

## [Smoke, Dust, and Fume Extraction Equipment Link](#)

### **The Invisible Enemy**

Fumes and vapors released during hand soldering with lead-free solder may pose a greater risk to employees than ever before. Installing an effective fume filtration system is the way to lessen the risks.

A main driving force behind lead-free solder is the desire by government and industry to lower the negative impact of electronics on human health and the environment. But researchers are discovering lead-free solders could be more harmful than conventional ones during the hand soldering process.

The composition of lead-free solders, their stronger fluxes and higher processing temperatures all mean that manufacturers must not overlook the impact that going lead-free will have on the environment, both inside and outside their factories, specifically the added importance that effective fume filtration takes on in achieving these goals.

Many solders contain a rosin-based flux that produces colophony when heated, containing harmful constituents ranging from acetone to carbon monoxide, and is recognized as one of the most common causes of occupational asthma. Non-rosin solders contain alcohols and acids that can be even more dangerous to health than colophony.

The UK's<sup>1</sup> Health and Safety Executive (HSE) has issued strict guidelines for resin acids present in rosin-based fluxes. Manufacturers in the UK must ensure their employees are not exposed to more than 0.05 mg/m<sup>3</sup> per hour over an eight-hour period, or 0.15 mg/m<sup>3</sup> for 15 minutes. This maximum exposure limit is a requirement of the HSE, and if exceeded a company must stop using the offending chemicals or install an effective fume filtration system.

Research has shown that the fumes and vapors released by lead-free solders can be more dangerous to workers' health than lead-based formulae, especially on the benchtop, where workers are confronted by invisible gases, vapors and particulates.

A typical lead-free solder wire generally contains 2 to 3 percent flux by weight, broadly similar to conventional solders. However, the flux content may have to be more aggressive to achieve the same degree of solder wetting, which yields stronger, more potentially harmful chemicals.

The solders also generally have a higher melting point than tin-lead, meaning solder fluxes will be exposed to higher temperatures than ever before. As a result, greater levels of degradation are likely, leading to more toxic fumes released.

A further issue with lead-free solders is that their peak reflow dwell times can also be longer, so again there is more chance of flux degradation occurring and more chemicals and materials becoming airborne.

These three factors make fume filtration even more necessary during soldering, especially for hand soldering on the benchtop. Fume filtration actually produces cost savings in terms of increased operator productivity, reduced staff turnover and controlled healthcare costs. But lead-free increases the need for monitoring and improving internal air quality, driving a demand for new fume extraction systems that are powerful, highly efficient, portable and cost effective.

The visible smoke produced during soldering often is the least likely substance to cause harm, as the human body can filter much of it. It is the smaller particulates that pose the most potential risk, as these are able to get through to the technician's lungs.

The best way to eliminate hazardous particulates is to employ a two or more step fume filtration process that removes air from the operator's breathing zone and filters it before releasing it back into the room.

Most fume filtration units consist of a pump, collection device and filter, but vary widely in capability. A powerful pump is important, but not on its own without effective filtration. A good pump with a poor filter means that contaminated air is simply moved around, while a poor pump but good filter only results in a low operating pressure that fails to collect the soldering fumes efficiently. A rated suction force of 850 Pa provides adequate airflow and fume collection.

Arm extraction systems remove not only solder fumes but also vapors from solvents and adhesives. They also are the best option when tip extraction tubes block the operator's view of his or her work.

Cheap units, such as table top fans, with a basic carbon filter cannot remove the smaller, more dangerous particles. Even opting for HEPA filters does not guarantee success, as various grades of paper can differ in effectiveness by a factor of up to 100.

When choosing a filter, make sure any effectiveness ratings are given with a particle size. For example, a filter that claims to be 99.997 percent effective may only do so for particles of 1  $\mu\text{m}$  and above. Fumes may contain more than just particulates, and harmful vapors also are released during soldering. So a chemically treated gas filter is useful after the pre-filter and HEPA filter stages.

Besides efficient pumping, collection and filtration, the latest generation of fume filtration units can be moved easily between locations. These units only require an electrical socket, targeting manufacturers with a flexible layout to their workflows.

**Reference**

Britain's Health and Safety Commission (HSC) and the Health and Safety Executive (HSE) are responsible for the regulation of almost all risks to health and safety from work activity in Great Britain.