

### DESCRIPTION

Soldering is a thermal joining process where metals are connected using a filler metal with a low melting point. Soldering is often used to create electrical connections on electronic equipment, such as circuit boards and coils. Contact [EHRS](#) if you would like an evaluation of your soldering process.



Soldering Station – School of Engineering and Applied Science

### HAZARDS

Soldering poses three main hazards:

#### 1. Burns and Fire

The soldering iron, soldered joints, and soldering dross are sources of heat. The soldering iron tip can reach very high temperatures and will cause severe burns if touched. Soldered joints, molten solder, and soldering dross are initially hot and can cause burns until fully cooled.

The soldering iron can cause fires if it touches combustible or flammable materials.

#### 2. Flux/Rosin Fume Exposure

Some solders contain rosin flux that generates smoke when soldering. The smoke contains chemicals and particles that can be irritating to the eyes and respiratory system.

#### 3. Lead and Other Metal Exposure

Some solders contain lead (Pb) metal. Lead is a probable carcinogen and is a toxicant to multiple body systems. Chronic exposure to lead can lead to various health effects, including neurological effects such as decreased memory, learning and attention,

weakness in extremities, anemia, kidney damage, cardiovascular effects, digestive issues, reproductive effects, and cancer.

Other metals used in solders (such as tin, silver, and indium) are less toxic than lead but still pose potential health hazards, particularly when ingested.

### PREVENTION OF BURNS AND FIRES

Ensure that your work surface is fire-resistant and that no flammable materials, such as paper bags or towels, are present near the work area.

Check the condition of the soldering iron tip and replace it if it has visible damage. Check the condition of electrical wires and replace the soldering iron if the wiring is damaged.

Ensure that the work area is clear of power cords; touching a soldering iron to a power cord can cause electrical shock or burns.

Never touch the soldering iron tip, soldered joints, or soldering dross on the benchtop. If the soldering iron falls during use, do not attempt to catch it.

Ensure that cleaning sponges used on the iron tip are sufficiently wetted.

Always place the soldering iron in its stand (holder) when not actively using the iron. Ensure that the iron is turned off and unplugged when not in use. Do not leave the soldering iron station unattended while the iron is on or cooling.

Hot work permit: Any soldering or brazing work that uses an open flame must have a [hot work permit \(click for link\)](#).

**Personal Protective Equipment (PPE)** - Safety glasses, long pants and closed-toed shoes are required to prevent burns from solder sputtering. In Penn laboratories, a lab coat is required.

Outside of laboratories, a long-sleeved shirt or shop coat is recommended. Goggles and face shields are optional and may be worn in addition to safety glasses.

### PREVENTION OF FLUX/ROSIN FUME EXPOSURE

Do not place your face directly in the path of soldering smoke.

Ensure that the work areas where soldering is performed are well-ventilated. Use a benchtop soldering smoke extractor with activated carbon filters or a dedicated exhaust snorkel to draw soldering smoke away from the person soldering.



Smoke Extractor Setup for Capture of Soldering Smoke

Contact EHRS if you need assistance with a ventilation assessment or smoke extractor selection and installation.

### PREVENTION OF LEAD AND OTHER METAL EXPOSURE

The primary route of exposure to lead and other metals from soldering is through ingestion.

Ingestion occurs through accidental introduction of metals to the mouth via contaminated hands during contact with food, drink containers, smoking, or other hand-to-mouth behavior.

Skin contact with lead is considered harmless unless lead on the skin is later ingested.

Inhalation of lead and other metal fumes does not pose a significant exposure risk since solders are not heated to a high enough temperature to create a metal fume.

It is important to obtain and read a Safety Data Sheet (SDS) for your soldering material. The SDS will contain the composition of the solder.

**Use a lead-free solder whenever possible** – Substitution of lead-free solders such as those containing silver/tin alloys, for lead containing solders is the best way to prevent lead exposure.

### **Maintain a hygienic work environment** -

When using any solder:

- Wash your hands thoroughly with soap and water after soldering to prevent hand-to-mouth metal exposure.
- Never use compressed air or dry wipes to clean contaminated work surfaces.
- Do not store or consume food and drink in the space where you are soldering.

If using a leaded solder:

- Wash your hands thoroughly with soap and water after soldering. Wear nitrile gloves and thoroughly clean the work area with soapy water and rags or paper towels. Once finished cleaning, dispose of the cleaning materials as hazardous waste and wash your hands thoroughly with soap and water again.

### EMERGENCY PROCEDURES

Report any incidents to the lab PI or laboratory safety coordinator, or shop/makerspace manager.

If a fire or injury occurs on the Philadelphia campus call 215-573-3333 or 511 from a campus phone. From New Bolton Center or Morris Arboretum, call 911.

### LEADED SOLDERING WASTE

Soldering waste containing lead is a hazardous waste material. Leaded soldering waste must be disposed of in a container with a lid. The container must have a yellow hazardous waste tag.