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Focus on IFA's work

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# Permeation of breathing tubes by PAHs (polycyclic aromatic hydrocarbons)

**Problem**

Until a few years ago, steel and concrete surfaces in contact with water or effluent were protected against corrosion by the application of a coal-tar based coating. Until the use of asbestos was banned, the coatings frequently contained asbestos as a filler.

Renewal of the corrosion protection layer and maintenance and repair work entail partial or complete removal of the old layer from the components. In the past, a dry-blast cleaning process involving a granular blasting agent has been employed for this purpose. The use of this material in the working area leads to very high concentrations of carcinogenic polycyclic aromatic hydrocarbons (PAHs) and asbestos fibres.

In order to reduce these concentrations, the current trend is towards the use of ultra-high-pressure water jet processes (see also TRGS 551). Depending upon the geometry of the component, the work can be performed either with a manually guided blasting lance, or automatically.

When conducting this work, which is performed on fully enclosed construction sites, employees wear one-piece chemical protective suits with external breathing equipment. Despite the much lower PAH exposure when compared to dry-blasting and the breathing air supply independent of the ambient atmosphere, a substantially higher hydroxypyrene concentration was detected in the urine of employees.

Air supply and breathing tubes in the blast slurry from a construction site involving corrosion protection coatings

The studies were performed by the then BG for the building trade in the Rhineland and in Westphalia, in conjunction with Prof. Angerer at the University of Erlangen-Nuremberg. As a component of PAH mixtures, e.g. in tar, pyrene is converted in the body to hydroxypyrene. Pyrene is not considered carcinogenic; its metabolic product however frequently serves as an indicator of exposure to carcinogenic PAHs of lower volatility. Since the respiratory tubes almost always lie (see illustration) in PAH-contaminated blasting slurry during working, it was assumed that with increased duration of exposure, they would become permeable to PAH. In addition to study of this aspect, answers were also sought to whether hydroxypyrene is a suitable indicator for carcinogenic PAHs.

**Activities**

Static tests were performed in the laboratory in which various tubes were exposed to blasting slurry contaminated with PAH. The tubes were washed every 30 days and the wash solution tested for PAHs by high-pressure liquid chromatography. The tests were performed over several months.

**Results and Application**

The results show that the tube material generally employed withstands permeation by PAHs only for a limited time (approximately 30 days). After only 50 to 60 days, more volatile PAHs such as fluorene, phenanthrene and anthracene were detectable within the tubes, and in one tube fluoranthene and pyrene were also detectable. PAHs less volatile than chrysene were not detected in the course of the exposure tests. Employees are therefore not exposed to predominantly less volatile, strongly carcinogenic PAHs such as benzo(a)pyrene. Hydroxypyrene cannot therefore be recommended as a general marker for the examination of urine samples for PAH exposure.

A teflon-sheathed tube supplied by a manufacturer for test purposes was also examined. This tube resisted permeation by PAHs for a test duration of 275 days.

**Area of Application**

Companies performing blasting work; manufacturers of breathing tubes

**Expert Assistance**

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