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A Controlled Study of Workers Handling Organic Diisocyanates

A study of workers handling naphthylene diisocyanate (NDI) and prepolymerized tolylene diisocyanate (TDI prepolymer) in the manufacture of foamed and unfoamed urethane elastomers was carried out over a year, using controls drawn from similar work in the same factory but not handling isocyanates. The study was undertaken because of complaints by the exposed workmen that they were suffering from bronchitis. It was already known that a few cases of asthma had occurred in the course of this work, but prior to the study occasional atmospheric measurements of NDI had all been below a threshold limit value of 0.17 mg/m³ tentatively proposed for this substance (0.17 mg NDI ≡ 0.14 mg TDI).

The study consisted of full medical examinations at the start and end of the period, together with one-second forced expired volume (FEV₁) and forced vital capacity (FVC) measurements. At the end the revised MRC Standard Questionnaire on Respiratory Diseases was completed.

All episodes of respiratory illness during the year were recorded, whether causing absence or not.

Three groups emerged: (1) An exposed group having regular contact with NDI vapour and to a lesser extent TDI. (2) A neighbourhood group composed of people with intermittent and lesser exposure. (3) The non-exposed control group. The exposed and neighbourhood groups had all had pre-employment medical examinations before originally starting such work and the same criteria were applied in establishing the control group.

Chest illness was defined as: (1) Chronic bronchitis for the past three years as defined by the College of General Practitioners in 1961. (2) Episodes of chest illness of bronchitic type occurring within the three years up to the end of the study. (3) Episodes of chest illness with or without absence during the review period of one year.

Statistical analysis of the results showed a significant association between exposure to isocyanates and chest illness with or without absence from work during the review period amongst the exposed group ($P < 0.05$). There was also a significant relationship between regular or occasional exposure in the exposed and neighbourhood groups combined and episodes of chest illness of bronchitic type for the past three years ($P = 0.017$).

The control group showed an average deterioration in FEV₁ over the year of 0.11 litres and of 1.6% in FEV₁/FVC ratio, which was significant, $P < 0.05$. The FEV₁ and FVC in the exposed group and the FEV₁ in the neighbourhood group showed deteriorations which were not statistically significant. The neighbourhood group, whose mean age was significantly greater than that of the exposed or control groups, showed a fall in FVC of 0.09 litre ($P < 0.02$). Comparisons between the groups, however, showed no significant differences in FEV₁, FVC or FEV₁/FVC.

No significant differences were found in smoking habits and FEV₁/FVC or chest illness, lung function and chest illness, lung function and past dusty work or chest illness and past dusty work.

The study demonstrated that there is an association between exposure to isocyanates (particularly NDI) and episodes of chest illness of all types during the period and of episodes of chest illness of bronchitic type during the three years prior to the end of the period. This confirmed that the complaints of 'bronchitis' made by the exposed workmen were justified.