PCB.ASC

TO: Steve Puntar
FROM: Art Lange, Risk Manager Orange-Ulster BOCES
DATE: January 29, 1992

RE: POSSIBLE PCB CONTAMINATION IN SCHOOLS

PCBs (polychlorinated biphenyls) have gotten a lot of press due to the unfortunate accident at SUNY New Paltz. This is a misnomer, since in addition to PCB, there is also PCDF, PCDD, TCDF, TCDD, CFD and CDD included in the group of compounds. Prior to 1979, PCBs were used extensively in electrical components such as transformers, capacitors, switches and voltage regulators for their thermal stability and nonflammable properties as well as their high boiling point.

Some of the common trade names in use for the askarels (generic name for a group of PCBs), include Pyranol(tm), Inerteen(tm), and Noflamol(tm). Another group has the trade name Aroclor(tm) followed by 12xx (where xx represented the percentage of chlorine in the mixture in most cases).

Schools in Orange County will generally find PCBs in transformers and in capacitors in fluorescent lighting fixtures. Fluorescent lighting fixtures contain ballasts which are usually located beneath a metal cover plate. These ballasts contain small capacitors which may hold a small amount of PCBs in soldered, sealed metal containers. They also contain transformers and possibly contain a thermal cut-off switch. These components are surrounded by a tar-like substance which is designed to baffle the noise generated by the ballast. When a ballast fails, and excessive heat is generated, it is this tar-like substance which, should it burn or melt, emits a nauseating odor. The sealed capacitor container will not always rupture and leak PCBs into the room. There will only be need for cleanup if the sealed capacitor container ruptures and leaks PCBs into the room. Cleanup is handled in much easier fashion than an asbestos fiber release episode. If there is no sooty smoke on walls or ceilings or other surfaces than the windows should open opened for at least 30 minutes. EPA advises workers should wear rubber gloves. If the room cannot be ventilated workers should wear respirators with HEPA/Organic Vapor cartridges. Workers should also wear Tyvek suits with rubber gloves and appropriate eye protection; and these items should be properly disposed by EPA approved methods. The EPA recommends cleanup of contaminated surfaces with rags or paper towels, double cleaning surfaces with turpentine, mineral spirits, rubbing alcohol, deodorized kerosene, or trisodium phosphate. EPA advises that absorbent materials, such as carpets, drapes, and fabric covered-furniture, cannot be cleaned and should be properly disposed by approved transporters.
The EPA has stated that the danger from leaking PCBs from a single ballast is not significant, especially compared to a single asbestos fiber release which the schools handle with ease.

ALERT TO SCHOOL DISTRICTS -- PCBs IN ELECTRICAL EQUIPMENT

Many school districts do not realize that electrical equipment in use or stored around schools may contain Polychlorinated Biphenyls (PCBs).

WHAT ARE PCBs?

PCBs are a class of man-made chemicals that were widely manufactured and used for many years. The manufacture of PCBs was banned by the Environmental Protection Agency (EPA) in 1979, but many pieces of electrical equipment, including transformers and capacitors, still contain PCBs.

PCBs are not acutely toxic, but exposure to PCBs can produce skin disorders (chloracne), nausea, dizziness, eye irritation, and bronchitis. Ingestion of PCBs can cause liver damage and digestive problems. EPA classifies PCBs as a suspected human carcinogen.

The continuing use and disposal of PCBs is strictly regulated by Toxic Substances Control Act (TSCA) regulations administered by EPA. Civil penalties of up to $25,000 per day may be levied for violations of the PCB regulations.

WHAT CAN YOU DO?

The most important thing to do is to determine where PCBs are or might be within the school facilities and property. It is wise to maintain a simple inventory of location, condition, and ownership of potential PCB sources.

PCB testing of unknown equipment is not required, nor, in most cases, is the removal of PCB equipment, but school districts may want to develop long range plans to identify and gradually replace PCB items. Routine inspection and maintenance programs, as well as preventive measures, can reduce risks.

WHERE CAN YOU TURN FOR HELP?

EPA's TSCA Information Line at 202-554-1404 can provide copies of the federal PCB regulations and answer questions on many technical and regulatory issues. If you have a question about a specific situation in your school, they will provide the name and number of the PCB Coordinator in your EPA regional office.

Local electrical utilities have experienced workers who are knowledgeable about electrical systems and can clarify ownership issues. They may also be able to provide information on the PCB content of a particular piece of equipment.

Local health departments or districts may be able to provide suggestions on testing of your equipment.

Environmental Assistance Division (TS-799) February, 1990

From: Agency for Toxic Substances + Disease Registry
U.S. C.D.C. June 1990 P.C.B. Toxicity

Challenge

(2) Are other sources of PCB exposure likely for the patient described in the case study?

Biologic Fate

- **PCBs are stored in lipid tissues.**
- **The liver is the primary site of PCB metabolism.**
- **The slow metabolism of PCBs leads to bioaccumulation.**

PCBs are readily absorbed into the body but slowly metabolized and excreted. After absorption, PCBs partition between the aqueous and lipid compartments of the body in a biphasic pattern. During the first day after PCBs were administered to laboratory animals, they were distributed mainly to the liver and muscle tissue. In a second phase, PCBs were redistributed to the adipose tissue, skin and other fat-containing organs. More highly chlorinated PCBs redistribute to adipose tissue to a greater extent than do PCBs with a lower percentage of chlorine; the presence of more highly chlorinated PCBs appears to delay excretion of the lesser chlorinated compounds for reasons not clearly understood.

The liver is the primary site of PCB metabolism by hydroxylation and conjugation with glucuronic acid and sulfates. The rate of metabolism depends on the number and position of chlorine atoms, with lesser chlorinated isomers being more readily metabolized.

Excretion of PCBs is slow, so bioaccumulation occurs even at low exposure levels. As long as exposure continues, a true steady state is never achieved. PCBs metabolized with more difficulty are excreted almost exclusively by the biliary route; metabolites of PCBs with a smaller percentage of chlorination are eliminated through bile and urine. Urinary metabolites are in the form of conjugates, including glucuronides and sulfates.

There are essentially no pharmacokinetic data for humans. PCB half-lives in the rat range from 1 day to 460 days depending on the degree of chlorination.

Background levels in human sera are typically less than 20 parts per billion (ppb), and residues measured in human milk have ranged from 40 to 100 ppb. Reported levels in adipose tissue range from 1 to 2 ppm.

Challenge

(3) Explain why patients with Gilbert's syndrome may be at increased risk of adverse effects due to PCB exposure.

Physiologic Effects

In humans, PCB toxicity affects the skin and liver, and may have developmental effects. Metabolic, reproductive, endocrine, and immunosuppressive effects have been noted in animals, but have not been adequately studied in humans. Although data from animal studies indicate that PCBs are definitely animal carcinogens, data from PCB-exposed human populations are inconsistent and inconclusive.

- PCBs have low potential to cause acute effects.
- EPA considers PCBs to be probable human carcinogens.

Dermatologic Effects

Chloracne is the only overt effect of PCB exposure in humans, but absence of chloracne does not rule out exposure. There is no reliable dose-response model for chloracne in exposed populations; the dose-response relationship may be dependent upon individual predisposition. Chloracne typically develops weeks or months after exposure. The lesions are often refractory to treatment and can last for years. One case persisted for more than 30 years.

- PCB-induced chloracne can reflect systemic toxicity.

The acneform lesions arise from altered differentiation of acinar sebaceous base cells into keratinocytes. The chin, periorbital, and malar areas are affected most often, although lesions may

also appear on the chest, arms, thighs, genitalia, and buttocks—areas not commonly affected by acne vulgaris. The most distinctive lesions are cystic and measure from 1 to 10 millimeters (mm). Other prominent lesions are comedo. The cysts and comedones can become inflamed and secondarily infected. The papules and cysts may be surrounded by edema and erythema. Chloracne may result not only from dermal contact but also from ingestion and generally indicates systemic toxicity.

Besides chloracne, Yusho patients had hyperpigmentation of the skin, conjunctiva, gingiva, and nails. These pigmentation disturbances have also been noted in some PCB-exposed workers.

Hepatic Effects

- **High-level PCB exposure may produce elevated levels of liver enzymes.**
- **Evidence suggests that PCBs cause hepatotoxicity in humans.**

Epidemiologic studies and clinical surveys indicate that severe occupational exposure to PCBs can increase serum liver enzymes. The enzyme levels often show inconsistent patterns, however, and increases generally have not been associated with hepatic dysfunction, although approximately 10% of the Yusho patients experienced jaundice. Asymptomatic hepatomegaly has been reported in workers, many of whom had concomitant elevated serum PCB levels. Some researchers believe that aspartate aminotransferase (SGOT or AST) and gamma glutamyl transpeptidase (GGTP or GGT) are the most sensitive indicators of PCB exposure in humans, and that changes in these liver enzymes may occur at exposure levels below those at which chloracne appears. Liver damage, histologically documented, is the most consistent finding among laboratory animals tested with PCBs.

Increases in urinary porphyrin levels have been noted in a study of workers with low-level PCB exposure. Changes in porphyrin metabolism may be triggered by the induction of liver microsomal enzymes. PCBs are more potent enzyme inducers than phenobarbital, a drug that occasionally causes clinical problems due to its enzyme-inducing effects, and PCBs' enzyme-inducing effects can persist long after cessation of exposure. The health implications for enzyme induction include the occurrence of disease secondary to increased metabolism of endogenous or exogenous substances, and interference in medical therapy due to increased metabolism of administered drugs.

Reproductive and Developmental Effects

The Yusho incident documents PCBs' potential to cause developmental and fetotoxic effects in humans. Two of the Yusho mothers had stillbirths; 10 of 13 infants had abnormal skin pigmentation, 9 of 13 had ocular discharge, and 12 of 13 were smaller than average. Two infants developed Yusho from breast feeding. In contrast, the authors of a study of nursing infants whose mothers were occupationally exposed to PCBs found no adverse health effects. Contaminants in the PCB oil cannot be ruled out as factors in Yusho disease. Follow-up of the Yusho infants revealed no persistent morphologic or behavioral abnormalities.

- **PCBs have a potential to cause developmental and fetotoxic effects in humans.**

In laboratory animals, changes in estrous cycles, failure of ovum implantation, increased frequency of spontaneous abortions, and low birth weight of offspring have been reported after PCB exposure. No teratogenic effects have been reported in studies of humans or animals.

Carcinogenicity

The epidemiologic evidence is insufficient to evaluate the potential of PCBs as human carcinogens. Although Yusho victims showed a slightly higher rate of deaths from neoplasms 15 years after the incident, the data were not adjusted for age or smoking and drinking patterns. Cancer data from other human populations are inconsistent and inconclusive.

- **PCBs are considered potential human carcinogens on the basis of results from animal studies.**

Data from animal studies have shown that PCBs cause hepatocarcinomas, pituitary tumors, leukemia, lymphomas, and gastrointestinal tract tumors. On the basis of these data, EPA considers PCBs to be probable human carcinogens.

Challenge

(4) Is there a need to be concerned about PCB exposure when the clinical effects of the patient in the case study seem so limited?