Occupational Dermatitis from Soldering Flux

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Abstract: The aim of this study was to determine the specific agent responsible for eczema on the forearms of 2 electronic assemblers who cleaned out a flux-spraying unit once a week. Soldering flux can be a source of skin irritation as well as allergy. Patch test with dried flux residue (as is) and rosin in dilution series of 20%, 10%, and 1% in olive oil was performed. Readings were taken on day 2 and day 3. The rosin in dilution series was negative; however, the flux residue gave a + reaction on day 2, and by day 3 the reaction had weakened (+?). Similar results were obtained in 2 unexposed controls. Patch tests results in our cases indicate that the flux used in the soldering process caused irritant contact dermatitis.

Key words: Soldering flux, Irritant contact dermatitis, Electronics industry

In electronics factories, the assembly of printed circuit boards (PCBs) includes a soldering process in which soldering fluxes are used. Soldering is the joining together of 2 metals using a low melting point, tin-containing alloy as the filler metal. Without a properly formulated flux, soldering is impossible. Soldering flux, containing alcohols, rosins, organic acids and amines, can cause both irritant and allergic contact dermatitis1). The most commonly reported cases of contact allergy associated with soldering are caused by rosin in flux resulting either from direct contact with the flux2, 3) or from exposure to solder fume4). Reported other contact allergens from solder flux include hydrazine5) and aminoethylethanolamine6). These cases occurred in manual soldering2, 3, 5, 6) and wave-soldering processes5) but was not reported in clean-up of a flux-spraying unit before. We report here two workers exposed to the flux dust (the dried flux residue) when cleaning the inside of a flux-spraying unit, who developed recurrent eczema.

A 40-year-old man and a 29-year-old man, engaged in an electrical assembly operation for 6 months and 2 yr, respectively, experienced recurrent episodes of dermatitis involving the wrists and occasionally the forearms (Fig. 1). In the automated soldering process, the PCBs are conveyed first on to a flux-spraying unit and then on to a solder unit. There is a hood and fume-extraction fan to enclose each unit. Both workers cleaned out the flux-spraying unit with a brush once a week (Fig. 2). They performed cleaning as part of their work duties. During this process they were exposed to the flux dust (the dried flux residue) that would settle on their wrists and forearms. Although protective rubber gloves were worn while cleaning out the unit, attacks occurred on uncovered skin (the wrists and forearms), especially in summer. Their dermatitis appeared after returning home from work. The mean period between starting work and the occurrence of dermatitis was 4 (range 2–6) months. We advised regular washing of the hands, wrists, and forearms after work. Since then, neither of the workers developed symptoms of contact dermatitis. Thus, exposure to the flux dust was strongly suspected of being the major cause of their skin problems.

According to the material safety data sheet, the liquid soldering flux contained 85.0% isopropyl alcohol, 12.8% rosin, and 2.2% activator. The contents of the activator were secret. The manufacturer supplied samples of the rosin (without the other added constituents) specifically used in the product, but not those of the activator. On examination the 2 workers had no symptoms. Patch testing was performed according to the recommendations of the International Contact Dermatitis Research Group with 2 d occlusion with the dried flux residue (as is) and this rosin in dilution series of 20%, 10%, and 1% in olive oil. The rosin in dilution series was negative; however, the flux residue gave a +
reaction on day 2, and by day 3 the reaction had weakened (+?). Similar results were obtained in 2 unexposed controls. Patch tests results in our cases indicate that the flux used in the assembly process caused irritant contact dermatitis.

In many electronics factories, much soldering is carried out automatically, there is a hood and fume-extraction fan to enclose this soldering process, and thus workers have little contact with flux or soldering fumes. However, the workers in this study were exposed to flux dust while cleaning out the flux-spraying unit and developed irritant contact dermatitis to the dust. The risk of workers in electronics factories developing occupational contact dermatitis from the soldering flux should be recognized. Good working practice and care when cleaning will prevent unnecessary exposure to the dust.

In conclusion, for occupational hygiene reasons, skin contact with flux dust should be minimized by the means of primary prevention, including the use of protective gloves and arm covers, and good personal hygiene (e.g., washing one’s hands and forearms). In addition, rosin has been associated with occupational asthma7). It is not acceptable to sweep, no matter how carefully, because flux dust could float in the environment. Thus, the flux-spraying unit should be cleaned with a vacuum cleaner instead of a brush.

References