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"Quest"

PUBLIC HEALTH MONOGRAPH NO. 36

A Quest Into The Environmental Causes Of Cancer Of the Lung

U. S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE

API 06399

prolong the duration of the effect of the specific carcinogenic chemicals on the lung tissues.

Since our civilization and economic life has been built around the production and use of the basic carbonaceous substances and their derivatives, it does not seem feasible to attain complete protection against exposure to these carcinogenic chemicals with the preventive and prophylactic engineering and sanitary measures practical and economical at the present time. There is, however, no doubt that a great deal remains to be done in this respect and that we are still rather far removed from having the maximal amount of possible reduction in exposure to the respiratory cancer producing hydrocarbons contained in the various carbonaceous substances mentioned.

Carbon and Silicon Polymers

Recent studies of English investigators (Hendry, Homer, Rose, and Walpole; Hendry, Rose, and Walpole; Haddow) have furnished a new and intriguing concept as to possible combinations of carcinogens with tissue proteins through the postulated formation of cross linkages between certain types of carcinogenic chemicals and the macromolecular fibers of chromosomes. This hypothesis was evolved from evidence obtained in the study of carcinogenesis by nitrogen-mustards, diepoxides, polyethyleneimines, and related compounds. In view of the fact that one of the various means by which these substances may exert their specific action in the cells is through polymerization, it is assumed that polymerized epoxide chains might interreact with proteins or mucoproteins of chromosomal origin, by cross linkage with multipoint attachment, and thereby cause mitotic aberrations. The initial reaction of one of the epoxide groups of monomeric molecules with the cell component also may start a process of polymerization by being followed by a self-condensation of the free epoxide groups into a polyetheneoxy-structure.

These concepts are important in connection with respiratory carcinogenesis for several reasons. Since Oppenheimer and associates; Druckrey and associates; and Zollinger have shown that a parenteral implantation of various polymerized plastics (cellophane, polyethylene, polyvinyl chloride, polymethyl methacrylate, polyamide, Teflon, and others) into rats and mice are followed by the development of sarcomas at the site of deposition, there exists the possibility that the inhalation of vapors, mists, and dusts of the monomers and polymers of these and related chemicals for occupational reasons may create a respiratory cancer hazard to man.

The more immediate importance of these concepts, however, lies in their application to the production of occupational respiratory cancers by a silicon polymer, asbestos, possibly also by a carbon polymer contained in isopropyl oil (polypropylene or propyl epoxide). The probability of such an action mechanism, moreover, is supported by observations of lung cancers among Japanese mustard gas manufacturers.

ASBESTOS

Asbestos differs from the ordinary giant molecular crystalline silicates not only in its chemical and physical properties, but also in the anatomical aspects of the pneumoconiosis produced by it. In contrast to the tridimensional polymerized silica crystals in which no oxygen atoms are left carrying charges to attract positive ions, asbestos consists of giant fibrous molecules composed of polymerized silico-oxygen tetrahydra which are arranged in chains or bands (Parkes). Depending on the origin of asbestos, the fibrils may be short or long. Italian, South African, and Australian asbestos (amphibils) consists of fibrillar or radiating crystals of calcium-magnesium silicate or sodium iron silicate (40 percent iron oxide). Canadian, Russian, German, and French asbestos is hydrated magnesium silicate, which contains small amounts of iron oxide (5.75 percent). Canada furnishes about 75 percent of the world production of asbestos. Canadian asbestos, because of its long fibers, is especially suitable for textiles.

Depending on its physical characteristics, asbestos finds numerous uses (textiles, filter material, building material, gaskets, insulating material, adsorbants, and so on). Some 35,000 workers in the United States are exposed to asbestos dust.

It is asserted that inhaled asbestos dust pro-

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EPI report 10/55

For Information Only - Not for Publication

Appraisal of the Potential Carcinogenic Properties of American Petroleum Products

Report of the Progress in the Epidemiological Studies October 1955

The Kettering Laboratory
in the
Department of Preventive Medicine and Industrial Health
College of Medicine
University of Cincinnati
Cincinnati, Ohio

API 06517

EPI
3/58
starts
w/13pp
review
of the
history

An Epidemiological Study of Cancer Among Employees in the American Petroleum Industry

March 1958

THE KETTERING LABORATORY
in the
Department of Preventive Medicine and Industrial Health
College of Medicine
UNIVERSITY OF CINCINNATI, CINCINNATI, OHIO

API 06632

Discussion

From several points of view, this attempt to estimate by epidemiological techniques the hazard of occupational cancer from exposure to petroleum and its fractions cannot be considered an entirely successful venture. Only two relatively simple approaches were implemented, and neither was expected to do more than to indicate the presence of a possible hazard. Even though the limited objectives were selected, the number of old and current cases assembled proved far too small to permit detailed or elaborate analyses.

Accordingly, only a few pertinent variables were examined, although as many more were of equal interest and concern. On the other hand, the similarities demonstrated in the patterns of distribution between the U S. and the API cases were noteworthy. The apparent differences could generally be explained either because of the age group involved or because of the geographic location of the cases. It is unfortunate that the size of the sample so laboriously collected did not warrant employment of standard significance tests.

The epidemiological work, however, was productive of certain indirect benefits. The interest stimulated by this investigation of cancer among employees of the oil companies carried over into other areas. It pointed up the need for more and better medical supervision, coupled with adequate records of the medical and occupational history of each employee. As a matter of fact, in order to improve their reports, several companies took steps during the study period to insure that such services and information