



Filter Systems

FACTS

Health hazards by
inhaling and
exposure to soldering

For better workbench environment

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Health hazards by inhaling and exposure to soldering fumes

Producers of flux usually point out that inhaling of flux fume, created when flux is heated to soldering temperatures, will cause irritation to nose, throat and respiratory organs. The health hazards authorities also state that extended or repeated exposure to rosin flux may cause hypersensitivity and lead to occupational asthma.

Conventional flux is based on colophony. It is the translucent amber-coloured rosin obtained when turpentine is distilled from the resin of pine trees. Colophony is since long time widely used in soldering processes.

What is Colophony composed of?

Colophony is a mixture of approximately 90 % resin acid, mostly abietic acid with 10 % neutral material such as stilbene derivatives, and hydrocarbons of different kinds. When flux is heated, airborne products are generated including aliphatic aldehydes such as formaldehyde. Most fluxes are also composed of organic amine hydrochloride, an activator helping to clean the soldering area. When heated, it releases hydrochloric acid and other gaseous containing benzene, toluene, styrene, phenol, chlorophenol and isopropyl alcohol.

What health hazards are related to flux gases?

Studies have been made on workers in the electronic industry, mostly in the United States, England and in the rest of Europe. These studies show that at least 20 % of the solders or employees working in the soldering area indicate clinical symptoms of asthma caused by the environment. These symptoms are characterized of coughing, shortness of breath, wheezing and chest pain. The conclusion of these studies is that colophony fume is the main reason to illness and labour turnover in soldering occupations.

Allergic hypersensitivity is common in soldering occupations. Hypersensitivity of flux fume and its symptoms is usually developed from a period of a few months up to 16 years. The average period before the symptoms are developed is four years. Hypersensitivity of colophony is gradually indicated by wheezing and breathlessness. These symptoms are more and more common by long duration of employment and they can even continue many years after the person has finished with this kind of occupation. Eye and nose irritation is quite common, due to the fact that the fume from hydrochloric acid, generated when flux is heated, create a strong slime that causes irritation. Further, there are reports showing that colophony may cause airborne contact skin diseases because many components in the flux such as aminoethyl-ethanolamine and hydrazine are harmful to the skin.



Colophony fumes are known to cause:

- Occupational Asthma
- Chronic Bronchitis
- Chemical Hypersensitivity
- Chest Pain
- Headaches & Dizziness
- Eye and Nose Irritation
- Skin diseases

Health hazards by occupational lead exposure

22 CCR 12805 is a lead with a reproductive toxicant with an acceptable dose limit of 0,5 µg/day for a 70 kg person. Lead can cause a wide range of adverse health effects. These include fatigue, irritation and anemia and other reproductive effects such as spontaneous abortion and sterility.

What does these health hazards result in?

INCREASE IN SICK ABSENCE

Studies show that flux fume is the main reason to sick absence. Regular visits to doctors are common.

LABOUR TURNOVER

Labour turnover among solders is mostly caused by flux fume. Recruitment gives extensive costs for the industry.

WORKER 'S CLAIM FOR DAMAGES

90 % of all claims in the United States according to respiratory diseases, which are related to soldering occupations, are litigated. This is expensive to the industry. Increased health insurance premiums are costs effecting both employees and employers.



What can be done to minimize exposure of flux fumes?

Most countries have limits for the exposure to pollutants. When the operator is exposed to 10 % of the threshold value measures must take to reduce the dangerous substances created in the process.

A rule of thumb is to control and reduce the exposure to a level that most employees can be exposed to day after day a whole working life without health risks. (In UK referred to as COSH)

Various solutions are:

1. CHANGE/REMOVAL OF SOURCE

The source producing the toxicants can be removed or replaced. However, some processes require the use of certain chemicals to obtain required quality at products.

2. MOBILE SPOT SUCTION SYSTEMS AND AIR RECIRCULATING THROUGH FILTER SYSTEMS

Spot suction systems prevent toxicants reaching the respiratory organs if they are placed as close to the source as possible without interfering with the process.

This method is the most common and it has many advantages:

- a. The polluted air is caught in a filter system and does not reach the external environment which means that the pollution of both working area and products is reduced. The working area gets less polluted and results in better environment.
- b. The installation is easy and cost-effective. The investment is done only against actual need. The filters can be adjusted to the specific process at the individual workbenches.
- c. Some of the spot suction systems have three- or four-stage filters to make it possible to capture both particles and gases. The filtrated air can therefore be recirculated in to the working area which saves energy and does not effect the existing ventilation.

3. SPOT SUCTION THROUGH THE VENTILATION SYSTEM OF THE BUILDING

With this technique, big volumes of air can be removed from the operator's breathing zone. The method is as effective as extraction with mobile systems but has several disadvantages:

- a. As this installation is extensive, the construction is often dimensioned for bigger, future needs. This means that systems become expensive both in installation and operation and that flexibility at the working area is limited.
- b. It is quite complex to build filters which catch the wide spectra of pollutions produced in the different processes at the working area. Instead it is common to let the pollutions outdoors without any filtration.



Filter Systems

Threshold values for some of the VOC's that exist in soldering smoke.

CAS-no	Name	Chemical no:	Threshold value mg/m3*	Threshold value ppm*
25167-80-0	Chlorophenol	C_6H_5ClO	0,5	-
50-00-0	Formaldehyde	CH_2O	0,6	0,5
111-30-8	Glutaraldehyde	$C_5H_8O_2$	0,8**	0,2**
71-43-2	Benzene	C_6H_6	1,5	0,5
108-95-2	Phenol	C_6H_6O	4	1
141-43-5	Ethanolamine	C_2H_7NO	8	3
7647-01-0	Hydrochloric acid	ClH	8**	5**
75-07-0	Acetaldehyde	C_2H_4O	45	25
100-42-5	Styrene	C_8H_8	90	20
108-88-3	Toluene	C_7H_8	200	50
67-63-0	Isopropanol	C_3H_8O	350	150
67-64-1	Acetone	C_3H_6O	600	250

* Average threshold value per day

** Maximum threshold value for 15 minutes

Source: AFS 2005:17 from Swedish Work Environment Authority