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Cancer Hazards Caused by Industrial Air Pollution

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ENVIRONMENTAL CANCER HAZARDS CAUSED BY INDUSTRIAL AIR POLLUTION

Introductory Comment to the Discussion

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AN APPRECIABLE number of recognized or suspected occupational cancers are probably caused by inhalation of certain cancerigenic chemicals in dust, fumes, vapors, mists or gases (figs. 1 and 2). Many of these industrial agents are also introduced into the air while they are being used or released as waste products. Because the minimal effective cancerigenic dose of almost every one of these agents is yet to be established, the possible, even the probable, existence of cancer hazards resulting from pollution of the environmental air by chemicals represents an appropriate subject for those taking part in this conference to consider.

With the exception of soot as a possible cause of cancer of the lung and cancer of the scrotum, cancer-producing factors polluting the environmental air have only rarely been considered or investigated in connection with cancer in man. Studies of this problem which render valid evidence are difficult, complex and time-consuming. There is small wonder, therefore, that at present all available data on this matter have suggestive value at best, and most are mere speculation.

Some years ago Green alleged that the sulfur dioxide released during the burning of coal and the smelting of ores is the cause of an excessive incidence of cancer among population groups exposed to the fumes. On the other hand, Stephens blamed carbon monoxide, which was introduced into the atmosphere from domestic and industrial sources, for causing cancer in certain workers and the general population. These claims have little, if any, basis in fact.

Much more substantial, however, is the evidence in regard to other industrial products (table). There can be no doubt that products of the combustion and fractionation of coal, such as soot containing cancerigenic tar, tar fumes, pitch and tar dust are polluting the environmental air from various sources and at many places. Similarly, combustion products and processed fractions of mineral oils, shale oils and natural gas are released into the air as domestic or commercial soots and fumes,

Read at the United States Technical Conference on Air Pollution, May 3 to 5, 1950.

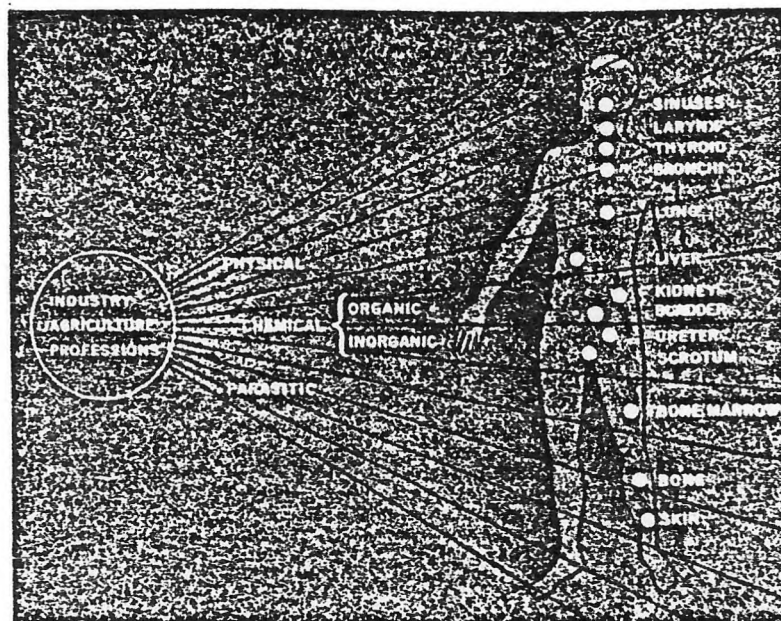


Fig. 1.—The environmental cancer spectrum.

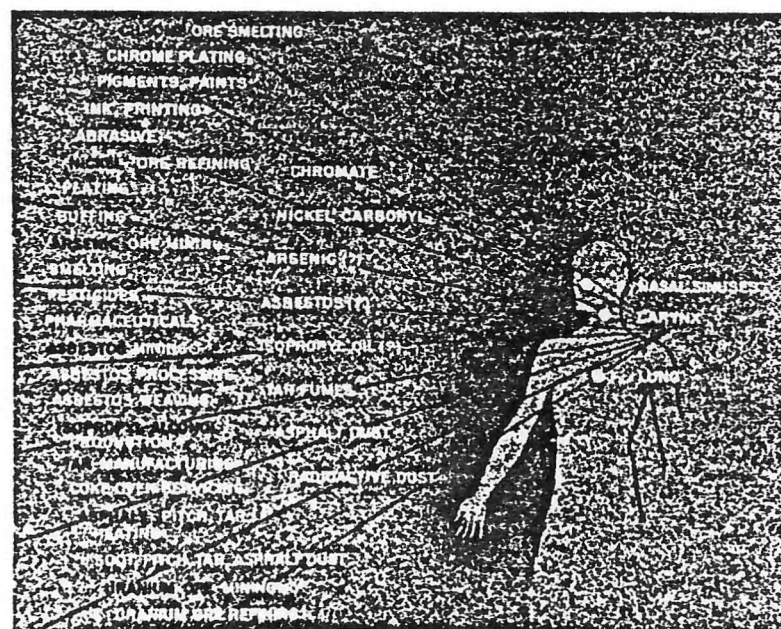


Fig. 2.—Established and potential sources of environmental respiratory cancer.

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Environmental Cancerigenic Agents and Sites of Cancer

Cancerigenic Agent	Type of Contact	Site of Cancer
Aromatic Organic Chemicals		
Benzene	Cutaneous Respiratory	Leukemia Lymphosarcoma? Myeloma?
Aromatic amines Beta naphthylamine Benzidine	Cutaneous Respiratory	Carcinoma of bladder, ureter, renal pelvis
Coal tar, pitch, asphalt, soot, bitumen, creosote oil, anthracene oil (3,4-benzpyrene)	Cutaneous Respiratory (fumes)	Carcinoma of skin Carcinoma of lung
Shale oil Lubricating oils Crude paraffin oils Lignite oils	Cutaneous	Carcinoma of skin
Lubricating oils Crude paraffin oils Tar oils	Cutaneous	Carcinoma of skin
Petroleum and petroleum products Lubricating oils Crude paraffin oils Fuel oils Commercial soots	Cutaneous Respiratory (Mist-Dust)	Carcinoma of skin Carcinoma of lung?
Aliphatic Organic Chemicals		
Isopropyl oil?	Respiratory	Carcinoma of nasal sinuses and lung?
Inorganic Chemicals		
Arsenicals Inorganic and organic?	Cutaneous Alimentary Respiratory	Carcinoma of skin Carcinoma of lung? Carcinoma of alimentary tract? Carcinoma of bladder? Carcinoma of lung Carcinoma of nasal sinuses and lung Carcinoma of liver?
Chromates Nickel carbonyl?	Respiratory Respiratory	Carcinoma of lung Carcinoma of nasal sinuses and lung Carcinoma of liver?
Asbestos	Respiratory	Carcinoma of lung
Physical Agents		
Ionizing radiation of electromagnetic (gamma) and corpus- cular types (alpha, beta) from radioactive chemicals	Cutaneous Respiratory Alimentary General body Parenteral	Carcinoma and sarcoma of skin Carcinoma of lung Carcinoma of nasal sinuses Sarcoma of bones Leukemia, lymphosarcoma Carcinoma of liver?
Ionizing radiation from x-ray tubes	Cutaneous	Carcinoma of skin Sarcoma of connective tissues and bones Leukemia, lymphosarcoma
Ultraviolet radiation solar radiation	General body Cutaneous	Carcinoma of skin
Cancerigenic Agent	Site of Cancer	Species
Potential Environmental Cancerigenic Agents and Cancer Sites		
Aromatic amino compounds	Liver Bladder	Rat Mouse
o-aminoazotoluene o-aminoazobenzene 2,3-azotoluene n,n-diethyl-p-amino- azobenzene 4-dimethyl-amino- benzene-1-azonaph- thalene 4-oxy-2,3-dimethyl- azobenzene 2-acetylaminofluorene 2-aminofluorene Dibenzocarbazole 4-dimethyl-amino- azobenzene		
Estrogenic compounds Stilbestrol	Breast Uterus Hemopoietic tissue	Mouse Rat Guinea pig Mouse
Aliphatic compounds Chlorinated hydrocarbons Chloroform Carbon tetrachloride Diethylene glycol Carbamate derivatives	Liver Bladder Lung	Mouse Rat Mouse Rat Mouse Rabbit Rat
Thiourea derivatives Beryllium Selenium	Thyroid gland? Bone Liver	

or may cover mineral particles escaping from cracking towers, thereby becoming a part of the constituents of smogs. Whenever production and waste disposal methods in aromatic amine operations are inadequate, dust, fumes and vapors of beta or alpha naphthylamine and benzidine may enter the air of the factory fume zone. The large scale use of arsenical dusts as pesticides and the long-continued and formerly uncontrolled release of arsenicals with the waste fumes of metal ore smelters may have created potential cancer hazards in many regions. It may be wise to consider the possible existence of similar conditions for the population living near chromate factories, beryllium operations and asbestos mills. In recent years the potentiality of cancerigenic air pollution hazards in connection with many establishments in which radioactive material is produced, used or handled has become an important factor in their operations.

Cancerigenic agents polluting the air may enter the human body by inhalation, cutaneous contact or ingestion. Exposure of the population to cancerigenic air pollutants, especially those of stable nature, may result from their subsequent incorporation into and contamination of drinking water, foodstuffs and soil. Cancers caused by cancerigenic air pollutants may affect not only parts of the respiratory tract, such as the lung or the nasal sinuses, but, depending on the nature of the agent and the type of exposure, may affect other organs, such as skin, bones, bone marrow and bladder.

The future control of these potential hazards depends, first, on the reliable qualitative and quantitative demonstration of cancerigenic agents in the air around establishments producing or handling recognized or suspected cancerigenic agents; second, on thorough epidemiologic studies of cancer incidence in the population living in the fume or waste disposal zone of such plants; and third, on the subsequent institution of effective measures preventing further release of cancerigenic agents into the environmental air.

To cope properly and speedily with this new health hazard from air pollution in the modern industrial environment, it is essential that industrial management, public health agencies and the medical profession be alerted to the problem and that they work together harmoniously in trying to solve it.

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