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IMPORTANT

professional protection magazine

Published by Sundstrom Safety (Aust.) Pty Ltd
in the interest of Industrial Safety in Australia,

Number 2, 1987

RUN FOR SAFETY!

The Florida sky was cloudless. Miami's hotels and resorts were going to enjoy yet another sun-drenched day.

But on this morning there was something special happening. Down by the Key Biscayne area of Miami, the atmosphere was charged with electric anticipation.

The megaphone boomed;

ON YOUR MARKS!

The starter's call meant the beginning of a gruelling race for 1844 runners from all over the world. Calmly, two Swedish athletes walked up to take their turn at the starting line.

READY . . .

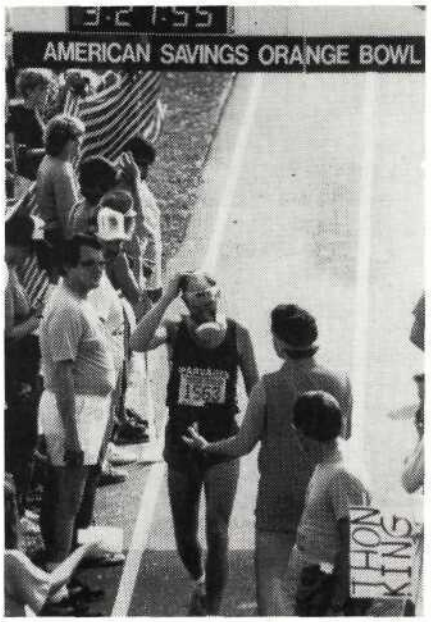
Christer and Goran Larsson, along with scores of other runners, contemplated the ordeal that lay ahead: nearly 27 miles of hard bitumen and more than 3 hours' exhausting, slogging, draining run under the hot Florida sun.

SET ...

But there was one thing that set Goran and Christer apart from the rest of the line-up. Their mission was not simply to complete the race — they had something else to prove to themselves and to others. Shortly before taking their places, both brothers strapped a breathing mask on to their faces. They had both set put to complete the gruelling marathon run wearing the masks, and still do their utmost.

GO!

The famous Orange Bowl Marathon 1987 began.



From here on, everyone fends for himself. Hilly, scenic, taxing — the Orange Bowl Marathon is a T.A.C. certified marathon, qualified for the 1988 Olympic Games. Contending against some of the world's best known names in marathon running, Christer and Goran Larsson began their long and exhausting run with determination and will.

* * *

Divide the world's population into two groups: people who run marathons and (like the editor of this newsletter) people who think that marathon running is legal proof of insanity.

Now consider two Swedish marathon runners who agree to run a 43km race in glaring sun with rubber breathing masks on their faces, Suddenly, insanity takes on almost unimaginable proportions.

However, the real purpose of the Florida event was very sane and sound indeed.

The inclusion of Christer and Goran in the Orange Bowl Marathon was the brainchild of Sundstrom Safety's designers, who wanted to quell — once and for all — the common arguments against wearing breathing protection while performing heavy duty work.

So how did our marathon runners fare?

Christer Larsson, wearing a standard Sundstrom SR-85 particle mask with main filter, pre-filter and exhaust valves, finished 63rd among 1,844 runners. Goran came in 155th due to a leg injury — still an excellent feat. That's the performance part of the experiment. The continuity part:

3h06m07s for Christer. Mask worn for the duration of the race.

3h27m36s for Goran. Mask worn for the duration of the race.

Both runners were pleased with their results. Neither of them had any complaints about breathing resistance, impaired performance or discomfort. Goran's final comment was, "A full working day in this mask would present no problem at all. I think our run today is evidence enough."

Objections, anyone?

WELDING

WELDING is a procedure which incorporates a multitude ot possible health risks. The arc itself is capable of causing severe burns — but proper training and careful work practices will almost entirely eliminate the risk of accidents.

An appropriate pair of welding goggles or a visor will protect the eyes from the intense light as well **as** sparks.

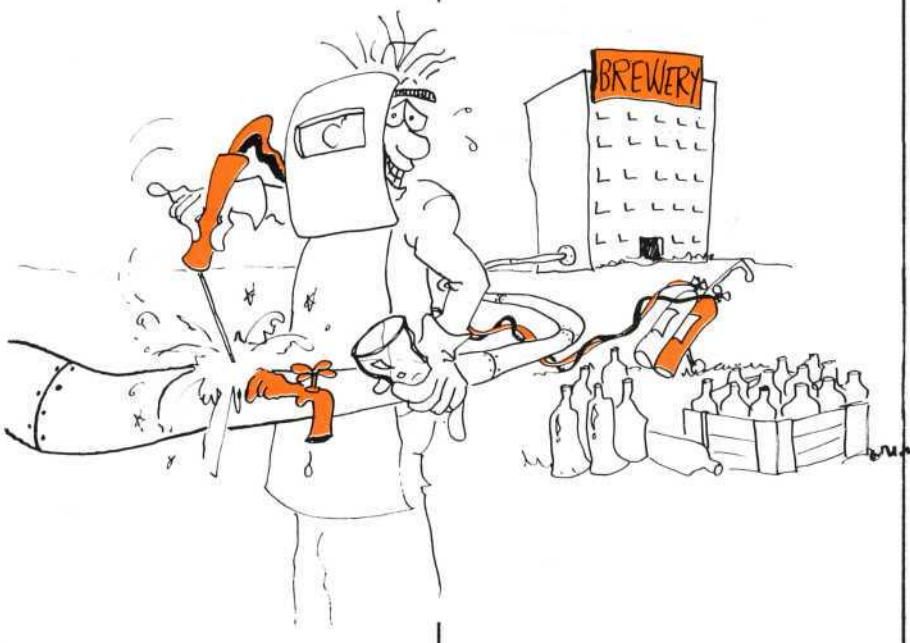
Another health hazard, the welding fumes that are formed when metals are heated and fused, is much more difficult to handle effectively.

The health hazards vary considerably, depending on a number of factors:

1. The metal which is to be worked upon.
2. The type of fill metal, flux and coating.
3. The time it takes to weld the material.
4. Industrial hygiene and safety precautions.

Many materials may be readily welded without any cause for concern. The metal fumes and/or particles are usually not toxic, and have only temporary nuisance effects, if any.

There are, however, certain metals and alloys that contain high amounts of harmful substances. These substances are released in the form of welding fumes when the metal is heated up by the arc. Here is a list of some potentially dangerous metals and those constituents which are most likely to contribute significantly to the toxicity of the fumes:



Metal/ Alloy	Toxic Constituent
High yield steel	Manganese
Aluminium alloys	Manganese, Zinc
Magnesium alloys	Zinc, Manganese, Thorium
Aluminium bronze	Copper
Brass	Zinc, Copper
Cupronickel	Nickel, Copper
German Silver	Copper, Nickel, Zinc
Manganese bronze	Copper, Manganese
Monel	Copper, Nickel
Nimonic	Chromium, Cobalt, Nickel
Phosphor bronze	Copper, Lead
Soft solder	Lead

Many of these constituents are capable of causing mild to severe irritation to mucous membranes and the upper respiratory tract. Some materials, such as zinc, may cause metal fume fever, a flu-like condition. Manganese, however, has far more serious effects, causing general depression of the Central Nervous System, with speech impairment, muscular weakness, and increased susceptibility to bronchial conditions and pneumonia as the most serious health problems. Both chromium and cobalt may cause dangerous fibrosis of the lungs.

It is relatively easy to avoid any ill effects of welding. It takes only common sense and a bit of care to completely safeguard against hazardous welding fumes. The necessary precautions vary according to the location.

FUMES

WELDING IN THE OPEN AIR:
Stand upwind of the weld. If the fumes are bothering you, use a fan or local exhaust or, alternatively, use a particle respirator.

SPACIOUS ROOMS (WORKSHOPS, ETC.)
Ensure that the room is well ventilated. If you're welding toxic metals, local exhaust may be required. If fumes are noxious or toxic, wear breathing protection.

SMALL ROOMS, SEMI-CONFINED AREAS
Local exhaust required. If you're performing high duty cycle or high current welding, and if you're working on toxic metals, wear breathing protection.

CONFINED AREAS (TANKS, CISTERNS, ETC.)
Local exhaust and personal protection required. In many cases, extensive breathing gear is required, such as self-contained breathing apparatus.

Always ensure that you can escape quickly in an emergency, and that rescuers can easily reach you in the case of an accident. Check fire and explosion risk.

When selecting personal breathing protection, make sure that you obtain the appropriate respirator for the situation, and that the construction and design of the face piece allows easy head movements, and can be used with welding goggles.

There are also a few other health hazards, commonly associated with welding, but not necessarily tied to the weld itself.

Chlorinated hydrocarbon solvents, for instance, are often used in degreasing and cleaning operations before the welding starts. These vapours may form highly toxic phosgene gas which destroys lung tissue.

The heat and energy of the welding arc may produce nitrogen dioxide, a toxic gas which is difficult to detect, and which may be inhaled in significant amounts without any warning signs. Lung damage may ensue.

Welding operations in well-ventilated areas should present little or no health hazards to the welder. However, if you're welding metals with potentially hazardous constituents or if you're performing your work in confined or poorly ventilated spaces, pay special attention to the points given above.

Source:
N. C. Balchin
The Welding Institute,
Cambridge, 1983.

Paint Vapours

PRETTY COLOUR - DEADLY SMELL
Spray painters are becoming increasingly aware of the dangers involved in connection with spray application of certain paints. Every week, we receive new information on the health effects of widely used solvents, such as toluene-di-isocyanate, which may have devastating effects even in low concentrations. In fact, the latest research shows that TDI and other solvents are likely to have serious effects even in low concentrations AND short term exposure.

Consequently, the need for pollutant free breathing air is now widely accepted, and industries are doing what they can to eliminate any vapours from reaching the lungs of the painter.

This can be done in a number of ways. The most desirable (but hardest to achieve) is to "engineer out" the problem through high efficiency ventilation, floor exhaust, point exhaust, chemical fume hoods, etc. Other measures include supplied air equipment, air filtering equipment, etc.

It is a great step forward. Australian spray painters are finally accepting that the substances they handle in their daily work may be harmful to their health — not only immediately, but also through a number of insidious long-term effects.

Ventilation and exhaust have their own specific problems, mainly due to air movement patterns (see

Paint Vapours

separate article in this issue). Personal protection, on the other hand, is highly dependent on the wearer. If correctly used, personal protection equipment will keep providing the user with clean, tresh air. But there are many pitfalls. Here is a list of the most common faults in the use of personal breathing protection.

1. Improper fit

The mask is worn with the headband and neck-strap adequately tightened and properly positioned around the head (it is very common to see workers use only one strap, or to put the two straps together).

Unshaven users (including those with a day-old beard) have no chance of achieving a good fit. Many Australian industries insist that all their workers, be clean shaven.

Recent studies show that a bearded user will attain — on average — a protection level 246 times lower than that of a clean shaven user! And that's only when using a half mask. The same test with a full face mask established an average 330-fold drop in protection levels when the mask was strapped on to bearded users.

How a beard affects the protection factor:

Beard growth	Protection factor
Clean shaven	18,000
2 weeks	7,500
4 weeks	2,000
6 weeks	500
8 weeks	200

2. Old filters

All filters should be exchanged regularly. Gas filters and particle filters become exhausted in two different manners:

Gas filters give NO WARNING SIGN when they are used up. The porous absorption surface of the active carbon simply cannot bind any more gas molecules, and the filter begins to let poisonous fumes through without any decrease in breathing resistance. Some ill-advised users only change their gas filters when they can smell the chemical through the filter — but odour is a tricky thing, and it is foolish to depend on your nose when your health is at stake. Gas filters should be exchanged on a rigid, regular schedule, worked out on the basis of concentration levels.

Particle filters are easier to detect: they simply become harder to breathe through when too much pollution has been absorbed in the fibre.

3. Improper storage

This is something few people think about: a gas filter keeps on absorbing gases and vapours even when you take it off. Always store mask and filters in a sealed plastic bag.

4. Inadequate mask maintenance

A dirty mask is sure to leak. Grit and grease around the rim create tiny apertures through which polluted air leaks in. Improperly cleaned valves (especially the exhaust valves) may be downright dangerous.

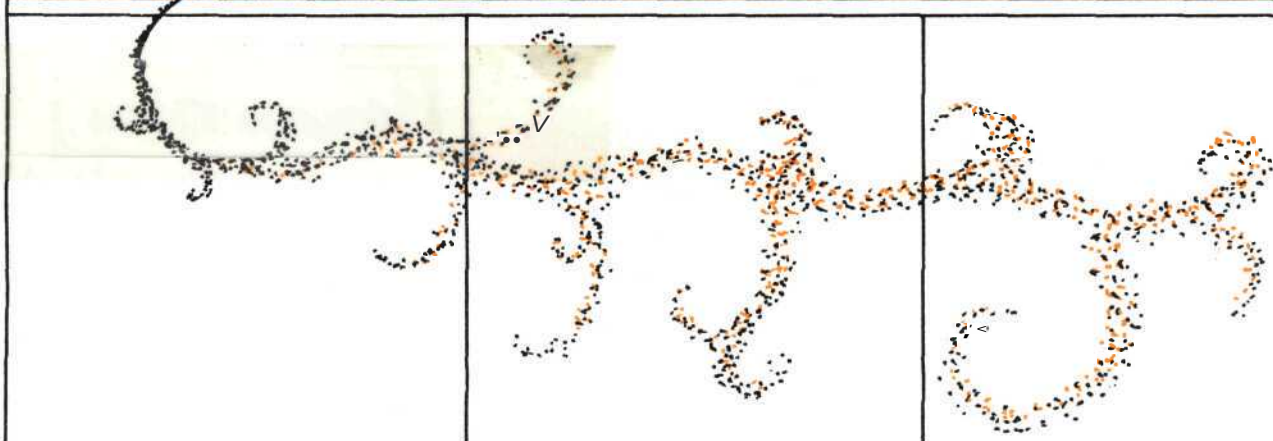
5. Non-continuous wear

This is by far the MOST DANGEROUS FACTOR of all when using breathing protection. The mask must be worn ALL THE TIME. It is all too easy to take off the mask as soon as the spraying is done. The importance of continuous wear cannot be emphasised enough: the only proper place for a mask is on your face — at all times. Taking off the mask as soon as the hazardous work procedure is over results in almost total loss of all protection.

ONE SINGLE HOUR WITHOUT A MASK IN AN EIGHT-HOUR DAY MEANS A LOSS OF 80% OF YOUR TOTAL PROTECTION FACTOR.

Sources:
McGee and Oestenstad, American Industrial Hygienists Assoc., 1983.
Skrevedt and Loschiave, Am. Ind. Hyg. Assoc. 1984.

Swirls



THE TRUTH ABOUT SWIRLS

The air flow direction in the majority of all spray booths is from behind the painter, through the booth, and to the exhaust in the far end of the box. This even, smooth flow away from the painter's face is considered to be an effective and comfortable way of eliminating hazardous vapours from the spray gun.

However, recent Swedish research shows that simply moving great volumes of air through the booth may not be such an effective way to achieve acceptable safety levels.

The reason? Swirls. These are small patterns of turbulence, created by an object placed in the way of the air flow.

The research team started off by examining the flow in an empty spray booth of common design. A special white oil mist was used in order to detect air movement.

The empty booth worked beautifully. The air moved in the ideal way: from the painter's end towards the exhaust end — without any unusual swirls.

However, when a painter entered the booth, the pattern changed drastically. The painter's body now stood in the way of the air stream, and the air had to move around him in order to reach the exhaust end of the box. This is where the most interesting result of the test became evident.

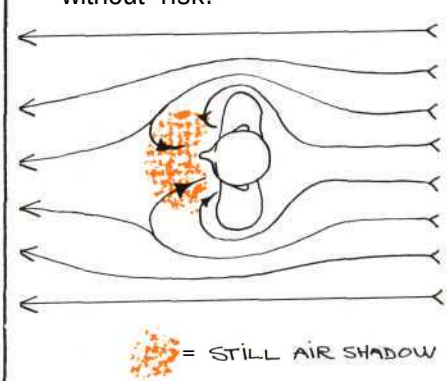
The painter's body created an area of "leeward shadow", where the air stayed for several seconds. When using a dye which was lighter than air (to simulate solvent vapours), it was clear that the air first became trapped in the wake of the painter, then moved upwards slowly towards the face.

Considering that a spray painter's normal working position is with the back against the flow direction, it follows that the face is nearly always in the "air shadow", inhaling the stagnant polluted air.

European scientists have developed a new type of spray booth, where the airflow is in a vertical direction, moving from the ceiling down to a steel mesh floor, where large exhaust fans ensure effective air flow.

The same test in the new booth showed that the "shadow" was almost elminated, but other areas proved to act as air traps: when a car was rolled into the booth for a simulated painting session, the open bonnet created a still area, as did the entire bottom of the car, as well as the wheelhousings.

This test, in context with recent scientific studies into the hazards of solvents, showed that extra precautions must be taken in spray booth situations. Two-pack paints, as well as many common paint solvents, may have far more serious health effects than previously believed. It is therefore essential that spray painters are not led to believe that working in a spray booth is entirely without risk.



Take Five? No way!

THE SHORT BREAK - THE CRUCIAL FACTOR

During a working day, a spray painter may keep contamination levels down by wearing breathing protection — most of the time.

It is the short breaks between jobs, the short time the mask is taken off while admiring or checking the job that create the high exposure tops in an otherwise harmless day.

It was recently established that it is not the overall long term exposure to small concentrations that constitute the highest health hazard to spray painters, but the brief, momentary exposure to the polluted air.

Not wearing a mask while wheeling a car into the booth, rolling it out of the oven, mixing paints, matching colours, cleaning tools and guns, etc. — these are the REAL dangerous elements in a painter's day.

Nils Plato, one member of a European research team into the effects of long- and short-term exposure to solvents, says:

"It seems that people believe that half a minute without a mask can't do any harm — but this creates very dangerous exposure peaks in a working day. To create a safe workplace, these peaks must be cut."

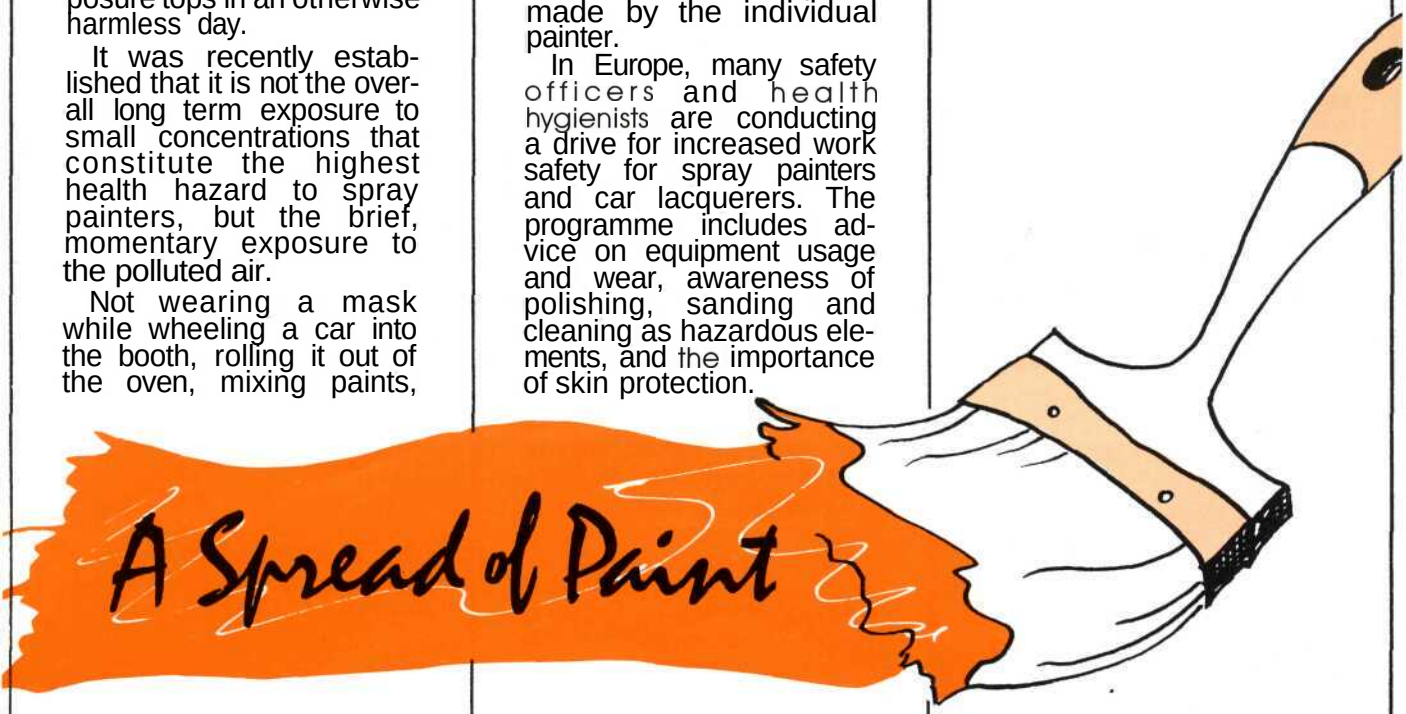
The cut can only be made by the individual painter.

In Europe, many safety officers and health hygienists are conducting a drive for increased work safety for spray painters and car lacquerers. The programme includes advice on equipment usage and wear, awareness of polishing, sanding and cleaning as hazardous elements, and the importance of skin protection.

Handy Hint:

HEALTHY HANDS

Most solvents de-grease the skin, causing rashes, cracks, blisters, eczema and dermatitis. It is inadvisable to clean your hands in thinners after work. The best way to protect your skin is to rub in skin creme before work. The creme will not only keep the skin smooth and moist, but also make cleaning your hands after work a lot easier.



A Spread of Paint

Faints and coatings are usually made up of four types of chemicals.

SOLVENTS
BINDERS
PIGMENTS
ADDITIVES

This holds true for most paints with only a few notable exceptions (for example water-based paint and clear/colourless coatings and varnishes).

The SOLVENT is the part that keeps the paint "suspended" in liquid form until it dries and becomes solid.

The BINDER is usually a resin or oil which gives surface adhesion, gloss or matt paint surface and some resistance.

The PIGMENT gives the paint its colour.

A Spread of Paint

ADDITIVES are used to give the paint special characteristics. Common additives are biocides and repellants, plasticisers and anti-skin agents.

A typical paint or coating will contain several chemicals from each of the four groups, and the painter, mixer, manufacturer, remover, polisher, stripper (and even the occasional private person who happens to live near a manufacturing plant) is often exposed to a bewildering array of chemical substances.

It is easy to forget that potentially hazardous chemicals are released in ALL manufacturing and application processes. Thus, the paint manufacturing worker may inhale pigment dust, the mixer will breathe solvent vapour, the spray painter will be exposed to the complex compound in aerosol form and, **finally,** the paint will continue to release vapours for some time after it dries.

Hazardous chemicals may be released even years after the paint has been applied — for example when polishing the surface, stripping the paint, or welding a piece of painted metal.

It seems that the most vulnerable professional group is the painters. And it has been established that wet spraying is the most hazardous application technique, although electrostatic spraying, paint dipping, and brush and roller application also may constitute health risks.

So what are the risks?

CANCER

Numerous research projects have looked at the cancer incidence in people who are frequently exposed to paints and coatings. A Swedish report presents figures that clearly show a higher percentage of cancer of the oesophagus, the larynx and the hepatic bile ducts (Englund 1982, Princetown Scientific Publishers). American research material contains ample information on cancer in painters and coaters who, according to the reports, stand a higher than average mortality risk from cancer of the lungs, colon, rectum, liver and the skin. (Sheffet 1982 — Environmental Health; Davies 1984 — Journ. of Ind. Health; Morgan 1981 — Journ. of Occupational Medicine; and others.)

Painters and coaters should not be alarmed by these reports — almost all of the researchers conclude that professionals are not at any major cancer risk.

NERVES

Again, Scandinavian authorities have performed extensive testing in the area of nervous complaints among painters. The research concerns mainly solvents, which have been shown to have far more serious health effects than previously thought. Since the research results were released, numerous professionals with nervous conditions have received compensation.

In other European countries, the scientists disagree, and have so far not committed themselves to confirm or deny neurological effects of solvents.

RESPIRATION

The lungs are by far the most vulnerable part of the body when it comes to exposure to harmful paint fumes, vapours and aerosols, as well as dry pigment and paint dust.

The inhaled substances can cause systemic damage by being absorbed into the blood stream. This enables the substance to reach vital organs. More common, however, are direct irritant effects in the upper respiratory system.

The possible health hazards to the respiratory system may be divided into four groups:

IRRITATION
ALLERGY
FIBROSIS
LUNG CANCER

The IRRITATION may be short term coughing and burning or long-term bronchitis-like symptoms, dry "smoker's cough" and so on. Usually, the irritation disappears as soon as the painting process is over.

The ALLERGIC (sensitising) properties of certain chemicals are more serious. A painter or coater may be exposed to concentrations well below established safety levels — but during prolonged exposure, the chemical may sensitise the worker and cause severely disabling respiratory disorders, such as asthma. Once the worker has become sensitised, it will only

A Spread of Paint (cont.)

take a minute amount of the substance to cause an asthmatic attack, This is particularly true for di-isocyanates.

Isocyanates are now a recognised cause of occupational asthma, and isocyanate-induced asthma has been registered as a prescribed disease in Britain since 1982.

FIBROSIS is caused by inorganic particles which become lodged in the lung tissue, The particles produce tiny scars on the surface of the lung. In turn, this leads to an excess build-up of fibrous connective tissue, rendering the lung stiff and inflexible. The disease is very serious.

Much research is going into chemically induced LUNG CANCER, and, although results are by no means conclusive, tests point to a wide variety of chemicals that are capable of producing or promoting cancer.

SKIN DAMAGE

Every painter knows how dry your hands feel after you wash them with thinners. This is the first immediate effect of most solvents. The solvent de-greases the skin, depriving it of the natural moisture-retaining fats or oils that normally work to keep it soft and smooth.

The dry skin is likely to crack, and frequent use of solvents may lead to blisters and open cracks — ideal routes of entry for other toxic chemicals.

Apart from irritation and drying out of the skin, allergic reactions are also possible, where the chemical caues rashes, eczema and dermatitis.

Countless solvents and additives in paints and coatings are capable of causing irritation and degreasing of the skin. Allergic sensitising may be caused by epichlorohydrin, acrylate monomers and many chromatic pigments.

REPRODUCTIVE HAZARDS

Both women and men may stand a real risk of damage to the reproductive system by certain chemical substances. Danish research shows a higher incidence of spontaneous abortion among women in the paint industry, and several research projects suggest that Toluene may be the main cause of dramatically reduced sperm counts in men (see our PPM newsletter No. 2, 1986). (Haidam 1984 — Journ. of Epidemiol. Comm. Health Vol. 38).

IN CONCLUSION

These are the most important health effects caused by substances commonly present in paints and coatings. Other organs may also be affected, such as liver and kidney — but the health and resedrch information is very scant.

It is important to point out that the industry has become much more aware of the dangers, and that most plants and operators have taken adequate safety precautions.

In general, painting, coating, paint manufacture, mixing, polishing and other similar processes are perfectly safe — provided the adequate safety steps are taken and adhered to. Ventilation, exhaust, air purification or air supply are paramount to the health of the worker. A careless or casual attitude may constitute serious health hazards with both immediate and long-term effects.

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