PCB White Paper — Pt II

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The National Cancer Institute, 1978, Fisher 344 rats. Groups of 24 eight-week-old rats of either sex were fed Aroclor 1254 at dietary levels of 0, 25, 50 or 100 PPM for 105 weeks. Their report stated that Aroclor 1254 was not carcinogenic under test conditions.[illegible]

Norback and Weltman, 1980, rats. They fed Aroclor 1260 to Sprague-Dawley rats at dietary levels of 0 and 100 PPM for 105 weeks. The study concluded that this mixture was "carcinogenic in female rats, causing significant increases in liver hepatocellular carcinomas."[illegible] (Note that it was the liver that had the carcinomas — see page 10).

Treon, 1956, 10 mice, 6 guinea pigs, 4 rabbits and a cat. This was an inhalation test. Each set of animals was exposed for 7 hours/day, 5 days a week at differing concentrations and different mixtures. The group inhaling Aroclor 1242 did this either at 8.6 mg/liter or 3 weeks, or 1.9 g/liter for 31 weeks or 6.83 mg/liter for 17 weeks. The groups inhaling Aroclor 1254 did this at either 1.5 μg/liter for 31 weeks or 5.4 μg/liter for 17 weeks. The standard for workers is 1 mg/m³ which is the mathematical equivalent of 1 μg/liter.

FROM NIOSH STUDIES

Torok, 1976, Pregnancy in NMRI mice. Group one was a control group, group two received 375 mg/kg/day for three days and group three received 750 mg/kg/day for three days. In other words, these mice received in three days, from 7,990 to 15,900 times what a 154 pound woman would ingest in one year. The result was "longer intervals from breeding to parturition (birth) . . . (and) reductions in the number of dams with litters and in the mean litter size."[illegible]

No consistent changes in mortality, growth, pathology, organ size, liver function, or hemotologic parameters were found in animals exposed to Aroclor 1242. The animals exposed to Aroclor 1254 vapors showed no changes in growth or mortality but microscopic evidence of apparently reversible hepatic cellular injury was found in all species but the cat. At both exposure levels, enlarged livers were found in the animals exposed at 5.40 μg/liter.[illegible]

These, are a representative sampling of the animal studies conducted which involve PCBs. Animal studies are one of only two arguments (excluding Yusho) that have been put forward in defense of the position that PCBs should be banned. It is therefore of the utmost importance to determine what relevance these animal studies have to the human population. This is especially so with regards to the fear inducing potentially carcinogenic label that gets pinned on PCBs. (Note: Of the scientific reports we have read none say PCBs are carcinogenic to humans, only the media has pronounced them so — see addendum).

	EPA	MSDHP	HMS_A	HMS_B	50 kg	70 kg	100 kg
	Percent of Test Subjects						
NONE	—	—	24.5	9.1	0	0	0
1 PPM	69	56	40.2	50.6	.06	.07	.1
1-2 PPM	31	36	29.8	35.4	.1	.14	.2
2 PPM	—	9	5.5	4.9	.5	.7	1

ANIMAL STUDIES AND RELATION TO HUMAN BEINGS

A 1980 study by the California Research Division of PCBs had this to say:

The biggest difficulty in using animal studies to determine potential health effects is in extrapolating toxicological results from animal species to humans. It is often seen that two types (species) of animals do not react the same way to the same chemical.[illegible]

One good example of this was seen in a study with TCDF (Tehrachloro Dibenzo Furan), the contaminant in the Yusho incident. The single oral LD_{50} (lethal dose for 50% of test subjects) in guinea pigs was estimated at between 5 and 10/μg/kg body weight while single oral doses of 6000 μg/TCDF/kg body weight did not produce any toxic effects in mice.[illegible]

The 1981 California study states that "the effect of PCB exposure on immune and endocrine system function has not been carefully studied in humans. So the relevance of these animal observations to human health remains unknown."[illegible]

The National Academy of Sciences Division of the National Research Council has also called into question the relevance of animal studies to human health. The following quotation was with respect to TOSCA's testing results.

It should be noted that most of the chronic tests proposed to assess human health hazards require use of species (rodent plus one other mammal) that would not adequately reflect the human toxic response to PCB exposure. The common laboratory test animals (rats and dogs) do not always respond to PCB exposure in the same manner as humans, and Table 3.6 suggests that no one species exhibits "typical" human symptoms of PCB poisoning except in the case of reproductive tests.[illegible]

Note: In regards to this statement, consider the fact that penicillin kills guinea pigs.[illegible] Should penicillin be banned because of this? Aspirin administered to rats causes birth defects in rats.[illegible] Should aspirin be banned because of the rats?

Dr. Leonard Goldwater, M.D., an expert in the field of toxicology gave a courtroom his opinion of animal studies. "Animal studies tell you what happens when you give chemicals to animals."[illegible]

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• Oil Assistance and Treated Coal

To prevent dusting in transportation, coal is frequently sprayed in the cars. We have found that up to 2 gallons per ton of #2 oil has no effect on the baghouse. Residual oil or used crankcase oil should definitely *not* be allowed. Coal treated with this is difficult to burn and will effect the baghouse. In winter ethylene glycol is frequently used, and this does not seem to have any effect.

Many times it is necessary to burn oil along with the coal, for instance during flameout. This is acceptable. However, many customers ask "How much oil can I burn continuously?" There has not been much experience with this on baghouses. We would recommend oil not to exceed 5% of the thermal capacity of the system until enough operating experience has been accumulated to verify the percentage.

• Bag Cleaning Problems

Probably the most aggravating problems with baghouses is high pressure drop. When this occurs it could limit boiler capacity because the I.D. fan may not have enough capacity to overcome the increase in pressure. The problem can be caused by a number of things.

We have previously discussed the verification of flue gas volume under "other variables." Undersized equipment due to this problem will require additional cloth or a larger fan to solve the problem. However, during normal operation occasionally this problem can occur. In a reverse air baghouse a malfunction of the reverse air fan may trigger the high pressure drop. If for some reason the fan has stopped, cleaning will not be accomplished and just putting the fan back on line may not rectify the situation. The baghouse pressure may be so high that the fan can not overcome it. In this case the baghouse must be placed on bypass and cleaned.

Improper bag tension can cause cleaning problems. This should be checked periodically. Smoking boiler conditions can generate very small particles that imbed themselves in the cloth. Off line cleaning will often remedy this. On rare occasion the wrong type material to "seed" the bags prior to start-up can cause high pressure drop. Lime should never be used. We recommend fly ash, but even then the calcium content must be low.

• High Temperatures

Many installations are adding economizers to conserve energy. These are also necessary to prevent temperature entering the baghouse from exceeding 500°F. The finish on the fiberglass bags deteriorates rapidly above this temperature. The finish protects the bags from acid attack and also is a lubricant for long bag life.

Failure to have feed water or other economizer problems can allow high temperature flue gas to enter the baghouse. An automatic bypass is very strongly recommended to prevent bag failure.

High temperature is not a problem for electrostatic precipitators. Temperatures up to 700°F. may be handled with standard design units.

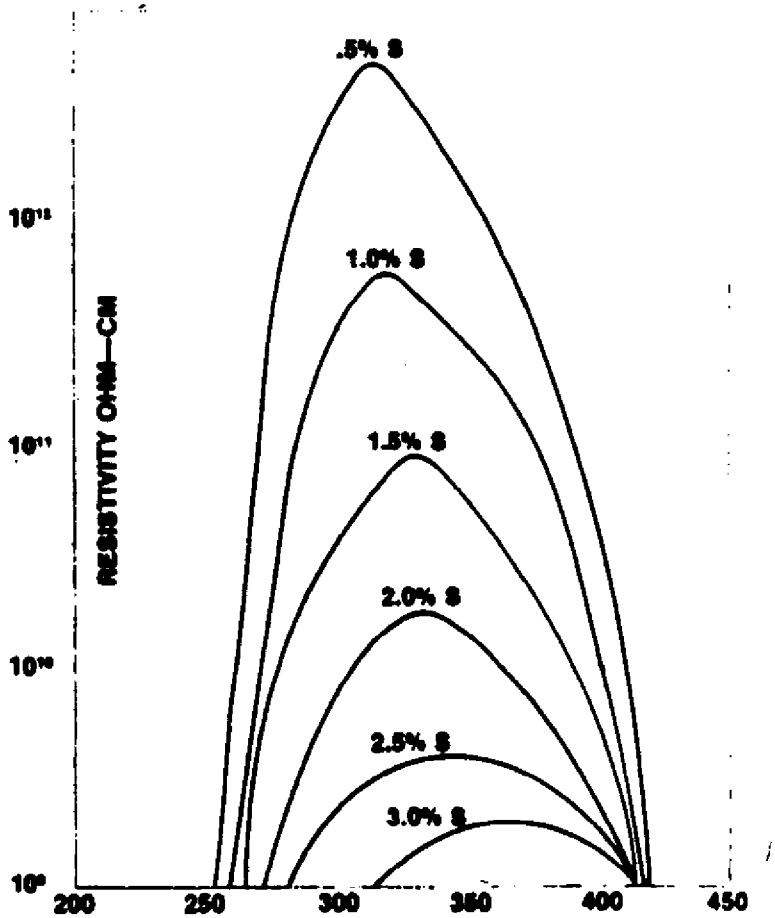
Conclusion

This article has concentrated on experience and problems. We hope you don't assume that every project has problems. This is not the case. This article will hopefully present ways to learn from the past and incorporate what we learn to future projects. The best way to avoid problems is to have a great deal of past experience. We would recommend you investigate your supplier and verify that he has a number of successfully operating projects. □

Acknowledgement

The author thanks Jack Riley, Product Manager of E.P. Systems with American Air Filter Company, for his review and comments on this paper.

This article was presented at the Twenty-First Annual Kentucky Industrial Coal Conference, University of Kentucky, April 1982.



FLYASH RESISTIVITY
FIGURE 3

MONS 216426

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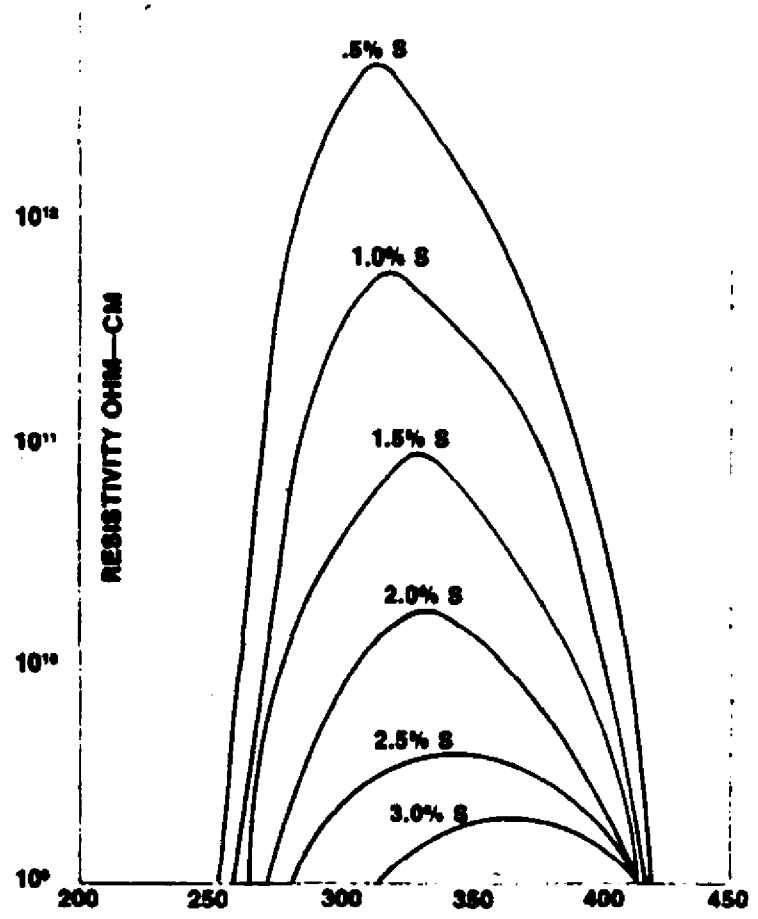

FLYASH RESISTIVITY
FIGURE 3

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STUDIES ON HUMAN BEINGS

It is with this recommendation that studies of the human population be included in any decision that we begin our next section.

Before examining specific cases of human contact with PCBs, however, it would be good to look at the risk to the population as a whole. This can be done by first determining the amount of PCBs that are in the population as a whole. The following three paragraphs describe studies done that determine the PCBs content of fat. The findings are summarized in a table following the paragraphs. It shows the percentages of people falling within each grouping.

The EPA's Human Monitoring Survey analyzed human adipose tissues, a major deposit area, from 1968 to 1972."

Price and Welch, 1972, describe the findings of a study done by the Michigan State Department of Health Pesticides (MSDHP) on over 4000 human adipose tissues. They also mentioned finding 100-250 ppm in the adipose tissues in an autopsy of a 77 year old man. The highest PCB concentration was in the liver."

The Human Monitoring Survey (HMS) examined 1277 (A) adipose tissues in one year and 1047 (B) in another. The years ran between July, 1972 through June, 1974."

The right side of the above table gives the figures for how much the PPM translates into for a 50, 70 and 100 kg person. The numbers are in grams and were calculated using the high figure, i.e., 1 and 2. The important things to note from this table are: One, the low amount of PCBs present in the body; and Two, that over 90% of the U.S. population has less than 2 ppm PCB.

The National Academy of Sciences has estimated that the mean concentration of PCBs in human adipose tissue of U.S. residents is 1.2 mg/kg. For a 154 pound man, that works out to 0.084 g. Compare this amount to what a 154 pound West German carries, which is over six times that amount: 0.55 g.

As can be seen, the U.S. has one of the lowest mean concentrations of PCBs in the industrialized world.

These figures also provide a check for the NIOSH figures for daily PCB intake that have been used for comparative purposes in the section on animal studies. NIOSH said the dietary intake was on the order of 10-20/μg/day and intake from inhalation up to .1 μg/m³. We used 27 μg/day as the high figure. Fifty years of intake at this level would yield a body burden of 0.49275 g. For a 154 pound person that works out to 7 mg/kg, or 7 ppm — almost six times higher than the average. Which means that the estimated daily intake of 27/μg/day is either too high or else the PCBs are leaving the body. So, if we have misrepresented the comparative amounts in the animal studies, we have certainly done so on the conservative side.

Polychlorinated Biphenyls have also been found in mother's milk, a fact that some try to exploit for sensational purposes. The most comprehensive study we have thus far encountered was done by E. P. Savage, who reported his findings to NIOSH in 1977. One hundred-forty-one

TABLE 1.24 PCBS IN HUMAN ADIPOSE TISSUE

Country	Mean Concentration (mg/kg)
Denmark	5.0
Japan	4.7
West Germany	7.8
Austria	4.8
U.K.	1.3
Norway	0.8
Canada	1.2
East Germany	8.4
Israel	3.8
New Zealand	0.8
U.S.A.	1.2

human milk samples from 40 states were tested for PCBs. One hundred-twelve samples contained over 50 ppb, (parts per billion) with the highest being 350 ppb. (Caution should be exercised when looking at milk figures because many times they list the findings on a *fat* basis, which is less than 3% of the milk. This way they can put down a bigger number to evoke more fear. For example, on a *fat* basis, the 350 ppb in the milk translates into 12.6 ppm.)" After discussing the PCB level in human milk and adipose tissue, NIOSH concludes with the following statement, giving 12 sources from which it made this decision.

"While no adverse effects have been associated with PCBs at the concentrations found in adipose tissue, blood, or milk of individuals whose only known exposures were from environmental concentration, knowledge of these concentrations is important to the evaluation of reports on occupational exposure."" Further at a Toxic Substance Control Institute Seminar October 15-19, 1979 Raymond D. Harbison, Director of the Toxic Substances Control Laboratory at Vanderbilt University — said PCBs are totally immobile and are not carcinogenic to humans."

INCIDENCE FOR HUMAN EXPOSURE

Since PCBs in the environmental levels present have caused no adverse effects on human life, what segment of the population might have cause for concern? Those workers who are occupationally exposed. NIOSH cites a 1978 study, when PCBs were still being manufactured. In its report it states "that 12,000 workers have potential occupational exposure as a result of current uses of PCBs in their working environment."" (Note: Production of PCBs was terminated in 1977). To better understand the potential risks involved let us compare this figure with some other risk numbers. The American Cancer Society estimates that 78,750 persons will die of lung cancer caused by smoking in 1981. These are real deaths and are six times more numerous than a "potential occupational exposures."" For some other examples, let's translate the 12,000 into a per 100,000 basis. It works out to 8.3. FBI statistics from 1976 state that a person has 66% more of a chance of being murdered (and by non-negligent manslaughter) than he does of being "potentially-occupationally exposed" to PCBs." By 1976, the deaths of

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Whenever policy is being determined, the risk factor must be taken into account. Life is filled with risks and nothing is ever risk-free. Even if PCBs killed on contact, the associated risks are less than those when compared with deaths that occur from such social activities as drinking and smoking. But that argument does not really matter, for PCBs have never caused one death in their fifty-plus years of existence. In fact, American PCBs have never caused one illness," except when they were heated. And even then there were only reported cases of chloracne — a skin disorder not unlike teenage acne. And this was attributed to contaminants in the compounds used to make the PCBs — not the PCBs themselves.

EPIDEMIOLOGIC STUDIES (15)

Our opponents in this matter have said that not enough epidemiologic evidence exists on which to make a decision of PCBs.[70-71] So they utilized animal tests. Below are over 15 epidemiologic studies that show why animal studies were needed by the radical environmentalists: not one serious illness could be attributed to PCBs.

The first epidemiologic study we would like to cite was conducted by Dr. Leonard Goldwater, a toxicologist working at Duke University and the University of North Carolina, with the EPA and with NIOSH. His observations of people who worked with PCBs came out in sworn testimony before a court of Law. The observations relate to his studies done for the Navy in 1943. The studies were conducted in four major cable factories (two in New York City, one in Rome, New York, and one in the San Francisco Bay area).[1]

In one of these plants in particular they were very, very sloppy in their work, and they were under great pressure to turn out as much cable as possible, they were working a lot of overtime and working around the clock three shifts a day, and the air was thick with the fumes from these things because they were heating them to impregnate the cable, and the workers were practically bathing in this stuff. They were not provided with any adequate shower facilities or work uniforms and they literally had their skins caked with the condensed insulating material which contained PCBs. Now, these are the ones who had the main difficulties. In one of the other plants — another extreme — they were careful, they had adequate ventilation, they had showers, they had work uniforms. There they had practically no problems at all."

The "main difficulties" the people had was chloracne.

He also examined 3000 electricians in the Brooklyn Navy Yard who put this cable on the ships.

And they were examined for evidence of acne, chloracne — which were mentioned here the other day — and for evidence of any liver injury, which is the main organ that one would expect to be affected if there was any effect; and, just by examining these people and assuring them that nothing was happening and then re-examining any who were nervous about themselves, all of this fear and almost hysteria that had been whipped up by the news media very quickly subsided and the shipbuilding effort resumed with the results we all know."

Capacitor workers probably received more exposure to PCBs than workers at PCB manufacturing plants did. A 1980 retrospective cohort mortality study of 2349 workers in two capacitor manufacturing plants was recently completed by NIOSH. The total exposure of these men was 38,890 "man-years." Some of the workers had 38 years on the job, some as little as three months.[70-72]

The major organ checked for carcinogenicity and other such problems in the animal studies was the liver. Therefore, one would expect that if any serious health problems were connected with PCBs, they would show up in the liver. This, however, is not the case. A twenty-five year study on different cancers by the American Cancer Society shows that from 1950-52 to 1975-77 deaths from liver cancer has steadily decreased. For men it has gone down by over 38% and for women by 53%.[3] All this while the production of PCBs was increasing. If PCBs were as bad as the environmentalists claim, why should liver cancer be decreasing?

Many epidemiologic studies have tested for impaired liver functions. Most deal with increased levels of enzyme production, something that occurs when a foreign substance enters the body. (Liver enzyme production is triggered, for example, by nicotine in cigarettes, charcoal-broiled meats with benzopyrene on it, birth control pills, BHT preservatives that are widely used in food, brussel sprouts, cabbage, and even stress.)[4] So what happens to workers exposed to PCBs? The next studies should reveal the answer to that question with respect to liver function.

HUMAN LIVER STUDIES

Puccinelli, 1954, Italy. Men were exposed to heated Aroclor 1254 at a factory that produced capacitors impregnated with the chemical. This Aroclor was present in concentrations from 5-7 mg/m^3. (International standard is 1 mg/m^3). Three men, ages 18-24, developed chloracne after working in this area for 2-4 years. "Other than chloracne, the men appeared healthy, and all findings, including liver function tests, were reported normal."[5]

Karppanen and Kolho, 1972, Sweden. Six persons handled PCBs in an analytical lab and 12 worked in a plant where Aroclor 1242 was impregnated into capacitors. The capacitor workers had been at their job for 4 years. Special care was given to protecting their skin and the workroom air met internationally accepted standards (1/mg/m^3). Subcutaneous adipose tissue was taken from two lab workers. The capacitor workers had the highest concentration of PCBs in their tissue, having 180, 285 and 635 ppm. "All persons examined were in good health. The capacitor workers had been under special medical observation but the investigators were unable to detect any biologic effect from the PCBs."[6] No

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liver impairment was found.

SKIN EFFECTS

If the liver is not adversely affected, then what is? The skin, sometimes. In addition to the finding or non-findings of dermal disorders already mentioned in connection with the search for liver disorders and in Doctors Goldwater and Kelly's testimony, the remainder of cases of chloracne will presently be discussed.

In 1969, a 43 year old man got severe chloracne. He had put his hands in a PCB "mixture without skin protection for a long time . . . his clothes often became impregnated with the PCB. It was reported that this was the first case of chloracne in the plant. Where more than 100 workers had been engaged in the process for more than 20 years."[7]

In 1964, 13 of 15 workers exposed to an Aroclor which was a mixture of bi- and terphenyls (65% chlorine content) developed chloracne. "An enamel containing the Aroclor was painted onto glass and then baked in an oven. Faulty ventilation caused contamination by chlorinated hydrocarbon vapors."[8] Note that this was not an electrical-grade PCB.

The General Electric Company gave testimony in 1975 about what its records showed concerning persons working with PCBs (in the matter of General Electric Company, File No. 2833, New York State Department of Environmental Conservation). The testimony related to two manufacturing facilities that used PCBs. Their records showed that, during the previous 15 years, only 49 cases of skin rashes and dermatitis has been reported to the dispensary. Of these 49 visits, 22 were second visits. Of the 49 complaints, only the fingers and hands were involved in 21 of the cases, only the arms, and hands in 5, only the face and legs in 1. Fourteen complaints were about a generalized skin rash. On sixteen other occasions, things like a burning sensation in the eyes and nose, dizziness and nausea were reported. This latter group of people, along with those who complained twice, were taken off the job." Think about these figures for a moment: Only 49 complaints in 15 years involving hundreds of people.

In 1950, Elkins reported that although the average concentrations of PCBs in the workroom air of several plants in Massachusetts ranged from 0.1 to 5.8 mg/m³, with maximums of 0.2 to 10.5 mg/m³. "No evidence of immediate toxic effects was observed except at PCB concentrations approaching 10 mg/m³, which the workers found unbearably irritating."[9]

The 1943 study by Karppanen and Kolho of Sweden, mentioned earlier, turned up no cases of chloracne. The subjects of the study had blood PCB levels of 74-1000 ppb and had been exposed to PCBs for 4 years in capacitor-impregnating operations."

It should now be clearly evident why animal studies are so widely quoted by those trying to ban PCBs. No evidence, along human lines, exists to support their position, and this after 50 years of exposure to PCB under the worst possible conditions. Animal studies, they claim, are needed to determine the long-term effects (they are looking for cancer) of exposure to PCBs. But not only are the results of the animal tests extremely questionable in their relevance to human experience, they are unneeded. For (one), a long-term mortality study has been done (38,000 man-years of exposure, with a maximum of 38 years of exposure, seems pretty long-term to us) — probably the reason the results have not been very widespread related to its finding of "no long-term effects from exposure to PCB," (two), over a twenty-five year period beginning in 1950-52, deaths from almost all cancers had decreased, and liver cancer, the expected site for PCB-caused cancers, has decreased between 39 and 53%. (The exception, lung cancer, which has increased around 200%. The "increase seen in both sexes due to cigarette smoking.")" So if PCBs do cause cancer (which we are not in the least even intimating) then the number of cancers caused must not be very significant. The long-term effects of PCBs on humans is that literally thousands of people in the United States have worked with PCBs since 1929 with no evidence of health problems whatsoever. If the object is to determine deleterious effects of PCBs, then the simple thing to do would be to make a study of those people who died who worked with the PCBs and see what they died from.

These figures could then be compared to national average and we could see exactly how harmful this chemical is. As it is, however, the only such story published completely exonerates PCBs.

With respect to the carcinogenic evidence against PCBs, NIOSH gives what turns out to be the basis for the demands that PCBs be banned: "In humans, there are no adequate studies to confirm or deny carcinogenicity. . . ."[10]

Our claim about the foundation of their case will be discussed later, but first let's finish the quotation:

"Although preliminary data suggested that among Yusho patients, deaths due to cancers exceed expectations (160, 161) and preliminary studies of two occupationally exposed groups in the U.S. indicate that the occurrence of certain cancers may be excessive (H.A. Sinclaire written communication, June 1976; G. Roush, written communication, September 1976). However, the two reports are not consistent as to the types of cancers found to occur more frequently than expected."

Sinclaire searched through the records of a petrochemical facility for employees who were "likely to have been exposed to Aroclor 1254 for various periods between 1949 and 1957." The 8 cancers that occurred out of a group of 92 "were not significantly more than would be expected," but the 3 melanomas and the 2 pancreatic cancers were significantly different from what calculated expections."

Two observations about this study would be appropriate at this point. First at a petrochemical factory there are many other chemicals present

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and it would therefore be both unreasonable and unscientific to use an example such as this to make any judgment on the carcinogenic potential of PCBs. Second, even in the Yusho incident, where all those other contaminants were present "there were no deaths from malignant melanoma, a tumor previously suspected to be linked to PCB exposure."[98]

Roush studied 300 current and former employees engaged in the manufacture of PCBs and found no malignant melanomas or pancreatic cancers. There was an excess of lung cancer, but these were not corrected for age or smoking habits.[99]

This sums up the epidemiologic evidence of what PCBs do to human beings. NIOSH says that "since 1970, PCBs have been one of the more thoroughly investigated environmental and occupational hazards."[100] This was in 1977. As late as January of 1981, however, statements such as "since the published epidemiologic evidence is limited we have utilized animal toxicology studies where appropriate in anticipating potential biologic effects in humans,"[101] were still being thrown around. One has to wonder if it is not the fact that a lack of epidemiologic studies that show that PCBs are harmful is what these people mean, for we have listed here 15 separate studies of the effects of PCBs on humans and have yet to turn up anything more serious than chloracne. (Impotence and jaundice have been laid at PCBs doorstep. But the case against them involved a mixture of 90% tetra- and pentachloronaphthalenes and only 10% PCB.[102])

ENVIRONMENTAL CONCERN

Earlier in this article it was mentioned that those pushing for a total ban on PCBs had built their case on two foundations. The one foundation mentioned, which was discussed was animal studies, to which we added the epidemiologic studies to determine the relevance of the tests to human experience. The other foundation upon which their case is built is that of environmental concern. "Concern about PCBs has, therefore, focused on their resistance to bio-degradation with the consequent potential for long-term or delayed health effects."[103] It is to this concern that we would now like to address ourselves.

The major environmental (and occupational) concern is the great stability of PCBs: They biodegrade *very* slowly, if at all. Due to their stability and to the fact that they are not readily metabolized, PCBs tend to build up (bioaccumulate) in the tissues of living organisms, so that if a person ate 27 μg/day for 70 years he would have close to all 0.68985 g ingested in him at his 70th birthday. He would lose some of it along the way, but how much, is not known.[104]

This bioaccumulation is especially marked in the lower-life forms. Suppose some seaweed has PCB in it. A little fish comes and eats lots of seaweed and the PCB from that seaweed accumulates in him. A bigger fish eats him and others like him and he ends up with an even higher PCB level. Then a bird or human eats that fish and ends up with a major share of all the PCBs that those under him consumed. That's what is meant by bioaccumulation.

Let's see how this looks in a real life situation. The Great Lakes area, for example, one of the most PCB-contaminated bodies of water in the U.S. contains fish that have over 50 ppm PCB in their edible tissues.[105-108] The FDA at that time prohibited the sale of fish with over 5 ppm in their edible tissues.

Not all PCBs (209 different PCBs are possible) are alike. However, the degree of chlorination seems to be a determining factor in the stability of the PCB as it relates to metabolism and biodegradation. It appears that the lower chlorinated PCBs (e.g., Aroclors 1242 and 1016) cause less severe reactions in animal tests[109] and as for the environment, the following statement was made at the 1975 EPA Conference on PCBs:

At least 1500 reports in scientific literature have been written relating to PCBs and, whereas most of these deal with only the question of reporting the presence of PCBs in the environment, invariably these reports describe and relate Aroclors 1254 and 1260, the more highly chlorinated PCBs produced by Monsanto.[110]

It was also claimed that the EPA has stated that Aroclor 1242 bioaccumulates on the order of 8 times less than the more highly chlorinated Aroclors.[111]

Aroclor 1242 contains about 91% and Aroclor 1016 about 94% of the lower isomers, containing 4 chlorines or less that more readily biodegrade in the environment. Therefore, if some of these mixtures do enter into the environment "over 90% of the small amount that did enter into the environment would have relatively low persistence."[112]

Bernard Kerns of Westinghouse has stated that "Westinghouse utilized primarily only two askarels (generic name), Aroclor 1242 for transformers and Aroclor 1016 for capacitors."[113]

NIOSH says that, prior to 1971, Aroclor 1242 was the major capacitor impregnant and after that date, it was Aroclor 1016. Transformers contained the more highly chlorinated Aroclors.[114]

It would thus seem that Aroclors 1242 and 1016 could be used in transformers and capacitors, providing the needed safety and minimizing the persistent elements that could enter the environment. And this is exactly what we believe should be done. It is the height of stupidity to persecute a chemical (and indirectly, the chemical industry) that has saved thousands of lives and thousands of buildings from destruction (NIOSH's evaluation):

There are currently no commercially available fluids which can be considered as totally acceptable substitutes for PCBs in the broad range of AC capacitors, nor are there substitute dielectric systems which would satisfy reliability and safety requirements in most applications. Transformers containing PCBs represent only about 5% of the U.S. transformer market, and are used only where safety and reliability are of prime importance . . . Major construction changes would be required to compensate for the fire-resistance of

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askarel-filled units if existing askarel-filled transformers are to be replaced with oil-filled units of equivalent electrical ratings."[12]

Just because it might "potentially" harm someone, NIOSH recommends that a standard be set so that wherever more than one-millionth of a gram of PCB exists in 1000 liters of air only, "a self-contained breathing apparatus with a full face piece operated in the positive pressure mode will provide adequate protection (to) workers."[11] Why this recommendation? "NIOSH concludes that PCBs in workplace air are potential carcinogens." (Emphasis ours.)"[12]

In fact, when it comes down to the bottom line, this is the whole argument of those who wish to ban PCBs. Not because they can prove that PCBs have harmed anyone, but because PCBs are "potentially carcinogenic." Why are PCBs considered "potentially carcinogenic?" For the same reasons that saccharin and formaldehyde[10] are considered potentially carcinogenic — if enough of a substance is fed to a rat, it will develop cancerous tumors. PCBs are considered "potentially carcinogenic" because some, but not all, animal tests have turned up cancerous substances. No evidence exists, apart from the animal tests, that would link cancer and humans. So until a human cancer is linked to PCBs, PCBs will be called "potential carcinogens," and radical environmental groups like the EDF will want them banned.

THE REAL PROBLEM

But even this "ban" won't be complete. The EDF wants to destroy over 17 million mineral oil filled transformers that contain some PCBs in order to get rid of 400,000 pounds of PCBs. Yet 179,000,000 pounds of PCBs exist in the light fixtures, television sets and air conditioners that were manufactured up till the late 1970's.[10] Their proposed ban doesn't even mention those things even though they contain almost 450 times the amount of PCBs. Why don't they go after those household items? Because it would make them look like the extremists they are when government employees entered into every household in America checking to see if everything was properly labelled or, in the case of a ban, confiscating all those items. If they are going to call for a ban, why not be consistent?

Dr. Leonard Goldwater gave us the inspiration for our closing argument. He said:

"There is no substance known to man which cannot cause serious or fatal poisoning in large amount. And, by the same token, there is no substance known to man which cannot be tolerated in some dose."[11]

What we need to do is look at the risks involved with PCBs. They have saved thousands of lives. They have saved many buildings from destruction by fire. They have enabled America to grow industrially by answering the needs of the electrical industry. They have not seriously affected the health of anyone in their fifty-two years of existence. So before some law or regulation is passed that is going to cost one trillion dollars, or even one dollar, for that matter, those who want to pass it should be made to substantiate their case with more than a "potentially" this or that. The American justice system is based on the presumption that one is innocent until proven guilty. America has the right to see the dead bodies."[7] While they are vainly searching for their "dead body" or "smoking gun," let's discuss the costs of what will happen if the EDF gets its way and PCBs are banned from use in transformers and capacitors.

ECONOMIC IMPACT

Transformer Maintenance Institute's primary concern is that of PCB contaminated transformer oil. Pure PCB transformers and capacitors represent 750,000,000 pounds of PCB liquid to be destroyed along with the associated equipment (140,000 transformers, 10,000,000 capacitors).

But . . .

Oil filled transformers having 2 or 5 ppm of PCB contamination will probably be declared to be (outcome of EDF-EPA law suit) pure PCB as far as rules and regulations for marking, inventory storage and disposal is concerned. And herein lies the problem.

There is estimated to be 140,000 to 400,000 pounds of PCB in 1.4 billion gallons of transformer oil in 28 million transformers. To destroy this 400,000 pounds of PCB it will cost 1 TRILLION TWO HUNDRED SIXTY BILLION DOLLARS.

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