A. Polychlorinated Biphenyls (PCBs)

Health Effects

PCBs are a group of highly toxic chemicals which have been demonstrated to cause cancer in animals and are suspect human carcinogens. PCBs can cause liver damage, changes in skin pigmentation, and chloracne. PCBs can cross the placenta to an unborn fetus and can concentrate in the milk of exposed mothers. PCBs may decrease fertility. PCBs can increase the amount of certain enzymes which are found in the liver, lungs, and skin; the increased level of these enzymes may increase the toxicological hazard of other chemicals. PCBs bioaccumulate, which means that they are retained in human and animal tissues at concentrations in excess of exposure levels. PCBs are very stable and persistent in the environment.

EPA has determined in its Ambient Water Quality Criterion that 0.079 ppt (parts per trillion) of PCBs would be expected to produce one additional case of cancer per million people. PCBs have been identified in the soil on site. PCBs have also been identified in bulk tanks on site at high concentrations.

B. Cyanides

Health Effects

Cyanides can exist in both organic and inorganic forms. Hydrogen cyanide inhibits cell enzymes necessary for oxidative metabolism; acute exposure to high levels of cyanides can result in death due to respiratory failure.

Fire Hazard

Cyanides can react with acids to form flammable and toxic vapors such as hydrogen cyanide.

DFHLS

Highlights of the Potential Health Effects in the Human From Exposure to Polychlorinated Biphenyls (PCBs) and Related Impurities

Executed for the National Electrical Manufacturers Association and the Edison Electric Institute by Dent, Fraser, Hayes, Lusatti and Shutter Consultants in Toxicology

Introduction

Mixtures of chemicals known as polychlorinated biphenyls (PCBs) were manufactured commercially in the United States until 1977 and they are used throughout the world in a variety of applications. Over the years, people have been exposed to these chemicals both in the workplace and in the natural environment. Exposures in the workplace were generally far more intensive, especially in terms of inhalation and skin contact, than the typical low-level or occasional exposure in the natural environment. Much information on possible health effects resulting from PCB exposures has accumulated in the scientific literature, starting back in the 1930s. This report reviews this information and uses it as the basis for an objective assessment of the potential health effects of PCBs on people.

Methodology of the Study

Two teams of specialists, representing the disciplines of medicine, toxicology, pharmacology, biochemistry and epidemiology, participated in the study. The first team reviewed the PCB health effects literature in detail through 1981, and prepared draft reports on the relationships between PCB exposure and specific health effects in test animals and in exposed people. The second team of scientists from universities independently reviewed the draft material. Conclusions and opinions in the final report reflect contributions from both teams.

The health effects information reviewed was of two major types: first, results from large numbers of studies in which laboratory test animals were exposed to graded dosages of PCBs for variable time periods; second, data on effects detected in occupationally exposed workers as deduced from epidemiological and clinical studies. In the major recent studies, which are continuing, several thousands of occupationally-exposed workers are being followed.

From the entire collection of data on people and test animals, conclusions and opinions as to the possibility of occurrence of specific potential health effects in people from exposures to PCBs have been drawn. The results fall into two categories of effects, as follows.

Health Effects Observed in People and Animals

Two health effects, neither of them serious, have been observed in workers occupationally exposed to PCBs and in experimental animals. They are:

1. A skin disorder known as chloracne. The intensity of this effect is related to degree of exposure and to PCB chemical structure. Chloracne diminishes on termination of exposure, and is not a serious health problem.

2. In the process of metabolizing PCBs, excess amounts of proteins (enzymes) known as mixed function oxidases (MFOs) are produced, chiefly in the liver. This condition, even following extended industrial exposures, is not of significance to health over the lifetime of a PCB-exposed person. At most, elevated MFO levels can cause changes in the required dosages of medicines or other therapeutic agents that are

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subject to ready oxidation in the body. Similar MFO elevations are caused by certain drugs, hydrocarbons, and other substances.

Health Effects Observed Only in Test Animals

Several health effects have been observed in test animals, but have not been observed in people, even after many years of occupational exposure. They are:

1. The possibility that exposure to PCBs can lead to cancer has been studied in test animals and in exposed people. The bulk of the studies on animals yielded negative results on cancer in all tissues in all species, with an exception of some unverified results on liver cancer in mice and rats. In studies of occupationally-exposed workers, the test results were also negative with an exception of a single report of excess skin cancer in one group of workers. This report was not confirmed in other studies. It can be concluded that there are no demonstrated connections between PCB exposure and cancer in people, even when occupationally exposed.

2. Adverse effects on reproduction have been observed in experimental animals, generally at very high dosages. They are:

   a. Effects of PCBs on the developing embryo or fetus leading to birth defects (teratological effects) have been observed in a limited number of experimental animals.

   b. Toxic effects on the developing fetus in test animals can be produced by high dosages of PCB.

   No evidence for such effects in people has been recorded, even for pregnant women occupationally-exposed to PCBs. It is concluded that the probability of such effects occurring in people is very low.

3. PCBs are able to produce adverse effects on liver tissues in test animals, reversible at low doses and increasingly irreversible at higher exposure levels. No adverse effects on liver functions have been observed in occupationally exposed workers, leading to the conclusion that these chemicals do not cause human liver disease under these conditions.

4. PCBs exhibit a low to moderate degree of acute toxicity in test animals. However, there is little evidence in people of any acute toxicity in the course of PCB intake, storage in tissues, metabolism and excretion. Further, there is no evidence to indicate the PCBs produce any adverse effects on the human immune system or blood supply.

Other Observations and Conclusions

Mutagenesis: The possibilities of harmful, heritable changes in genetic material of cells and tissues under the action of PCBs have been studied in biological test systems, experimental animals, and occupationally-exposed workers. All test results are negative for such changes. The risk of genetic damage on people from PCB exposure is negligible. This conclusion is consistent with the lack of a demonstrated connection between PCB exposure and cancer.

Yusho Disease: Because of the uniqueness of the Yusho episode in terms of the level of contamination of the PCBs, the dosage patterns and the symptoms observed, Yusho cannot be considered a model to reflect the possible effects of PCB exposure in man. It is impossible to stipulate whether any of the health effects observed are causally related to PCB exposure.

Summary

At human exposure levels as high as those previously encountered in occupational settings, PCBs can cause chloracne and increases in the levels of one or more liver enzymes. Neither effect represents a serious or life-shortening health problem. From present evidence, no firm associations can be made between PCB exposure and any other human health effects, even after long-term occupational exposures.

Since the risk to human health from even high level occupational exposures has been shown by the studies available to be low, it may be concluded that much lower human exposures to PCBs in today's workplace and in the natural environment do not present significant human health risks.



For the Firm, Seymour L. Friess, President
March 9, 1982

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