

o FORMALDEHYDE

(1) UNIVERSITY OF PITTSBURGH STUDY (A) - MARSH (5/81)

SCOPE:

- 2490 employees, one or more years' exposure between 1949 to 1966.

OBJECTIVES:

- Proportional mortality study of deaths between 1950 - 1976.

CONCLUSIONS:

- No statistically significant excesses in proportional mortality among exposed employees compared to U.S. and county groups.

I. Introduction

Formaldehyde, HCHO , and its derivatives are chemicals used in the manufacture, formulation, commercial distribution, and production of a variety of products including textiles, foam insulation, resins, preservatives, and wood products. It has been estimated by NIOSH that 8000 employees may be at risk of exposure to the high concentrations of formaldehyde found in industrial synthesis, formulation and distribution of concentrated products (1). The numerous uses of formaldehyde and its derivatives indicate, however, that a substantially larger population of employees may be at risk from intermittent exposures to products containing sources of formaldehyde or its congeners and derivatives (1).

Occupational exposures usually are the result of the release of free formaldehyde vapor into the air. Principal hazards which have been associated with human exposure to airborne formaldehyde are irritation of the respiratory tract, eye, and skin (2). In 1979, the Chemical Industry Institute of Toxicology reported a high incidence of nasal carcinomas among rats exposed to formaldehyde vapor (3).

Currently, there is little information available on the chronic toxicity and potential carcinogenicity related to human exposure to formaldehyde. This is a final report on a proportional mortality study of workers exposed to formaldehyde at a large chemical producing plant owned and operated by the Monsanto Company. Despite the well known limitations inherent in studies of proportional mortality, this design was deemed most appropriate for allowing a relatively quick, preliminary assessment to be made of the possible

health risks associated with occupational exposure to formaldehyde. The study was performed by the University of Pittsburgh, Department of Biostatistics, under contract with the Monsanto Company.

The Monsanto Company started using formaldehyde at its Springfield/Indian Orchard, Massachusetts plant in 1938. The chemical was used as a raw material in the manufacture of such products as phenolic resins, urea-formaldehyde resins, melamine-formaldehyde resins, hexamethylenetetramine, and resorcinol. Formaldehyde was first produced on a commercial scale at Springfield in 1948. Table 1, which summarizes the history of formaldehyde usage and manufacture at Springfield, shows that several of the original formaldehyde related processes were discontinued in the 1940's and 1950's. Clearly, there were some worker exposures, although no reliable quantitative information is available as to actual exposure levels. Exposure levels to formaldehyde vapor were probably higher, however, in the areas where formaldehyde was present in a liquid form (cast phenolics, resins, other Resinox[®], Resimines[®], and formalin plant) compared to levels in areas where formaldehyde had already reacted with other chemicals to form solid or powdered materials (resins compounding and molding powder) (4). In addition, due to major process changes, exposure levels in the late 1930's, 1940's, and 1950's are thought to have been substantially higher than in more recent years. Formaldehyde exposures which occurred in the Service Department-Waste Disposal are relatively insignificant compared to other areas since they were most likely intermittent and very brief.

It should be recognized that workers were not exposed to formaldehyde alone, but rather to a mixture of chemical substances of

variable nature and at various times. This is a major problem for epidemiological studies in much of the chemical industry. Exposure to chemicals used in the production of formaldehyde, for example, may have been as severe as exposure to formaldehyde itself. Moreover, many of the workers also had exposure to other chemicals prior to or subsequent to their formaldehyde-related job assignment. There seems to be no way of separating exposures, and this study was carried out with the full realization of these possibly confounding factors.

VI. Summary and Conclusions

A proportional mortality analysis was conducted on deaths occurring between 1950 and 1976 among 136 males who were employed a month or more in one of five formaldehyde-related areas of a large chemical producing plant. Overall, no statistically significant excesses or deficits in proportional mortality were observed among the formaldehyde-exposed group based on comparisons with both U.S. males and males from the local county area. In addition, no important differences in mortality were observed among this group when comparisons were made with 456 male decedents from the same plant who did not have a month or more of formaldehyde exposure. No sinonasal cancer deaths were observed among the chemical workers studied nor was mention made on any death certificate of sinonasal cancer as a contributory cause of death. No important excesses, trends, or patterns in cancer mortality were observed among white male formaldehyde-exposed workers when consideration was given to age and time period of death, type and duration of exposure, and the lapsed period from the onset of the first formaldehyde related job assignment. Although certain limitations of this study do not allow definite conclusions to be drawn, the results indicate no trends or patterns in proportional mortality that could be directly linked to formaldehyde exposures.