator regularly during your tasks.

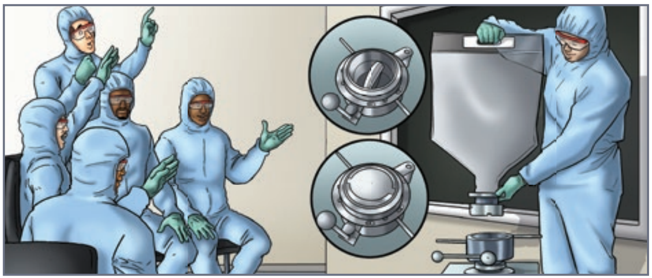
7. General Good Practices

Training

Make sure you are trained for the task you have been asked to do. STOP if you are not trained enough or feel you are not confident enough (e.g. working with a new piece of equipment).

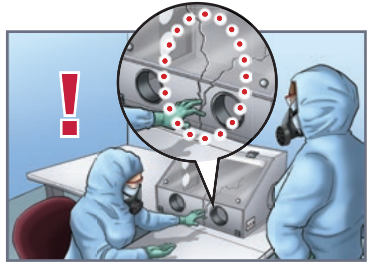


Attend refresher training to keep updated on new practices and as a reminder.

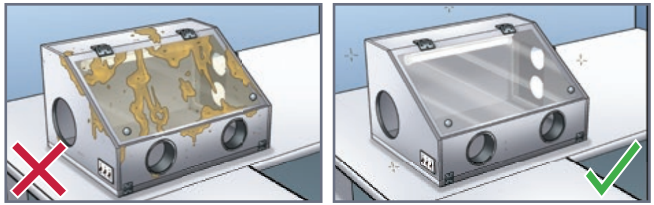


Reporting issues

Report controls or equipment that are broken, damaged or not working as they should.

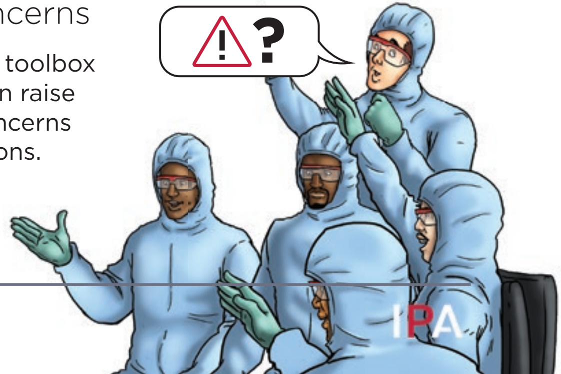


Regular cleaning will maintain clear visibility. Good behaviours will support good practices.



Raising concerns

Engage during toolbox talks so you can raise any of your concerns and ask questions.



*Some images have been illustrated based on visual references from Controlling Airborne Contaminants at Work: A guide to local exhaust ventilation (LEV)

8. Notes

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