Soldering and the use of tin and lead solder

Posted by Anonymous on Tue, 2019-08-20 17:48

Soldering and the use of tin and lead solder: Is it okay for students to do soldering using the tin/lead solder?

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Showing 1-1 of 1 Responses

Soldering

Submitted by sat on 20 August 2019

Answer reviewed 18 January 2023

Occasional soldering by students in class is unlikely to pose any significant risk to health and safety as long as the work area is well ventilated, students are under strict supervision and safe work and good hygiene practices are implemented. See below for details of suitable controls which will reduce the risk of exposure to soldering fumes and exposure to lead.

Determining whether exposure to chemicals, including fumes, is a risk to health and safety is

dependent on a wide range factors, including the length of exposure (both in the short term, and also over a lifetime), the composition of the fumes, as well as any controls put in place. Lead is a toxic metal and cumulative in the body and there are notification and health monitoring requirements for lead risk work.[1,3] This risk of exposure to lead is low for occasional soldering activities as long as safe work procedures, i.e. the appropriate controls are implemented.[2,3,4]

Soldering is a technique used in schools in some STEM curricula such as constructing electrical circuits where soldering is used to connect wiring and electrical components to circuit boards.

Soldering utilizes a soldering iron to heat a metal alloy (solder) sometimes containing a rosin flux to enable pieces of metal to be joined together. The presence of flux improves the flow of the molten solder but also creates hazardous fumes.[5]

Traditionally the type of solder used is an alloy of tin/lead in a 60/40 ratio containing a rosin-based flux. Rosin-based solder fluxes produce hazardous fumes and can cause contact dermatitis in people with an allergy to rosin. Lead-free and rosin-free alternatives have been developed, however the fumes generated from these are generally unknown and so are still regarded as potentially harmful.[6] Lead solder is easier to work with due to its lower melting point whereas the lead-free alternatives generally require a higher melting point and can be more difficult to work with.[6] The solder and flux chosen should be suited to the task.

In Europe, there has been a move away from lead solder due to directives for Waste Electrical and Electronic Equipment.[3, 6] As a result, in the UK, lead solders have been removed from use in schools not because of health concerns for their use in soldering, but due to tighter environmental regulations for waste disposal of lead. Therefore, only lead-free solder is permitted.[7]

If lead-free solder is used, schools may need to check if their soldering irons operate at the higher temperatures required.[7] Soldering at higher temperatures generally results in the production of more fumes[3] which may adversely affect people with asthma, which makes good ventilation even more critical as an essential control measure.

Hazards & Risks of Soldering

- **Inhalation of fumes:** from heating the solder and flux. The type of flux present determines the composition of the fume. The flux vapourises and condenses into fine particles forming the smoke fume.[3] The fumes can cause irritation to the skin and eyes and respiratory tract and can possibly lead to issues such as asthma. **People who frequently solder in poorly ventilated areas are most at risk**.[5]
- **Ingestion of lead:** from contaminated surfaces and hands. Lead is considered a toxic substance.[4]
- **Burns and fire:** from the hot soldering iron, molten metal splashes and other hot materials.
- **Rosin or colophony dermatitis:** Allergic contact dermatitis from solder containing rosin flux. This could occur soon after contact or even a few days later to people with an allergy to rosin.[9,10]

Appropriate controls and safety precautions need to be taken to minimize these risks.

Controls and Safety Precautions

- **Suitable ventilation:**
  - Conduct work in a well-ventilated area or by using mechanical extractor systems (the latter is best particularly if there are several students soldering in the same room at any one time).
  - Consider the use of a small fan that blows across the work area.
  - Instruct students to avoid inhalation of soldering fumes by keeping their head away from above the soldering area.[4]
- **Good hygiene:**
  - Keep all work areas clean.
  - Wipe down benches with damp paper towel after the completion of soldering activities to minimise the presence of any lead contaminants.
  - Instruct students to avoid touching their face or eyes.
  - Wash hands and forearms with soap and water after working with solder, including scrubbing fingernails, as this has been identified as an area that can harbour dirt and possibly lead. If people bite their nails this can be a significant source for lead ingestion.[4]
  - Don’t eat, drink, prepare or store food or food utensils in soldering areas.
- **Limit exposure:**
  - Remove asthmatics from the area, as exposure to the fumes may aggravate their condition.
  - **Note:** Students are not likely to be soldering all day every day, but only intermittently when lessons are scheduled.
- **PPE:**
  - Wear cotton long sleeve shirts, closed in shoes and safety glasses to protect from molten metal splashes and other hot materials.
  - Tie back long hair.
  - In the event of a known allergy to rosin, avoid contact with rosin by wearing close fitting gloves (E.g. cotton gloves, NOT latex, PVC or other materials that would cause an additional hazard by melting if in contact with heat from the soldering iron) and observe hygiene measures above.
- **Burns/fire:**
  - Work on a non-flammable surface.
  - Do not touch the tip of the hot soldering iron, hot solder or other hot components
  - Use a clamp or a 3rd hand to assist holding wires or other components in place
  - Return the soldering iron to its stand when not in use and never put it down on the workbench.
  - Never leave the iron unattended when on.
  - Never flick the soldering iron to remove excess solder.
- **Electrical:**
  - Check the electrical safety of the soldering iron to ensure that it has been tested and tagged and that no damage, such as a melted cord, has occurred since the test.

- **Waste disposal:**
  - Collect lead solder waste, such as solder dross, solder drips, sticks, ingot etc. in a labelled container with a lid for disposal as hazardous waste. Note: Some companies recycle this waste.
  - Place paper towels and used solder sponges in a sealable plastic bag for disposal as hazardous waste.
- **Alternatives:**
  - Consider the use of a lead free and or rosin free solder if suitable to the task.
  - **Note:** The same controls and safety precautions apply to lead free and/or rosin free solder

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