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Respirators, Isocyanates, and Spray Painting

What do your painters wear when they spray? Half mask cartridge respirators? An airline system, using a fresh air pump or your compressor? Or a helmet with a belt-worn filter pack and blower? Which ones will protect your workers from the paint? All of them can... if they are used correctly.

The form of isocyanate usually found in polyurethane automotive paints is hexamethylene diisocyanate (HDI). This chemical cures to form the polyurethane. In that can of hardener, there's very little of the HDI molecule, the monomer. But there is a sizeable amount of the polyisocyanate, the HDI molecule that's linked to other HDI molecules. There's some evidence that the polyisocyanate may be safer than the monomer. But it is still a hazard.

Isocyanates can irritate the lung and skin. Repeated exposure may cause long-term lung damage. And, of most concern, they are potent sensitizers. People readily become allergic to them, either from repeated contact or from one high overexposure (for instance, from a spill). Once someone has been sensitized, exposure to even very small amounts can cause a severe allergic reaction. That could be a skin rash, hives, and swelling, or – worse – it could be an asthma-like reaction.

Painters are exposed to isocyanates when they are mixing paints and when they are spraying. Because the isocyanates do not evaporate easily, the main route of exposure when mixing paints is dermal (skin contact). Wearing impermeable gloves, such as surgical-type nitrile gloves, prevents that. Surgical latex gloves are completely ineffective against isocyanates, allowing them to penetrate with no obvious damage to the glove.

When spraying, the main route of exposure becomes inhalation. Some of the isocyanate is in droplet form, in the paint mist. Some may be in the vapor form when sprayed. So a respirator needs to be able to remove both forms of the chemical.

Supplied air respirators, the type hooked up to your compressor or an air pump, handle that situation well. They don't have to remove either form of the chemical, because they

supply clean air to the painter instead. They provide a higher level of protection and, often, more comfort. In addition, for body shop painters, the fit of the respirator is not critical. So a painter with a beard can use this type of respirator.

The most common respirator used by painters is the half mask respirator with organic vapor cartridges and prefilters. The organic vapor cartridges remove vapors from the solvents (toluene, xylene, etc.) in the paints. The prefilter removes the droplets of mist created when painting.

A new study from a study at Yale University, the Survey of Painters and Repairers of Auto bodies by Yale (SPRAY), studied whether this respirator actually does protect the painter. The researchers measured how well the respirators fit. They also measured isocyanate concentration inside and outside the respirator. These respirators, when they fit the users correctly, provided adequate protection against the isocyanates, particularly if painting was done in a good down-draft booth. But workers whose respirators leaked were exposed to more isocyanate.

Powered air purifying respirators work the same way as the half mask cartridge respirators: They filter the air the painter breathes. So the filters and cartridges used are the same basic types as those used with half mask respirators. The big advantage of powered air purifying respirators is that they use a battery-powered fan to draw the air past the cartridges. These, like supplied-air respirators, are positive pressure respirators; if they leak, most of the leaks will be the filtered air leaking out from inside the facepiece, instead of contaminated air leaking in. They are often considered more comfortable than the usual half mask respirator.

Which should your painters use? The highest level of protection, especially needed if you don't have a downdraft booth, is provided by a supplied air respirator. But workers often don't like those, because of the extra hoses they require. Half mask respirators with organic vapor cartridges and prefilters will protect your workers' lungs against isocyanates – but only if they are correctly used and maintained. That means that painters must wear respirators that fit them correctly, as shown by respirator fit testing. The respirator cartridges need to be replaced regularly, well before the painters can start smelling solvents inside their masks. The respirator facepieces must be kept in good condition, clean and undamaged. And the painters need to use the respirators correctly. Of course – there must be no facial hair where the respirator seals to the face, as that will prevent a good fit.

For more information on this or other safety issues, please contact Complete Health, Environmental & Safety Services, Inc. (CHESS, Inc.) at 651-481-9787 or 1-877-481-9787 (toll-free). CHESS specializes in helping small to medium sized business with occupational health and safety issues. We have been providing services to the automotive industry for over 10 years.