

Monsanto

FROM - NAME & LOCATION -

W. B. Papageorge - General Offices, B1ND

DATE

December 5, 1973

CC

SUBJECT

REFERENCE

TO : Messrs.

P. G. Benignus - B2SC
H. S. Bergen - B2SL
W. R. Corey - B2SL
K. W. Easley - 1920
T. L. Gossage - B2SL
J. N. Haggart - 5040
J. B. Hosmer - E1SF
E. V. John - B1ND
P. J. A. Marsh - 5040
R. S. Munch - T2B
C. Paton - B2SC
W. R. Richard - T3A
J. R. Savage - B2SL
J. F. Stapleton - B2SA
E. P. Wheeler - A2SA

Attached are copies of communications submitted by General Electric to Dr. Martha Sager, Chairman of the Effluent Standards and Water Quality Information Advisory Committee and to Dr. C. Hugh Thompson, Environmental Protection Agency.

These reports resulted from my discussions with Al Pozefsky, Jim Nelson and Ed Simons of General Electric regarding requests from both Dr. Sager and Dr. Thompson for brief statements describing the economic impact which could result if PCBs were banned or if severe restrictions were imposed which would have the effect of a ban.

It is my understanding that General Electric plans to comment further when the proposed PCB effluent guidelines are published in the Federal Register. Publication of the guidelines was targeted for December 3 but this target was not met. Publication of the guidelines is still expected within the next week or so.



W. B. Papageorge

/bt

Attachment

MONS 091932

NOV 26 1973

GENERAL ELECTRIC

PRODUCT

QUALITY

STAFF

GENERAL ELECTRIC COMPANY, 1 RIVER ROAD, SCHENECTADY, NEW YORK 12345
Phone (518) 374-2211

Subject: Toxic Pollutant Effluent Standards

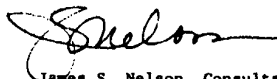
November 12, 1973

Mr. William Papageorge
Monsanto Company
800 North Lindberg Boulevard
St. Louis, Missouri 63166

Dear Mr. Papageorge:

Enclosed is a copy of our communications to the EPA (Thompson) and the Water Quality Advisory Committee (Sager) which are being mailed today. Please note our claim that Aroclor 1016 should not be considered a "toxic pollutant."

Very truly yours,



James S. Nelson, Consultant-
Product Environmental Compatibility

JSN:ev
Enclosures

cc: Dr. E. L. Simons
General Electric Company

MONS 091933

GENERAL ELECTRIC

PRODUCT

QUALITY

STAFF

GENERAL ELECTRIC COMPANY, 1 RIVER ROAD, SCHENECTADY, NEW YORK 12345
Phone (518) 374-2211

Subject: Effluent Limitations for Items on
Toxic Substances List: Economic
Impact of a Ban on PCB

November 21, 1973

Dr. Martha Sager
Chairman, Effluent Standards
and Water Quality Information
Advisory Committee
Environmental Protection Agency
Room 821, Crystal Mall, Bldg. #2
Washington, D. C. 20460

Dear Dr. Sager:

With reference to your forthcoming meeting (38FR30577) and pursuant to our understanding that the Committee has expressed an interest in knowing the economic impact of a possible ban of polychlorinated biphenyls (or a restriction tantamount to a ban), we have the following comments to offer:

The value of the annual production of PCB transformers in the U.S. is approximately \$45 million and that of capacitors \$140 million. Neither of these figures forms an appropriate base for assessing the socio-economic effect of regulations having the force of a ban on further production. Should such a ban occur in the near future (i.e., within five years) the impact of PCB transformer unavailability would be felt primarily in terms of disruption of building construction, electric distribution, and railroad equipment projects; and interruption of the supply of PCB capacitors would impact most heavily on the electrical supply situation, exacerbating the "energy crisis."

Most PCB transformers are installed in industrial, commercial, and residential substation applications. A considerable number are installed on electric railway passenger commuter cars serving major metropolitan areas. In all applications, these transformers distribute electric power reliably without risk of fire and explosion, and in compliance with specific laws, codes, and insurance restrictions mandating non-flammable liquid content. There is no readily available alternative for many applications where construction is under way or plans are complete. As much as \$1 billion of construction projects could be seriously delayed, involving schools, factories, office buildings, apartment houses, and commuter trains.

MUNS 091934

GENERAL ELECTRIC

Dr. Martha Sager

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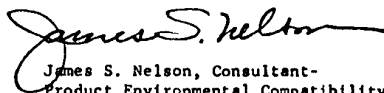
The PCB capacitors produced in the U.S. annually have a major effect in reducing the electric current which would otherwise have to be generated to serve industrial and public needs. The saving may be approximated by summing up the incremental cost of oversize generators and that portion of transmission and distribution system equipment which is thermally limited. Equipment in these classes, corresponding to the 44 million kilovars of new capacitors installed annually, has a value of approximately \$1 billion. A forced conversion to a non-PCB capacitor would be hampered by shortages of basic capacitor materials and factory production capability, thus placing in jeopardy about half of this annual saving. Additionally, there would be serious dislocations in the lighting and air-conditioning industries due to shortages and mismatches of capacitors required in those systems.

The enclosed paper, "The Role of Polychlorinated Biphenyls in Electrical Equipment", February 4, 1972, was prepared originally for the Office of Science and Technology and is included here for further information on the economic value of these devices. In addition, we have updated the information about capacitors and addressed ourselves specifically to the consequences of unavailability of PCB capacitors in the enclosed new study entitled, "The Impact of a 'Ban' on the Use of PCB in Capacitors," November 19, 1973.

Important as are economic considerations, we feel that the case for continued use of PCB's in capacitors and transformers rests less on these factors than upon the lack of substantiated need for any tighter constraints on the handling of these materials than those already in use or assumed as goals by the electrical industry. These aspects are discussed in the enclosed letter from Dr. Simons of General Electric to Dr. Thompson of E.P.A., commenting upon toxic pollutant effluent standards (reference, 38FR21342).

We hope this discussion will be of use to your committee.

Very truly yours,


James S. Nelson, Consultant-
Product Environmental Compatibility

JSN:ev
Enclosures

cc: Dr. C. Hugh Thompson
Chairman-Hazardous and Toxic Substance
Regulation Task Force
Office of Water Program Operations
Environmental Protection Agency
Washington, D. C. 20460

MONS 091935

THE IMPACT OF A "BAN" ON THE
USE OF PCB IN CAPACITORS

SUMMARY

The PCB-impregnated capacitors produced in the U.S. annually have a major effect in reducing the electric current which must be generated to serve industrial and public needs for power. The annual saving may be viewed as equivalent to 44 large electric generators, each of the 1000 megawatt size, which do not need to be installed - an aggregation comparable to the nation's annual growth requirement.

The following consequences will result from a PCB effluent standard so strict as to have the effect of a ban:

- If the industry is forced to convert to a non-PCB impregnant, low dielectric-constant liquids, such as mineral oil, offer the best initial fallback position.
- Mineral oil would roughly double the pounds of capacitor grade dielectric paper and aluminum foil needed to produce present capacitor requirements. Current world-wide shortages of capacitor paper and foil would not support this.
- Materials availability would support about 50% of the current capacitor requirements using mineral oil.
- If adequate materials supplies were somehow attained, current capacitor manufacturing facilities could produce at best only 50% of capacitor unit requirements.
- Forced conversion to a non-PCB would result in capacitor shortages and major production cutbacks in the lighting, air conditioner, and power supply industries, and in their customer operations.
- Doubling the size of capacitors would present serious replacement problems where PCB capacitors had been used.
- Ballast and air conditioner manufacturers would have to redesign certain products to accept the larger capacitors.
- Power system stability would be adversely affected by a shortage of capacitors, and black-outs could be expected.
- New non-PCB's, such as G.E.'s Ecnol[®], could substantially reduce the magnitude of the materials problem. However, Ecnol still represents an unknown risk in reliability and safety in the major consumer application areas. A mass conversion is not justified at this time.

I. INTRODUCTION

This is a forecast of the consequences of a PCB effluent standard which cannot be met by capacitor manufacturers, and consequently becomes an effective ban. It is submitted by the General Electric Company to assist in the determination of appropriate effluent standards relative to capacitor grade PCB.

II. BACKGROUND

In the U.S., an impregnated capacitor can be very simply described as:

- Aluminum foil (around 0.22 mil thick) which serves as the electrodes.
- Sheets of dielectric consisting of capacitor grade paper or combinations of this paper with plastic film. The dielectric is positioned between the aluminum electrodes as it is wound into rolls.
- An appropriate liquid impregnant.
- A sealed container for the capacitor roll and impregnant.

The choice of dielectric materials, the number of sheets, and their thicknesses are all the result of many years of research and testing for reliability and consumer use safety. About 90-95% of liquid impregnated capacitors contain PCB, and are critical components to the fluorescent and mercury vapor lighting, the electric motor and air conditioning industries, and power transmission by electric utilities. The dielectric paper and plastic films (primarily polypropylene), aluminum foil, and PCB have all been specially developed and controlled for capacitor use and are produced as "specialty" materials.

Capacitor grade PCB is Aroclor 1016, manufactured only by Monsanto. It is primarily trichlorobiphenyl. It differs from all previously used formulations in that practically all of the higher boiling homologs--which have given rise to reports of PCB in wild-life residues--have been removed. Introduced in 1971, it is now the only PCB used by the U.S. capacitor industry. Compared to other formulations,

- it has a higher degree of biodegradability;
- it has a lower degree of persistence in the environment.

III. CONSEQUENCES OF A "BAN" TO THE CAPACITOR INDUSTRY

This evaluation addresses itself to the situation wherein the capacitor industry is effectively banned from using PCB's.

A. Alternative Impregnants

Alternative impregnants are unproved in the U.S. capacitor industry. Mineral oil was the major impregnant before PCB's, and it appears to represent the best immediate fallback position. Even though mineral oil technology would put the industry back 30-40 years in progress, it still represents the best combination of known technology, materials availability, and reliability. For these reasons, mineral oil impregnant has been selected at this time as the basis of comparison with PCB's.

There have been a number of very active programs to develop non-PCB impregnants, especially after the environmental problem was recognized. These programs are continuing in the industry, and it is expected that an improvement will be found which would be more acceptable than mineral oil. As an example, General Electric is using a phthalate ester as the base for its non-PCB Ecenol impregnant. Ecenol capacitors are being sold commercially where special situations require a non-PCB. This is the case where U.S. electrical equipment, such as computers, is to be shipped to Japan where PCB's are banned.

Ecenol has a higher dielectric constant (see next Section B for discussion of this property) than mineral oil, and consequently will require less additional materials and manufacturing capacity. However, limited availability of the phthalate ester, lack of appropriate manufacturing facilities, need for developing new efficient manufacturing processes, and particularly the unknown factors of reliability and safety in the broad consumer use areas such as lighting and air conditioners are some of the problems that prevent a near-term substitution.

Unless considerable time for the development and evaluation of alternative liquids is permitted, the most suitable immediate stratagem appears to be the use of mineral oil.

The virtues of PCB impregnant and the disadvantages of mineral oil have been discussed in detail in a number of recent documents. Among these documents are the report of the Interdepartmental Task Force on PCB's (COM-72-10419), a paper titled, "The Role of Polychlorinated Biphenyls in Electrical Equipment" presented by General Electric on February 4, 1972, and NEMA's Official Standards Proposal CP-P1-1973/TR-P6-1973, dated January 25, 1973.

All of these documents have pointed out that PCB-impregnated capacitors are significantly smaller, more reliable and safer than mineral oil impregnated capacitors and that use of mineral oil would return

capacitor technology to its pre-1932 level. The substitution of mineral oil for PCB impregnants would necessitate redesign of end equipment to utilize the larger capacitors, large increases in capacitor manufacturing facilities (both plant and equipment) and would result in increased use of basic materials which are presently in short supply.

The following is an attempt to quantify some of the consequences related to the use of mineral oil as an alternative impregnant.

B. Capacitor Manufacturing Capacity

Mineral oil impregnated capacitor sizes relative to PCB capacitors are shown in Table 1.

Table 1 - Relative Size Comparisons

<u>Types*</u>	<u>AROCLO 1016</u>	<u>Mineral Oil</u>
Small Industrial	1.0	2-2.5
Power	1.0	2.5-3.2

*Small Industrial - Used in lighting, air conditioning, motors and electronics.

Power - Large capacitors used by electric utilities and by industry for induction furnaces and power factor correction.

The dielectric constant of a capacitor's dielectric system is the ratio of its ability to store electrostatic energy relative to air. The dielectric constant of PCB impregnant is 5.85 while that of mineral oil is 2.25. Use of the lower dielectric constant mineral oil in a paper dielectric system, assuming no change in the thickness of the paper dielectric, would result in a capacitor which is 60% larger than the PCB impregnated design. Additionally, however, use of mineral oil requires that the thickness of the paper dielectric be increased to reduce the operating stress on the system if equal life and reliability are to be attained. In the case of lower voltage industrial type capacitors, such as those used in fluorescent ballast and air conditioning applications, the dielectric thickness must be increased 10 to 25%. In power capacitors operating at higher voltages, the dielectric thickness must be increased 25 to 40%. The larger increase in the high voltage units is related to the fact that corona initiation and extinction voltages of mineral oil impregnated dielectric systems are lower than those of PCB impregnated systems.

The approximate doubling of physical size results in about half the throughput of capacitors in existing manufacturing equipment. The capacitor industry currently has little if any excess capacity to handle this, even if adequate capacitor materials supplies are assumed to be available.

CONSEQUENCE - THE CAPACITY AND OUTPUT OF THE CAPACITOR INDUSTRY WILL BE CUT APPROXIMATELY IN HALF.

C. Capacitor Materials Availability

The following Table 2 estimates the capacitor industry requirements for paper, foil, and impregnant based on the currently used AROCLOR 1016 and for mineral oil.

Table 2 - 1974 Capacitor Materials Requirements (lbs. in millions)

	<u>AROCLOR 1016</u>	<u>Mineral Oil</u>	<u>% Change</u>
Paper	26	52-65	100-150%
Al Foil	18	32-36	80-100%
Impregnant	26	35-42	35-60%

There is a worldwide shortage of capacitor grade paper and aluminum foil. The capacitor paper supply is expected to continue at its present level of availability. Mineral oil impregnation will require at least twice the amount of materials to produce the same capacitance as with PCB's. Using the most optimistic of the above numbers, the total capacitor industry's requirements of Kraft paper dielectric, all of it using imported pulp for its production, would increase by 2 to 2.5 times and its requirements for aluminum electrode foil would increase by 1.80 to 2 times.

Total industry requirements in 1974 for paper dielectric in PCB impregnated capacitors is estimated at 26 million pounds. Based on recent experience, this requirement is the limit that suppliers of this type of paper can produce with existing equipment. Adding facilities to more than double the present domestic output of paper is a task that could not be completed in less than 4 to 5 years and the total investment required by the paper manufacturers is estimated to exceed \$200 million. It is questionable that the paper industry would make this investment, facing the probability that future impregnant and design developments would negate its need.

Aluminum foil is also in short supply. Some investment in foil-rolling equipment is already under way at General Electric to alleviate the shortage, but an adequate continuing supply of reroll aluminum stock from which the thin gauges of aluminum electrode material are made cannot presently be assured.

The supply of dielectric-grade mineral oil required to replace PCB impregnants is also unassured. Doubling the size of capacitors would

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approximately double the volume of impregnant required. The sole manufacturer of dielectric-grade mineral oil has recently announced that its manufacture is being discontinued. The feasibility of supplying the capacitor industry on a timely basis with 35 million pounds annually, starting from a production rate of zero, is doubtful to say the least.

CONSEQUENCE - THE CAPACITOR INDUSTRY WOULD BE ABLE TO SUPPLY ONLY ABOUT 50% OF THE CURRENT CAPACITOR DEMAND BECAUSE OF MATERIAL SHORTAGES.

D. Costs

U.S. impregnated capacitor sales for 1974 are shown in Table 3.

Table 3 - Estimated 1974 Total Impregnated Capacitor Sales

	<u>\$ Millions</u>
Small Industrial	100
Power	55

About 90-95% of these are PCB impregnated capacitors. It is estimated that the cost of capacitors would increase by at least 100% in going to mineral oil. It is likely that there would be an added inflationary force with demand far exceeding supply.

CONSEQUENCE - COST OF CAPACITORS WOULD AT LEAST DOUBLE. AT CURRENT PCB CAPACITOR SALES LEVELS, THIS WOULD ADD ABOUT \$145 MILLION IN CAPACITOR COSTS TO EQUIPMENT MANUFACTURERS. TO THIS WOULD BE ADDED AT LEAST ANOTHER \$200 MILLION IN COSTS AT THE END-CONSUMER LEVEL.

E. Reliability and Warranty

The life expectancy of capacitors exceeds 10 years for lighting applications and more than 20 years in electric utility power transmission applications. Although capacitors are considered long-lived products, there is an ever present danger of short life and early failure. This can be caused by a number of factors such as poor process control, materials quality, mis-application, and new product introduction with inadequate knowledge and experience of reliability.

The General Electric Company warrants its capacitors for one year, and has extended this warranty where capacitor failures have been excessive and due to shortcomings in capacitor quality. The major reliability and warranty problems lie in the small industrial type capacitors

such as used for lighting, motors, and power supplies. The capacitor industry produces in the order of 100 million capacitors per year. The majority of these units sell in the price range of 50¢ to \$4. The service cost for replacing a failed capacitor is \$20 to \$25. The in-warranty failure rate of General Electric capacitors during the first year is well under 0.5%. We believe that this reliability is typical of the capacitor industry in general. This performance has been attained after many years of developing the PCB capacitor, and establishing expected norms for failure rates and service life.

The capacitor industry historically is very careful in introducing product and process changes because small changes in failure rate, which are extremely difficult to determine without years of service experience and statistics, could result in excessive complaint and replacement costs. For example, Table 4 shows the replacement cost if the failure rate during the warranty period increased by different levels.

Table 4 - Replacement Costs for Early Failures

<u>% of Annually Installed Capacitors Failing, over Existing Rate</u>		
<u>Increase in Percentage Points</u>	<u>Millions Replaced</u>	<u>Cost at \$25/Service Call</u>
1.0	1.0	\$25 million
2.0	2.0	\$50 "
3.0	3.0	\$75 "

In order to avoid the consequences of such warranty costs, the capacitor industry would design any new non-PCB products on the conservative side. However, there would still be a substantial risk associated with a mass changeover to a new impregnant, especially in the end-consumer product area, with essentially no experience on reliability and safety.

CONSEQUENCE - IF THE FAILURE RATE OF THE 100 MILLION CAPACITORS PRODUCED IN ONE YEAR WERE TO INCREASE BY 1 TO 3 PERCENTAGE POINTS, THE REPLACEMENT COSTS AT \$25 PER SERVICE CALL WOULD RUN FROM \$25 TO \$75 MILLION. THIS IS THE MAGNITUDE OF THE CAPACITOR INDUSTRY'S EXPOSURE IN GOING TO A NEW, UNTRIED IMPREGNANT ON A MASS BASIS.

IV. CONSEQUENCES OF A "BAN" TO CAPACITOR USERS

This section estimates the effect of a PCB ban on customers and users of capacitors.

CRITICAL COMPONENT AVAILABILITY

Capacitors are a critical and necessary component in end-user equipment, particularly in small industrial applications. Without the capacitor, the end product would not operate as designed. The capacitor shortage resulting from a "ban" on PCB capacitors would force a reduction by at least half from the normal production rate in the plants of capacitor users.

CONSEQUENCE - INCREASED LAYOFF AND UNEMPLOYMENT AS MANUFACTURERS ADJUST TO THE SHORTAGE.

ELECTRIC POWER SYSTEM SAVINGS

The magnitude of the energy levels under discussion can be assessed from the following:

- The U.S. capacitor industry produces the equivalent of 55 million kilovar per year.
- A kilovar is equivalent to at least 1 kilowatt of generating capacity (some estimates place this ratio of kilowatt/kilovar at up to 1.4).

About 20% of the capacitors are for replacement purposes, and the remaining 80% are for new service. Thus, 44 million kilovars are installed on new systems. Without these capacitors, the steam turbines and fuel requirements would be relatively unaffected, but generators would be larger to handle more current, and certain components of transmission and distribution systems (e.g., step-down transformers) would have to be larger to prevent burn-out. The additional generating capacity for 44 million kilovolt-amperes, priced incrementally, would amount to about \$300 million; the additional transmission and distribution equipment would amount to about \$700 million.

CONSEQUENCE - REDUCED AVAILABILITY OF CAPACITORS WOULD ADD FURTHER SUBSTANTIAL BURDEN TO THE ENERGY SUPPLY SITUATION.

POWER SYSTEM STABILITY

The preceding discussion indicates that electrical energy requirements could theoretically be met by using fewer capacitors and building oversize generation, transmission and distribution components (at a severe economic penalty). Such a system would be operating at low power factor -- or, in other words, the system would be carrying a large component of useless reactive volt-amperes in addition to the in-phase component that represents

energy delivery. Systems studies have shown (see Economics of Kilovar Supply by Campbell, Ros, and Tice, General Electric Company, June 20, 1972) that low power factor severely limits the capability of a power pool to import power from its neighbors during a loss-of-generation emergency.

CONSEQUENCE - CAPACITOR SHORTAGES WOULD MAKE LARGE
POWER SYSTEMS SUBJECT TO CASCADING OUTAGES, OR
"BLACK-OUTS."

SIZE AND REPLACEMENT

As pointed out earlier, the size and cost of mineral oil impregnated capacitors would be at least twice that of PCB capacitors. The lighting industry has designed their ballasts for the small size PCB capacitors. Approximately 20% of ballast capacitors are used in the replacement market. Many room air conditioners have no space for a larger capacitor if a replacement is required. The capacitor industry has continually moved to reduce the size of capacitors. Equipment manufacturers have taken advantage of these size reductions, and have no room for size increases. In certain cases, size limitations in the replacement market would force the scrapping of good light fixtures and air conditioners.

CONSEQUENCE - UNAVAILABILITY OF SMALL SIZE CAPACITORS
WOULD FORCE THE EARLY OBSOLESCENCE OF GOOD, FUNCTIONAL
EQUIPMENT.

General Electric Company
November 19, 1973

MONS 091944

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, ONE RIVER ROAD, SCHENECTADY, NEW YORK 12345
Phone (518) 374-2211

REAL ESTATE
AND CONSTRUCTION
OPERATION

November 21, 1973

Dr. C. Hugh Thompson, Chairman
Hazardous and Toxic Substance
Regulation Task Force
Office of Water Program Operations
Environmental Protection Agency
Washington, D.C. 20460

SUBJECT: COMMENTS ON TOXIC POLLUTANT EFFLUENT
STANDARDS (38 FR 21342, Sept. 7, 1973)

Dear Dr. Thompson:

In the above Federal Register announcement, the Environmental Protection Agency invited comments that might assist it in setting effluent standards for the pollutants on EPA's first list of toxic pollutants. On behalf of the General Electric Company, I am pleased to submit for your consideration the following comments that we believe are relevant to the establishment of effluent standards for polychlorinated biphenyls (PCBs). The General Electric Company is a major manufacturer of sealed capacitors and transformers that incorporate PCBs as insulating liquids.

COMMENTS

In promulgating its list of toxic pollutants, EPA stated that "Polychlorinated biphenyls are on the list because of their high order of toxicity to man and aquatic organisms, and because of their bio-accumulative potential. The data are adequate, and the point source discharges require prompt control." (underlinings added)

In an earlier section of this same promulgation (1, 3), which explains the criteria of toxicity, appears the statement that "substances which have an oral LD50 of 50 mg/kg of body weight or less ... are defined as highly toxic to mammals ...". This definition would seem to exclude PCBs, because the LD50's of all commercial preparations are many times greater, that of a typical material (Aroclor 1242) being 8650 mg/kg (1).

(1) PCBs and the Environment, Interdepartmental Task Force on PCBs, May 1972, p. 131.



SERVING
PROGRESS

MONS 091945

Dr. C. Hugh Thompson

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November 21, 1973

The low order of toxicity to man is supported by several decades of experience in the U.S. electrical industry.

In addition, the foregoing statements about PCBs quoted from the promulgation receive little support from EPA's subsequent publication in October of its "Proposed Criteria for Water Quality - Vol. I."⁽²⁾ These criteria "are defined as the acceptable limits of constituents in receiving waters based upon an evaluation of the latest scientific information by the Environmental Protection Agency" (p. 12) and "are based upon current knowledge of the effects on health and welfare of the presence of various pollutants in receiving waters" (p. 18). Criteria for PCBs are discussed under four categories of water use (pages 121, 180, 224, and 320) along with the rationale for the recommended limits. None of these discussions suggests biological effects that could be described as a "high order of toxicity to man and aquatic organisms"; most of the rationales represent far from "adequate" data; and none of them leads to the conclusion that "point source discharges require prompt control."

The only numerical value suggested is a maximum acceptable concentration of PCBs in fresh water of 0.002 μ g/l (0.002 ppb) (p. 121). The rationale given for this level is based upon an exceedingly tenuous chain of reasoning beginning with a PCB residue level that has been suggested (not demonstrated) as the threshold for salmon egg mortality and continuing through several other vaguely defined multiplicative factors. Further, this number has no operational significance because no analytical techniques are available for the reliable determination of so low a concentration of PCBs in water.

Section 304 (a) (1) of The Federal Water Pollution Control Act Amendments of 1972 requires that criteria for water quality should accurately reflect the latest scientific knowledge "on the kind and extent of all identifiable effects on health and welfare ... which may be expected from the presence of pollutants in any body of water ...". We submit that none of the water quality criteria proposed for PCBs, which presumably reflect the latest scientific knowledge, provides an adequate basis for establishing effluent standards for PCBs. Other bases than water quality should be used and are discussed later on in this letter. In our opinion, however, the recommendation that "the body burdens of PCB's in birds and mammals should not be increased over present levels in order to maintain acceptable levels" does represent a reasonable goal for any PCB control program (Ref. 2, p. 180).

The Proposed Criteria for Water Quality acknowledge (Ref. 2, pp 17-18) that other considerations are important in "establishing particular standards and control measures" for pollutants that "may be listed as toxic pollutants under subsection 307 (a)."

(2) Proposed Criteria for Water Quality, Vol. I, U.S. Environmental Protection Agency, October 1973.

Dr. C. Hugh Thompson

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"Some of the more important considerations are:

- (1) The nature of the environmental effect of the presence of pollutants in water (e.g., long or short term, temporary or permanent, localized or widespread, etc.).
- (2) The economic and social impact of the standards and control measures and the impact of the environmental damage to be alleviated.
- (3) The practicality and enforceability of the standards and control measures, including the availability of techniques and instrumentation for determining whether particular standards are being met."

Regarding the third consideration, we have already indicated that there is no practical method of enforcing a standard based upon the recommended maximum concentration of 0.002 ppb of PCBs for fresh water.

The following additional points, which we believe should be considered in establishing effluent standards for PCBs, are germane to the other two considerations.

(1) In 1971 the Monsanto Company (the sole U.S. producer of PCBs) began a program that has led to a total ban on sales of PCBs for all uses except the manufacture of sealed electrical equipment (capacitors and transformers). As a result there has been a large decrease in the number of point source discharges of PCBs. Since there are probably not more than 25 major users of PCBs throughout the country, current production-type discharges of PCBs are no longer as ubiquitous as when PCBs were a component of paints, inks, plastics, adhesives, textile coatings, hydraulic and heat transfer fluids, etc. Indeed, "production and sales figures for PCBs in 1971 were roughly half of those for 1970, when these volumes were at their peak ... (and) projections for 1972 indicate an even lower volume " (Ref. 1, pp. 5-10).

Thus, even apart from the introduction of improved control measures by present PCB-users, there has been a major decrease in the amount of PCBs to which the environment can possibly be exposed. Although current PCB discharges can and should be more carefully controlled, the situation is one whose magnitude is decreasing. There is, therefore, no need for emergency-type controls, which might be reflected in technically infeasible standards and compliance schedules.

Dr. C. Hugh Thompson

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(2) PCBs are not a unique chemical species. More than 100 isomers are possible, and major commercial products may contain as many as 18 distinct compounds. As pointed out by the Interdepartmental Task Force on PCBs:

"Full evaluation of actual or potential effects in the environment is hampered by the complex nature of the mixtures that compose PCBs, and by the inclusion of contaminants in these mixtures. As experimental studies have been conducted with the unaltered products, as sold, the results may not properly reflect the effects of the components as they exist in the environment." (Ref. 1, p. 19).

Furthermore, it was reported to the Interdepartmental Task Force

"... that all PCB products cannot be lumped together in terms of either their environmental impact or persistence." (3)

Other points made in this report to the Task Force are:

(1) As the degree of chlorination (of PCBs) decreases, the bacterial degradation rate increases. (Ref. 3, p. 4).

(2) The residue storage levels (in albino rats) decrease exponentially as the weight percent chlorine decreases. (Ref. 3, p. 6)

(3) PCB residues found in wild life are dominantly penta-, hexa-, hepta-, and octa- chloro biphenyls. (Ref. 3, Chart 4).

In recent years the Monsanto Company has developed a special product, Aroclor 1016, which is the only grade of Aroclor now used in capacitor manufacture. Although its gross chlorine content is almost the same as that of Aroclor 1242 (i.e. about 42% of Cl), Aroclor 1016 has been specially distilled to remove most of the higher boiling homologs, which are found in wild life residues. Indeed, more than 99% of Aroclor 1016 comprises homologs with 4 or less chlorine atoms per biphenyl (Ref. 3, Chart 1); and these homologs have not been found in wild life residues.

In light of the foregoing we recommend that the specific commercial preparation, Aroclor 1016, not be considered as a toxic pollutant. We are encouraged to see that in promulgating its list of toxic pollutants, EPA has recognized that not all compounds of cadmium and cyanide are toxic and has stated that distinctions will be made when the final

(3) Tucker, E.S., "Assessment of the Biological Persistence of Polychlorinated Biphenyls," from Presentation to the Interdepartmental Task Force on PCBs by Monsanto Company, May 15, 1972, p. 2.

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effluent standards are published. We recommend that similar distinctions be made in writing effluent standards for PCBs.

(3) The "economic and social impact" (consideration number 2) of a uniform effluent standard would be much more severe upon an existing plant than upon a new plant. Most of the existing plants that manufacture sealed electrical equipment containing PCBs were in operation for many years before there was any recognition of the possible environmental hazards of PCBs, and during these years no special precautions were taken concerning the handling and disposal of these liquids. Thus, accumulations of PCBs over the years in and around the drainage systems of these plants could result in continued discharge of PCBs even if the plants were to eliminate PCBs from their current operations. Elimination of such reservoirs of PCBs might well require a major and prohibitively expensive renovation of plant and site. However, with the institution of internal control measures such as described in proposed American National Standard Guidelines ⁽⁴⁾, older plants are preventing further build-up of such reservoirs.

WHAT EFFLUENT STANDARDS ARE FEASIBLE FOR THE ELECTRICAL MANUFACTURING INDUSTRY?

We have already noted that the Monsanto Company now sells PCBs only to manufacturers of sealed electrical equipment, such as capacitors and transformers. The soundness of this decision is supported by the findings of the Interdepartmental Task Force on PCBs (Ref. 1, p. 4) and the regulations promulgated by the Food and Drug Administration (38 FR 18096, July 6, 1973). These documents recognize the unique combination of fire safety and design efficiency that the use of PCBs imparts to capacitors and transformers and the minimal risk of environmental contamination associated with such use.

We believe that the special conditions pertaining to the past and present use of PCBs in the electrical industry warrant recognition in the setting of effluent discharge standards. These should not necessarily be identical to those deemed appropriate for the chemical industry.

The manufacture of transformers and capacitors involves a multiplicity of operations including vacuum impregnation, heat treatment, filling, sealing, washing operations and the like. Provision must be made for the handling of large apparatus containing up to 1500 gallons/unit (in the case of transformers) and for the filling and sealing of millions of small units per year (in the case of capacitors).

Control of PCB discharges in such electrical manufacturing plants requires a combination of process design and good housekeeping. For example, waste lines and operating procedures may be designed to eliminate contact between PCBs and water not directly used in the PCB operations themselves (e.g. cooling water). No effective end-of-line treatment has been demonstrated on a plant scale.

(4) Official Standards Proposal. Proposed American National Standard Guidelines for Handling and Disposal of Capacitor- and Transformer-Grade Askarels Containing Polychlorinated Biphenyls, C107.1- (), National Electrical Manufacturers Association Pub. No. CP-P1-1973 and Pub. No. TR-PG-1973, January 25, 1973.

Segregation of operations and waste lines is feasible in the design and construction of a new plant but would be prohibitively expensive for an old plant. If such controls are incorporated into a new transformer or capacitor plant on a new site, it should be possible to limit the discharge of PCBs to less than 5 pounds per day depending upon the volume and complexity of the production processes. The attainable discharge from an existing plant that had already been in production before the mid-60's may be as much as 15 pounds higher as the background level, depending on the size of the plant, its age, and the nature of its earlier operations, all of which would have affected the location and extent of its reservoirs of PCBs. Such a plant could install the control measures mentioned above and still be unable to reach the discharge levels for a new plant at a new site.

We believe that the foregoing numbers can provide the basis for realistic effluent standards because they reflect the actual technology of the capacitor and transformer industry. As we have mentioned earlier, the recommended water quality standards provide no practical basis for effluent standards.

SUMMARY

In the foregoing comments we have raised the following points:

- 1) Available data do not support categorizing PCBs as a "highly toxic" material, nor setting standards on the basis of this arbitrarily assigned hazard rating.
- 2) The maximum recommended concentration of 0.002 ppb of PCBs in fresh water is an operationally meaningless number that is unsupported by convincing ecological data. Any effluent standards based upon such a water quality standard could not be attained in existing plants and could lead to shut-down of capacitor and transformer operations.
- 3) Actions already taken by Monsanto and PCB users in the electrical industry have substantially reduced the exposure of the environment to PCBs and should result in a decreasing impact of PCBs in the environment.
- 4) Existing data suggest that Aroclor 1016 should not be considered a toxic pollutant.
- 5) Older plant sites will continue to have significant background levels of PCBs in their discharges because of accumulated reservoirs from years of operation before anyone recognized the possible environmental hazards of PCBs. These background levels should be considered apart from those levels contributed by current operating procedures.

GENERAL ELECTRIC

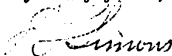
Dr. C. Hugh Thompson

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We appreciate the opportunity to submit these comments and hope that they will be of assistance to EPA in setting effluent standards for PCBs.

Very truly yours,



Dr. E. L. Simons, Manager
Environmental Protection Operation

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