

THE HUMAN HEALTH EFFECTS OF BENZENE

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SUMMARY

The epidemiological literature on the human health effects of benzene has been reviewed. The most important toxic effects are bone marrow suppression and leukaemogenesis, and most of the evidence about these comes from study of occupationally exposed populations.

In assessment of the risk from long-term low level exposure, acute non-lymphoblastic leukaemia (ANLL) is the critical outcome. Other haematological malignancies have not been consistently linked with benzene, and if they are associated with the compound, then the risk is almost certainly much lower than for ANLL. Severe bone marrow suppression has only been reported at exposures in excess of 25 ppm, and mortality studies indicate that any risk of serious aplasia at lower exposure levels is smaller than the risk of ANLL.

Attempts to quantify the risk of leukaemia associated with low level occupational exposure to benzene have usually been based on one or two key studies. They are limited particularly by the small number of leukaemia cases in these key studies and by uncertainties about exposure estimates in the absence of complete industrial hygiene records. Because of these weaknesses, it is not certain whether or not a lifetime's occupational exposure to 1-10 ppm of benzene carries an appreciable risk of leukaemia. However, one study has suggested an increased risk in this range, and given the known effects at higher exposures, it would seem sensible to limit long-term occupational exposure to a maximum of 1 ppm.

Extrapolation of risk estimates to the much lower exposures to benzene which occur in the general population is difficult because the biochemical mechanisms of its carcinogenicity are unknown. It is noteworthy, however, that the major determinant of benzene dose in the general population is smoking habit. The influence of driving and filling cars with petrol is smaller, while residence in the neighbourhood of refineries appears to be unimportant. Any risk of leukaemia from environmental exposure to benzene is likely to be lower than that in smokers as compared with non-smokers, and may well be orders of magnitude less than that from occupational exposure.

Future research should be directed at estimating more accurately the risk of leukaemia from long-term occupational exposures in the order of 1 ppm, and at establishing whether any other measurable haematological abnormalities or cytogenetic effects occur at this level of exposure. Further investigation of the biochemical mechanisms of benzene's carcinogenicity is also needed.

1. INTRODUCTION

This report was prepared at the request of the Institute of Petroleum. It reviews the current epidemiological literature on the health effects of benzene, particularly at low exposures, and makes recommendations for further research. Non-epidemiological evidence that bears on risk assessment (eg case reports) is also discussed but not reviewed comprehensively. Data on toxicity in laboratory animals are not examined.

To assist the reader, airborne concentrations of benzene have been quoted throughout in parts per million. Where papers have used other units (eg $\mu\text{g/L}$, mg/m^3) these have been converted.