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POLYCHLORINATED BIPHENYLS (PCB)

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HEARINGS

BEFORE THE

SUBCOMMITTEE ON FISHERIES AND WILDLIFE CONSERVATION AND THE ENVIRONMENT

OF THE

COMMITTEE ON MERCHANT MARINE AND FISHERIES HOUSE OF REPRESENTATIVES

NINETY-FOURTH CONGRESS

SECOND SESSION

ON

OVERSIGHT TO EXAMINE THE IMPACT OF POLYCHLORINATED BIPHENYLS AND SIMILAR TOXIC SUBSTANCES ON FISHERIES AND WILDLIFE RESOURCES

JANUARY 28, 29, 30, 1976

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POLYCHLORINATED BIPHENYLS (PCB)

WEDNESDAY, JANUARY 28, 1976

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON FISHERIES AND WILDLIFE
CONSERVATION AND THE ENVIRONMENT OF THE
COMMITTEE ON MERCHANT MARINE AND FISHERIES,
Washington, D.C.

The subcommittee met at 2:04 p.m., in room 1334, Longworth Building, Hon. Robert L. Leggett, chairman, presiding.

Mr. LEGGETT. The meeting of the Subcommittee on Fisheries and Wildlife Conservation and the Environment will please come to order.

Today the Subcommittee on Fisheries and Wildlife is holding hearings, the first of several days of hearings on a very important subject matter which may seriously affect the health and welfare of our ecosystem. Although this subject has gained considerable recognition over the past several months by the press media and some Federal officials, and some Congressmen, the problem is necessarily and certainly not new, as I am sure we will learn today.

Nevertheless, there remains many unanswered questions as to whether this problem of PCB'c or similar toxic substances can be ameliorated or avoided in the future.

Therefore, the purpose for these hearings over the next several days will be to examine the PCB problem as a case in point to understand its significance, to document its impact, and to assess whether additional legislative authority is required in order to anticipate, prevent, or cure similar problems.

Accordingly, the format for our hearings has been developed such that today we will receive testimony from the administration and industry representatives concerning an overall description of the PCB problem and the action which has been taken to minimize its adverse impacts.

Tomorrow afternoon, scheduled witnesses will provide to the subcommittee documentation of the adverse impacts on our wildlife resources attributed to PCB's; then, Friday morning, the subcommittee will consider the testimony of witnesses regarding the options available to the Congress to assume that we have the capability to deal with these problems before they grow to crisis proportions—if they are not at that point already.

Counsel, let me ask you this, do we have any bills currently assigned to the committee on this subject matter?

Mr. SPENSLEY. No.

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Mr. LEGGETT. The answer to that is negative, so we are generally reviewing the subject matter to determine whether or not in fact there is a problem that regulations in effect or existing executive authority cannot respond to. And if we find that there is a definable problem, we will then resort to Legislative Counsel's Office and the other experts around and attempt to draft legislation to respond to the problem.

Our first witness is the very distinguished Assistant Secretary of the Interior for Fish and Wildlife and Parks, Hon. Nathaniel Reed.

Nat, we are pleased to have you before the committee. You are the first witness.

STATEMENT OF HON. NATHANIEL REED, ASSISTANT SECRETARY OF THE INTERIOR FOR FISH AND WILDLIFE AND PARKS; ACCOMPANIED BY CHARLES R. WALKER, SENIOR ENVIRONMENTAL SCIENTIST

Mr. REED. Thank you, Mr. Chairman.

Mr. LEGGETT. Your statement will be accepted and incorporated in the record at this point as though you read it in full and you can read it in full or highlight it as you may choose.

[Prepared statement follows:]

STATEMENT OF NATHANIEL P. REED, ASSISTANT SECRETARY FOR FISH AND WILDLIFE AND PARKS, U.S. DEPARTMENT OF THE INTERIOR

Mr. Chairman, I am Nathaniel P. Reed, Assistant Secretary for Fish and Wildlife and Parks. I appreciate this opportunity to appear here today to discuss with you a national problem that the U.S. Fish and Wildlife Service has identified in both research and samples in the National Pesticide Monitoring Program—polychlorinated biphenyls—PCB's.

PCB residues have been found in fish samples from all major river systems throughout the United States, and in most of the bird samples taken since 1970. PCB's are literally everywhere. Exceedingly high levels occur in fish from many drainage systems including the Hudson River, the Great Lakes system, the Merrimac and Connecticut Rivers of New England, the Mississippi, Missouri and the Ohio Rivers of middle America, the Columbia River system in the Northwest, the Sacramento River in California, the Rio Grande and other Gulf Coast streams, and even the Yukon in Alaska.

Fish are not alone in accumulating sizeable quantities of PCB's. The birds we are monitoring are equally capable of amassing PCB's. Waterfowl carry the highest residues in the Atlantic Flyway, followed in descending order by the Mississippi, Pacific and Central Flyways. Further, all starlings collected since 1970 contain PCB residues.

The ubiquity of PCB's in our environment looms as a dark cloud casting an ominous shadow upon all of our living natural resources which depend on a clean and healthy environment. With more than one-third of the United States population living near the Great Lakes alone, and a majority of the population residing about other major waterways, we must be cognizant of the potential impact of the tons upon tons of PCB-infested materials which are daily deposited into these waters. Transformer fluids, plastic bottles, hydraulic fluids, carbonless paper, ink and other PCB-loaded wastes all find their way into our waters, where the percentages of PCB's amalgamate malignantly. Scientists have repeatedly demonstrated in laboratory and pen studies that PCB's affect the growth, reproduction and health of many kinds of animal life . . . from the lowly invertebrates and fish to birds and mammals such as mink and monkeys, and now man.

In particular, PCB's pose an immediate threat to our efforts to preserve and protect threatened and endangered species. Under present conditions,

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PCB's may very well be the deciding factor in the survival of some species in spite of our best efforts for preservation.

We cannot wish this problem away. Consider the Atlantic salmon, a species we are striving to reestablish into our New England rivers. Atlantic salmon egg mortality has been associated with a threshold concentration of about 0.5 ppm of PCB. Our scientists state that this threshold concentration in the eggs would be equivalent to residual PCB levels in whole fish of 2.5 to 5.0 ppm, comparable to the levels found in many species throughout the United States. Recent tests show that 75 percent of rainbow trout eggs containing as little as 2.7 ppm of PCB's and 90 ppb of DDT complex did not hatch and the majority of those that did hatch were deformed. Another test demonstrated that fish may accumulate more than 40,000 times the concentration of PCB in the water. I think the fish are trying to tell us something. They are stating unequivocally that our lakes, rivers and streams are sick.

In my capacity as the steward of fish and wildlife for the Department of the Interior and as a Commissioner on the Great Lakes Fishery Commission, I have an overwhelming concern for the protection and management of the Nation's water resources. With regard to the Great Lakes, during this century, the fisheries have suffered from heavy fishing, predation by the parasitic sea lamprey, the influx of alewives, and a diminished quality of habitat as a result of uncontrolled shoreline development and waste disposal including the discharge of PCB's. In recent years Canada, the United States, the Provinces and the States have taken significant steps at great financial cost to restore the Great Lakes fisheries to their former productivity. As a first step, we undertook the control of the sea lamprey. Our cooperative efforts achieved success in all the Great Lakes except Lake Ontario, where intensive control programs are now underway. After 17 years, and $33 million, the sea lamprey, with sustained control efforts, no longer represents a major threat in the upper Great Lakes. The reduction of the lamprey problem has permitted a successful State and Federal stocking program involving more than 150 million lake trout, splake, and coho, chinook, Atlantic, and kokanee salmon. In addition, millions of rainbow, brook and brown trout have also been stocked.

These salmonids feed heavily on the plentiful alewife and grow rapidly to trophy size. The resulting sport fishing contributes approximatley $350 million annually to the economy of the Great Lakes States and the Province of Ontario.

All our efforts are for naught if these fish cannot be consumed, and we now face this stark possibility. A significant portion of these fish contain PCB residues in excess of the 5.0 ppm permissible level established by the Food and Drug Administration. As a result, warnings have been issued about the consumption of trout, salmon and other species such as carp, chubs, smelt and alewife from Lake Michigan. To varying degrees a similar PCB problem exists in Lakes Superior, Huron, and Ontario. Carp from Lake Michigan have already been declared unmarketable because of PCB's, and chubs appear to be at or just below the 5.0 ppm permissible level.

If FDA lowers the current permissible level, virtually all species would be unmarketable and the Great Lakes commercial fishery would be dead. The current permissible level has already ended any serious consideration of commercially utilizing the salmonid populations in the near future. PCB's present a major problem in the future maintenance and growth of commercial fisheries. These fisheries today have a dockside value of about $19 million annually and a total economic contribution to the United States and Canada of possibly $95 million annually when processing, shipping and retailing are included.

We must now consider the expenditure of millions of dollars for controlling sea lamprey and stocking salmonids in the Great Lakes in light of continued contamination of the fish stocks with unacceptable levels of PCB's. There are important reasons in favor of continuing a stocking program. These include aspects of biology, economics, and ecology. The lake trout restoration program exemplifies these considerations. More than 17 years were required to restore lake trout to its present level in Lakes Superior and Michigan. If we stop our current programs, it is almost certain that the sea lamprey would reestablish itself and the salmonid populations would collapse, thus wiping out our investments of many years and millions of dollars and a Great Lakes fishery worth several hundred million dollars. Although we know

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considerably more now than we did 17 years ago about lamprey control and salmonid stocking programs, it would still require at least 10 years to again control the lamprey and rebuild the lake trout population.

I have been using the Great Lakes as an example. The Great Lakes are a virtual "sink" for PCB's. It takes more than 50 years for water to turn over in Lake Michigan; there is no fast flushing action by mighty rivers or ocean tides. However, many other areas of the country have been just as greatly affected any many other species, not just fish, have hazardous levels of PCB residues. We know that the reproductive success of bald eagles has been greatly reduced in Maine and along the shores of Lake Michigan where high residues of DDE, dieldrin and PCB's are found in eagle eggs. Alarming levels of PCB's have been found in some eggs of inland feeding birds including double-crested cormorants, Caspian terns and Fosters terns. Sixty-six percent of eggs analyzed in a recent study conducted on osprey in the Gulf of California contained PCB's. Among the most profound demonstrations of the adverse effects of PCB were the inhibitions of mink reproduction that were caused by feeding coho salmon containing PCB residues.

As soon as PCB's enter the food chain, the poison is off and running. The fingernail clam has demonstrated an inordinate capacity to concentrate PCB. This is another environmental stress to one of America's favorite waterfowl, the canvasback, which feeds voraciously on the clam. Investigative monitoring for PCB's indicate that the highest residues occur in industrial and urban areas. The clam was once common in the Detroit River, the Illinois River and Lake St. Clair—habitats that used to attract major flights of canvasbacks. The canvasback represents a valuable waterfowl resource struggling against many odds as a declining species, and I foresee little success for such a population which utilizes areas heavily contaminated with PCB's.

Past attempts to control the point-source of PCB's into the environment have failed to bring about any measurable reduction in the contamination of the Nation's lakes and rivers. For example, DDT levels in Lake Michigan fishes and mercury levels in Lake St. Clair fishes have declined from between 50 and 87 percent in the past four to five years as a result of controls on their use. Why have not PCB levels responded similarly? Do they behave so differently from DDT and mercury in the environment that we cannot reasonably expect to have observed some decline by this time? We will never know unless the flow of PCB's to the environment is stopped. It was commonly thought that decades might elapse before DDT and mercury would decline to satisfactory levels in natural waters. It appears highly probable that the primary cause for the failure of PCB's to decline is that their sources have not been curtailed to any significant degree.

To sum up, the insidious character of PCB's is now obvious and presents a very serious problem to all of us. This pollutant affects the very core of State and Federal resource management programs throughout the United States. We urgently need an effective program of control capable of rapidly eliminating the release of PCB's into our environment. Because of my deep concern with the problem, I support a national ban on all domestic and imported PCB's. We must have as our goal the elimination of PCB's from the environment of the United States as rapidly as possible. I recommend that the critical or essential use of PCB's in transformers and capacitors be immediately and critically reviewed in light of current potential replacement products.

The Fish and Wildlife Service's pesticide monitoring program acts as a bellwether for measuring the future environmental impacts of toxic substances upon mankind. The domestic water supplies for many millions of people are drawn from the Great Lakes and other waterways—the same lakes and waterways whose fish populations are so contaminated with PCB's and other chemical toxicants that they are unfit for human consumption even under the present outdated FDA regulations. Mr. Chairman, the health of our fish and wildlife acts as a pulse indicator for human health. All environmental gauges indicate this pulse to be unsteady and irregular. Mr. Chairman, we do not want a repetition of the Japanese "Yusho" intoxication in the United States. In 1968 over 1,000 Japanese experienced PCB poisoning after consuming rice oil contaminated with Kanechlor 400. In addition to causing headaches, swelling of the eyelids, temporary loss of vision and many other symptoms, PCB's affect the fetus of pregnant women. Nine out of ten live-born babies had usually grayish, darkened skin, and most were born

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underweight. Much of the same pathology has been reported over the years for fish and wildlife—that tragedy truly was the "miner's canary" for PCB's and many other environmental contaminants. The irony is that our research and monitoring efforts are often ignored. It pains me to remind you that the ban on DDT was not imposed until long after its threat to wildlife was proved, and action was taken only when studies showed the potential hazard to human health. Do we need a body count before we act?

Thank you, Mr. Chairman. I will be pleased to answer any questions you have.

Mr. REED. Thank you, Mr. Chairman and members of the committee.

Mr. LEGGETT. Just a minute—I yield to Mr. Oberstar.

Mr. OBERSTAR. Just a brief comment, Mr. Chairman, to thank the Chair and staff for the work done in initiating these hearings which I think will give significant importance in this very important critical and complex subject area, PCB's, one of the vexing impacts of man on environment, interrupting and involving the food chain all the way through, and one that has not had sufficient attention from committees of Congress. Our committee is taking the lead in this area, and I want to commend you, Mr. Chairman, for your leadership. It is also a matter of great importance to those of us in the Great Lakes area where PCB's have been discovered in waters of Lake Michigan, and some traces have been found in waters of Lake Superior. Just from the standpoint of easing fears and concern, a committee of Congress is looking into this matter and developing solid, scientific, reliable evidence, will be a great service to the public.

Mr. LEGGETT. Very good. Thank you very much.

I hope that we can maintain the interest of all the members of the subcommittee during these important hearings, so that we can reach some kind of agreement with respect to future course of action, particularly in light of the fact that we have no legislation before us. It is going to take our assimilative efforts to come up with something.

I might point up this, that we are holding these hearings also at the instance of Environmental Study Conference, chaired by our distinguished colleague, Dick Ottinger, who has likewise called our attention to some important subject matter.

Mr. Reed, you can proceed.

Mr. Forsythe, nice to have you here.

Very good. We are proceeding together today.

All right, Mr. Reed, please proceed.

Mr. REED. Mr. Chairman, I appreciate this opportunity to appear here today to discuss with you a national problem that the United States Fish and Wildlife Service has identified in both research and samples in the National Pesticide Monitoring program polychlorinated biphenyls—PCB's.

PCB residues have been found in fish samples from all major river systems throughout the United States, and in most of the bird samples taken since 1970. PCB's are literally everywhere. Exceedingly high levels occur in fish from many drainage systems including the Hudson River, the Great Lakes system, the Merrimac and Connecticut rivers of New England, the Mississippi, Missouri, and the Ohio rivers of middle America, the Columbia River system in the Northwest, the Sacramento River in California, the Rio Grande and other Gulf Coast streams, and even the Yukon in Alaska.

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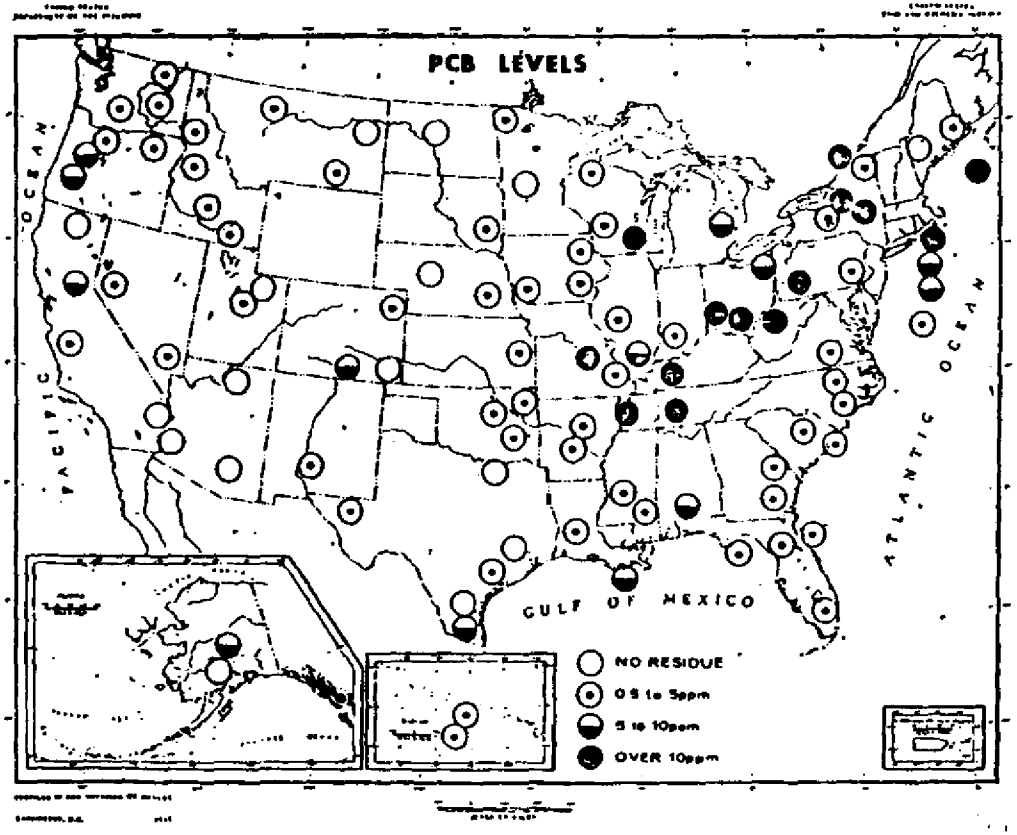
PCB LEVELS
PACIFIC OCEAN
ATLANTIC OCEAN
GULF OF MEXICO
NO RESIDUE
0.5 to 5ppm
5 to 10ppm
OVER 10ppm

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Mr. REED. Fish are not alone in accumulating sizable quantities of PCB's. The birds we are monitoring are also amassing PCB's. Waterfowl carry the highest residues in the Atlantic Flyway, followed in descending order by the Mississippi, Pacific, and Central Flyways. Further, all starlings collected since 1970 contain PCB residues.

The ubiquity of PCB's in our environment looms as a dark cloud casting an ominous shadow upon all of our living natural resources which depend on a clean and healthy environment. With more than one-third of the United States population living near the Great Lakes alone—and a majority of the population residing about other major waterways—we must be cognizant of the potential impact of the tons upon tons of PCB-infested materials which are daily deposited into these waters from industrial and domestic sewage, effluents, landfills, waste incineration, runoff from materials deposited in the soil and from general atmospheric fallout, as was documented by Hessee (55)* and Kleinert (58)* at the November PCB conference in Chicago.

Mr. LEGGETT. Mr. de la Garza wants to interrupt.

Mr. DE LA GARZA. Forgive me, please, you have added something that is not in this. Do you have an amended statement rather than the one we have?

Mr. REED. No, Mr. de la Garza, I have occasionally added for accuracy a word or two and I will note them if you would like.

The only one so far is the November conference; I felt it needed the addition of "November" to explain when we held this conference.

Mr. DE LA GARZA. You added about a study there. I am sorry to interrupt you, but——

Mr. REED. Hesse and Kleinert?

Mr. DE LA GARZA. Yes.

Mr. REED. My statement may have been amended since this morning when I made some corrections.

Mr. LEGGETT. Hesse and Kleinert's statement?

Mr. REED. Hesse and Kleinert are two researchers who documented major studies on the environmental sources of PCB's. They was presented at the November conference on PCB'c held in Chicago.

Mr. LEGGETT. Very good.

Mr. REED. Transformer fluids, plastic bottles, hydraulic fluids, carbonless paper, ink and other PCB-loaded wastes residual to the 1972 voluntary ban and the unknown quantities presently being imported into this country all find their way into our waters, where the percentages of PCB's amalgamate malignantly. Scientists have repeatedly demonstrated in laboratory and penned animal studies that PCB'c affect the growth, reproduction and health of many kinds of animal life—from the lowly invertebrates and fish to birds and mammals such as mink and monkeys, and now man.

In particular, PCB's pose an immediate threat to our efforts to preserve and protect threatened and endangered species. Under

*Reference numbers refer to material a list of which may be found on p. 13.

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present conditions, PCB's may very well be the deciding factor in the survival of some species in spite of our best efforts for preservation. Although we have been unable to document the direct contributary effect of PCB contamination, significant amounts of PCB's have been found in the brain tissues of dead peregrine falcons and bald eagles.

We cannot wish this problem away. Consider the Atlantic salmon, a species we are striving to reestablish into our New England rivers. Atlantic salmon egg mortality has been associated with a threshold concentration of about 0.5 parts per million of PCB. Our scientists state that this threshold concentration in the eggs would be equivalent to residual PCB levels in whole fish of 2.5 to 5 parts per million, comparable to the levels found in many species throughout the United States. A direct correlation has been found by Jansen (56), in Sweden, for equating significant PCB residues with mortality in Atlantic salmon.

Recent tests show that 75 percent of rainbow trout eggs containing as little as 2.7 parts per million of PCB's and 0.09 parts per million of DDT complex did not hatch, and the majority of those that did hatch were deformed.

Another test demonstrated that fish may accumulate more than 40,000 times the concentration of PCB in the water. The present Lake Michigan water concentrations of PCB's are generally below 10 parts per trillion—0.00001 parts per million— and the range of PCB residues in smelt and lake trout is from 2.5 parts per million to 165 parts per million, respectively, yielding a range of biomagnification of 30,000 times for the smelt and 150,000 times for the lake trout.

I think the fish are trying to tell us something. They are stating unequivocally that our lakes, rivers, and streams are sick.

In my capacity as the steward of fish and wildlife for the Department of the Interior and as a Commissioner on the Great Lakes Fishery Commission, I have an overwhelming concern for the protection and management of the Nation's water resources. With regard to the Great Lakes, during this century, the fisheries have suffered from heavy fishing, predation by the parasitic sea lamprey, the influx of alewives, and a diminished quality of habitat as a result of uncontrolled shoreline development and waste disposal—including the discharge of PCB's.

In recent years Canada, the United States, the Provinces, and the States have taken significant steps at great financial cost to restore the Great Lakes fisheries to their former productivity. As a first step, we undertook the control of the sea lamprey. Our cooperative efforts achieved success in all the Great Lakes except Lake Ontario, where intensive control programs are now underway.

After 17 years and $33 million, the sea lamprey, with sustained control efforts, no longer represents a major threat in the upper Great Lakes. The reduction of the lamprey problem has permitted a successful State and Federal stocking program involving more than 150 million lake trout, splake, and coho, chinook, Atlantic, and

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Kokanee salmon. In addition, millions of rainbow, brook, and brown trout have also been stocked.

These salmonids feed heavily on the plentiful alewife and grow rapidly to trophy size. The resulting Sport fishing contributes approximately $350 million annually to the economy of the Great Lakes States and the Province of Ontario.

All our efforts are for naught if these fish cannot be consumed, and we now face this stark possibility.

A significant portion of these fish contain PCB residues in excess of the 5 parts per million permissible level established by the Food and Drug Administration. As a result, warnings have been issued about the consumption of trout, salmon, and other species such as carp, chub, smelt, and alewife from Lake Michigan.

To varying degrees a similar PCB problem exists in Lakes Superior, Huron, and Ontario. Carp from Lake Michigan have already been declared unmarketable because of PCB's, and chubs appear to be at or just below the 5 parts per million permissible level.

Canada recently reduced its administration action level, or the permissible level, for PCB's to 2 parts per million for marketable fish. Should FDA lower the PCB residue tolerance to 2 parts per million, a significant proportion of our commercial fisheries will be forced out of business.

Even with FDA's present permissible level, some species are unmarketable and certain Great Lakes fishermen are being subject to economic hardship.

The current permissible level has already ended any serious consideration of commercially utilizing the salmonid populations in the near future. PCB's present a major problem in the future maintenance and growth of commercial fishing. These fisheries today have a dockside value of about $19 million annually and a total economic contribution to the United States and Canada of possibly $95 million annually when processing, shipping, and retailing are included.

We now must consider the expenditure of millions of dollars for controlling sea lamprey and stocking salmonids in the Great Lakes in light of continued contamination of the fish stocks with unacceptable levels of PCB's.

The current 1976 Fish and Wildlife Service budget contains $1.8 million for sea lamprey control and almost $3 million for the Great Lakes fishery program which annually produces some 11 million fish for stocking.

Mr. LEGGETT. How much do you have for control of PCB's?

Mr. REED. We have no appropriation for the control of PCB's, Mr. Chairman.

Mr. LEGGETT. How much did you ask for control of PCB's.

Mr. REED. Well, that would not be in our budget figures; as a protector of fish and wildlife, you would find correlation in our budget requests for the pesticide monitoring programs and for our pesticide and research labs. You could get some correlation there, but that is about it.

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Mr. RUPPE. Mr. Chairman, will you yield?

Is the lamprey control in your budget?

Mr. REED. No.

Mr. RUPPE. State Department's?

Mr. REED. It is in the State Department budget, but I testified on that, Mr. Ruppe, both in my capacity as Assistant Secretary and as Commissioner. I have been appointed by the President to the Great Lakes Fishery Commission. The total amount has been running about $1.8 million.

There are important reasons in favor of continuing a stocking program. These include aspects of biology, economics, and ecology. The lake trout restormation program exemplifies these considerations.

More than 17 years were required to restore the lake trout to its present level in Lakes Superior and Michigan. If we stop our current programs, it is almost certain that the sea lamprey would reestablish itself and the salmonid populations would collapse, thus wiping out our investments of many years and millions of dollars and a Great Lakes fishery worth several hundred million dollars.

Although we know considerably more now than we did 17 years ago about lamprey control and salmonid stocking programs, it would still require at least 10 years to again control the lamprey and rebuild the lake trout population.

I have been using the Great Lakes as an example. The Great Lakes are a virtual "sink" for PCB's. It takes more than 50 years for water to turn over in Lake Michigan; there is no fast flushing action by mighty rivers or ocean tides. However, many other areas of the country have been just as greatly affected and many other species, not just fish, have hazardous levels of PCB residues.

[The following was submitted:]

DATA ON THE GREAT LAKES SYSTEM[1]

	Lake Superior	Lake Michigan	Lake Erie	Lake Ontario
Length (kilometers)	560	490	385	309
Breadth (kilometers)	256	188	91	85
Area (square kilometers):				
Water surface	82,367	58,016	25,665	19,684
Drainage basin, land	124,838	117,845	58,793	70,418
Total	207,205	176,861	84,459	90,132
Maximum depth (meters)	406	281	60	244
Average depth (meters)	148	84	17	86
Volume of water (cubic kilometers)	12,221	4,871	458	1,636
Average annual precipitation (millimeters)	735	787	953	863
Mean outflow (liters per second)	2,057,360	5,012,640	5,550,720	6,626,880
Average retention time of water (years)	191	30.8	2.6	7.8
Population [illegible], maximum (years)[2]	450	70	5	20

[1] Adapted from Quinn, F.H. Schwarz and Fish, J.H. (1975).

[2] Time required for the lake to replace by precipitation level by 95 percent through natural flow when the addition of pollutants is discontinued. The time required for the flow of water through the lake to equal 2.3 times the volume of the lake.

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ake Erie	Lake Ontario
385	309
91	81
666	19,684
793	70,449
459	90,132
60	244
17	86
458	1,636
853	863
0,720	5,626,880
2.6	7.8
5	20

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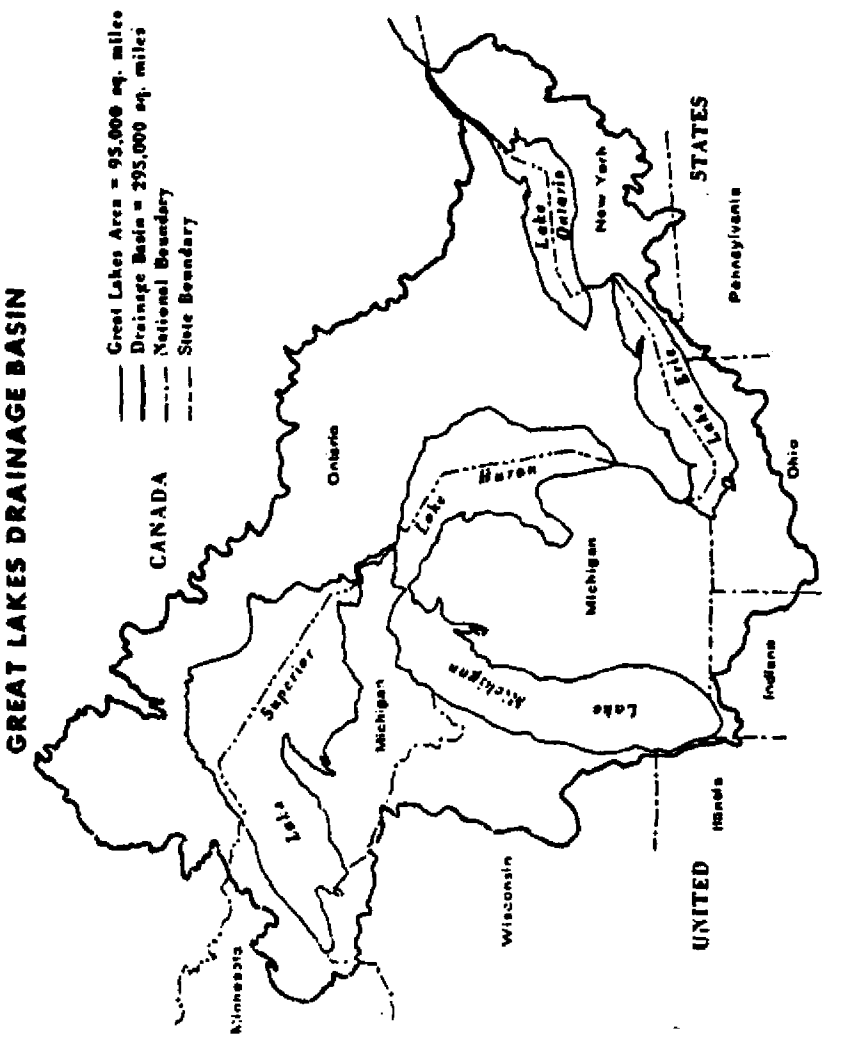

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Mr. REED. We know that the reproductive success of bald eagles have been greatly reduced in Maine and along the shores of Lake Michigan where high residues of DDT, dieldrin, and PCB's are found in eagle eggs. Alarming levels of PCB's have been found in some eggs of inland feeding birds including double-crested cormorants, Caspian terns and Fosters terns.

Recent analyses by Weimeyer and his associates (50) of the Fish and Wildlife Service, for residues in bald eagles from Maine shows that the levels of PCB's in brain and other tissues are increasing. Among the most profound demonstrations of the adverse effects of PCB were the inhibitions of mink reproductions that were caused by feeding the mink coho salmon containing PCB residues.

As soon as the PCB's enter the food chain, the poison is off and running. The fingernail clam has demonstrated an inordinate capacity to concentrate PCB. This is another environmental stress to one of America's favorite waterfowl, the canvasback, which feeds voraciously on the clam. Investigative monitoring for PCB's indicate that the highest residues occur in industrial and urban areas. The clam was once common in the Detroit River, the Illinois River and Lake St. Clair—habitats that used to attract major flights of canvasbacks.

The canvasback, once the most popular duck in America, represents a valuable waterfowl resource struggling against many odds as a declining species. Canvasback habitat is critically limited and I foresee little success for restoring this species to its former abundance in those many areas which are now subject to PCB contamination.

Past attempts to control the point-source of PCB's into the environment have failed to bring about any measurable reduction in the contamination of the Nation's lakes and rivers. For example, DDT levels in Lake Michigan fishes and mercury levels in Lake St. Clair fishes have declined from between 50 and 87 percent in the past 4 to 5 years as a result of controls on DDT's use.

Why have not PCB levels responded similiarly? Do they behave so differently from DDT and mercury in the environment that we cannot reasonably expect to have observed some decline by this time? We will never know unless the flow of PCB's to the environment is stopped.

It was commonly thought that decades might elapse before DDT and mercury would decline to satisfactory levels in natural waters. It appears highly probable that the primary cause for the failure of PCB's to decline is that their sources have not been curtailed to any significant degree.

To sum up, the insidious character of PCB's is now obvious and presents a very serious problem to all of us. This pollutant effects the very core of State and Federal resource management programs throughout the United States. We urgently need an effective program of control which will rapidly halt the release of PCB's into our environment

Because of my deep concern with the problem, I have reached the conclusion that no matter how painful the decision may be, I sup-

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port a national ban on all domestic and imported PCB's. We must have as our goal the elimination of PCB's from the environment of the United States as rapidly as possible.

I recommend that the critical or essential use of PCB's in transformers and capacitors be immediately and critically reviewed in light of current potential replacement products. I recommend to the Congress, the enactment of an effective Toxic Substances Act which contains stringent provisions for control of PCB pollution, and PCB importation, and for the critical premarket testing of substitutes.

The Fish and Wildlife Service's pesticide monitoring program acts as a bellwether for measuring the future environmental impacts of toxic substances upon mankind.

The domestic water supplies for many millions of people are drawn from the Great Lakes and other waterways—the same lakes and waterways whose fish populations are so contaminated with PCB's and other chemical toxicants that they are unfit for human consumption even under the present outdated FDA regulations.

Mr. Chairman, the health of our fish and wildlife acts as a pulse indicator for human health. All environmental gages indicate this pulse to be irregular and unsteady.

Mr. Chairman, we do not want a repetition of the Japanese "Yusho" intoxication in the United States. In 1968, over 1,000 Japanese experienced PCB poisoning after consuming rice oil contaminated wth Kanechlor 400 (60, 61, 62). Nine of 10 babies born to mothers who had consumed the rice oil had unusually grayish, darkened skin and most were born underweight.

Although we have not had an incident of direct ingestation of PCB food poisoning in the United States, J. R. Allen's unpublished studies show similar "Yusho" effects in monkeys that were fed levels of PCB's comparable to those found in our contaminated fish. The irony is that our research and monitoring efforts are often ignored.

It pains me to remind you that the ban on DDT was not imposed until long after its threat to wildlife was proved, and action was taken only when studies showed the potential hazard to human health.

Do we need a body count before we act?

Thank you, Mr. Chairman and members of the committee.

I will be pleased to answer any questions you may have.

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Mr. LEGGETT. Thank you very much, Mr. Secretary.

Certainly nobody can accuse you of having lack of courage after that statement. It is regrettable indeed and I guess we should probe a little bit and find out the degree of the commitment in your agency and when it was discovered.

Is your agency totally polarized on this issue? Because the Chief of Fish and Wildlife Service and your assistants feel as you do?

Mr. REED. Yes, sir.

Mr. LEGGETT. Has there been a recommendation mad by your research analysts on toxic substances that supports your view??

Mr. REED. Yes, sir. In 1960 and 1970 with the development of a new technique and new equipment both of which are patented the Fish and Wildlife Service, that could properly identify toxic substances in fish and wildlife, we made major patented breakthroughs in being able to avoid the lumping of toxic substances together. We know how to separate and measure environmental contaminants in fish, birds and mammals this includes organichlorine contaminants such as PCB, DDT and other pesticides PCB, DDT, DDE, and without confusing one compound with another.

We worked very closely in 1970 and 1971 with the industry and with what at that time was the Federal Water Pollution Control Administration to gain elimination of PCB's into the environment.

Frankly, we thought we had it with the voluntary restriction of PCB's for use only closed cycle equipment. We felt that we had done it.

The industry had made a major commitment to us to go that way and we were very pleased.

Then I think we sat back on our haunches. At that time we were anticipating trends from our national monitoring system on birds and fish which would indicate a decline. Not until 1973 did we begin to realize that something was wrong—instead of going down, which was what DDT, and DDE, and dieldrin residues were doing, the levels of PCB were continuing to grow.

In 1974 and 1974, as the levels escalated, we have come to the conclusion that PCB's are entering all waterways in the United States

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from a multitudinous group of discharges. They are being imported into this country, put into various chemicals for use, and are being discharged into sanitary sewer systems discarded into landfills. dumps or are incinerated and end up in maor waterways throughout the country.

Mr. LEGGETT. You find them in the Yukon River; the inference would be it gets there atmospherically?

Mr. REED. Yes sir, that is one possible source.

Mr. LEGGETT. If it gets there atmospherically, it could well be getting there, I suspect, from Japan, Canada, and the Soviet Union, as well as from the United States?

Mr. REED. We are interested in the results of the ban by the Japanese of PCB's following the Yusho disaster of 1968. Now their levels are still alarmingly high throughout the waterway system in Japan, but are beginning to tell.

We are not showing any tail off at all. We just show a steady incline.

Mr. LEGGETT. I assume you can produce for the committee documentation of PCB levels for various times and places all over the country?

Mr. REED. That would be our pleasure, sir, that is our duty and our responsibility.

(See also references 57, 59, 60, 61, 62, 63, 67, and U.S. map).

[The following was submitted:]

PCB RESIDUES FOUND IN FISH AND LOCATION

River (location) and species	Lipid percent	PCB residues (microgram per gram) as Aroclor 1242	1254	1260
Great Lakes				
St. Lawrence (Massena, N.Y.):				
White sucker	2.3	.....	0.70	.....
Do	1.8	.....	.70	.....
Northern pike	1.8	.....	3.60	.....
Yellow perch	1.7	.....	1.00	.....
Do	2.0	.....	1.10	.....
Genesee (Scottsville, N.Y.):				
Redhorse sucker	2.9	.....	.42	.....
Northern pike	2.5	.....	.98	.....
Black crappie	2.8	.....	1.20	.....
Do	3.1	.....	.57	.....
Lake Ontario (Port Ontario, N.Y.):				
Rock bass	3.8	.....	7.00	.....
Yellow perch	5.5	.....	6.30	.....
Do	5.7	.....	6.60	.....
Do	7.3	.....	8.00	.....
White perch	13.7	.....	14.1	.....
Lake Ontario Lake (Cape Vincent, N.Y.):				
Brown bullhead	6.1	.....	3.60	.....
Rock bass	2.3	.....	1.70	.....
Yellow perch	4.3	.....	.90	.....
Do	3.8	.....	1.30	.....
Lake Erie (Erie, Pa):				
White sucker	5.8	.....	.35	.....
Freshwater drum	12.1	.....	1.00	.....
Yellow perch	4.2	.....	.90	.....
Do	4.9	.....	1.00	.....
Lake Erie (Fort Clinton, Ohio):				
Carp	10.3	.....	1.30	.....
White bass	8.8	.....	12.00	.....
Walleye	16.4	.....	5.70	.....

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PCB Residues Found in Fish and Location—Continued

River (location) and species	Lipid percent	PCB residues (microgram per gram) as Aroclor 1242	1254	1260
Lake St. Clair (Mount Clemens, Mich.):				
Carp	11.8	.....	6.3	.....
Do	11.3	.....	1.9	.....
White bass	9.6	.....	1.9	.....
Walleye	10.7	.....	12.8	.....
Lake Huron (Bay Port, Mich.):				
Carp	12.0	.....	3.4	.....
Do	11.8	.....	3.8	.....
Channel catfish	13.4	.....	4.7	.....
Yellow perch	4.3	.....	2.2	.....
Do	5.4	.....	3.8	.....
Lake Huron (Alpena, Mich.):				
White sucker	5.3	.....	.46	.....
Lake whitefish	10.8	.....	.51	.....
Yellow perch	6.5	.....	.65	.....
Do	5.7	.....	.94	.....
Do	5.4	.....	.73	.....
Lake Michigan (Sheboygan, Wis.):				
White sucker	6.3	.....	.....	1.70
Do	7.5	.....	2.00	.....
Bloater	20.1	.....	3.20	.....
Do	20.2	.....	11.00	.....
Do	19.9	.....	13.80	.....
Lake trout	16.6	.....	.....	.60
Do	18.5	.....	19.00	.....
Lake Michigan (Saugatuck, Mich.):				
Bloater	16.4	.....	4.20	.....
Lake trout	15.3	.....	13.00	.....
Yellow perch	7.4	.....	7.70	.....
Do	8.2	.....	4.70	.....
Lake Superior (Bayfield, Wis.):				
Lake whitefish	12.3	.....	.70	.....
Bloater	14.1	.....	2.70	.....
Do	11.4	.....	1.20	.....
Lake trout	11.4	.....	2.70	.....
Do	11.5	.....	2.70	.....
Lake Superior (Keweenaw Point, Mich.):				
Herring	9.8	.....	1.10	.....
Bloater	16.6	.....	.79	.....
Do	15.3	.....	.61	.....
Lake trout	24.4	.....	4.50	.....
Do	24.5	.....	3.70	.....
Atlantic Coast				
Penobscot (Old Town, Maine):				
White sucker	4.3	.....	.30	.....
Chain pickerel	2.5	.....	0.48	.....
Yellow perch	4.2	(1)	(1)	(1)
Do	4.4	.....	.....	.....
Androscoggin (Lewiston, Maine):				
White sucker	7.7	.....	1.40	.....
Do	4.3	.....	1.80	.....
Chain pickerel	3.8	.....	1.30	.....
Yellow perch	4.4	.....	.80	.....
Do	4.2	.....	.30	.....
Kennebec (Hinckley, Maine):				
White sucker	3.6	.....	.....	.....
Channel catfish	1.8	.....	.46	.....
Yellow perch	4.2	.....	.50	.....
Do	4.2	.....	.46	.....
Do	9.3	.....	.50	.....
Lake Champlain (Burlington, VT.):				
Chain pickerel	2.7	.....	.94	.....
Pumpkinseed sunfish	6.7	(1)	(1)	(1)
Yellow perch	3.3	.....	1.20	.....
Do	3.3	.....	1.30	.....
Merrimac (Lowell, Mass.):				
White sucker	5.4	.....	1.40	.....
Do	4.4	.....	1.40	.....
Chain pickerel	5.3	.....	4.60	.....
Yellow perch	5.0	.....	5.00	.....
Connecticut (Windsor Locks, Conn.):				
White catfish	5.2	.....	5.30	.....
Do	5.6	.....	5.90	.....
Brown bullhead	2.7	2.10	1.20	.....
Yellow perch	5.7	.....	2.40	.....

(microgram per gram) as Aroclor 1254	1260
0.70	.....
.78	.....
3.60	.....
1.00	.....
1.10	.....
.42	.....
.98	.....
1.20	.....
.57	.....
7.00	.....
6.30	.....
8.60	.....
6.00	.....
14.1	.....
3.60	.....
1.70	.....
.90	.....
1.30	.....
.35	.....
1.30	.....
.90	.....
1.00	.....
1.90	.....
12.00	.....
5.70	.....

MONS 216594

PCB Residues Found in Fish and Location—Continued

River (location) and species	Lipid percent	PCB residues (microgram per gram) as Aroclor 1242	1254	1260
Atlantic Coast—Continued				
Hudson (Poughkeepsie, N.Y.):				
Goldfish	17.0	.....	75.00	.....
Do	6.8	.....	30.00	.....
Pumpkinseed sunfish	3.2	.....	25.00	.....
Largemouth bass	5.4	.....	13.00	.....
Susquehanna (Conowingo Dam, Md.):				
Carp	4.9	.....	.....	1.10
Channel catfish	13.1	.....	.....	5.90
Do	12.7	.....	.....	2.80
White perch	7.2	.....	.....	3.20
Do	7.2	.....	.....	3.10
James (Richmond, Va.):				
Redhorse sucker	22.1	.....	.....	4.20
Channel catfish	11.0	.....	.97	.....
Do	11.2	.....	1.10	.....
Largemouth bass	3.5	.....	.67	.....
Roanoke (Roanoke Rapids, N.C.):				
Carp	1.5	.....	.20	.....
Do	1.4	.....	.20	.....
Do	2.8	.....	.10	.....
Channel catfish	5.1	.....	1.10	.....
Largemouth bass	3.1	.....	.17	.....
Cape Fear (Elizabethtown, N.C.):				
Gizzard shad	4.1	.....	.....	1.00
Do	2.4	.....	.....	1.60
Brown bullhead	2.1	.....	.....	.40
Largemouth bass	3.9	.....	.....	.90
Pee Dee (Dongola, S.C.):				
Bluegill	6.9	.....	.40	.....
Warmouth bass	1.6	.....	.....	.....
Largemouth bass	6.5	.....	.80	.....
Do	5.8	.....	.75	.....
Do	2.0	.....	.30	.....
Cooper-Santee (Summerton, S.C.):				
Redear sunfish	2.1	.....	.....	.10
Largemouth bass	2.9	.....	.....	.20
Do	4.4	.....	.....	.20
Savannah (Savannah, Ga.):				
Striped mullet	4.7	.....	.....	.10
Do	4.7	.....	.....	.20
Do	6.6	.....	.38	.....
Bluegill	1.9	.....	1.10	.....
Largemouth bass	3.6	.....	.78	.....
St. Lucie Canal (Indiantown, Fla.):				
Channel catfish	6.4	.....	.10	.....
Do	6.6	.....	.10	.....
Bluegill	1.4	.....	.40	.....
Largemouth bass	2.6	.....	.20	.....
Do	1.9	.....	.10	.....
Gulf Coast				
Rio Grande (Brownsville, Tex.)				
Gizzard shad	3.5	.....	.....	.....
Do	4.0	.....	.....	.....
Black bullhead	2.2	.....	.....	.....
Do	3.0	.....	.....	.....
Channel catfish	2.7	.....	0.60	.....
Rio Grande (Elephant Butte, N. Mex.)				
Carp	5.3	.....	.83	.....
Do	5.9	.....	.34	.....
Channel catfish	3.8	.....	.57	.....
Bluegill	2.4	.....	.....	.....
Pecos (Red Bluff, Tex.)				
Gizzard shad	6.2	.....	.80	.....
Do	4.2	.....	.....	.....
Channel catfish	1.8	.....	.....	.....
White bass	5.5	.....	.....	.....
Nueces (Mathis, Tex.)				
Smallmouth buffalo	19.0	.....	.....	.....
Channel catfish	4.0	.....	.....	.....
Do	4.1	.....	.....	.....
Do	2.1	.....	.....	.....

MONS 216595

PCB Residues Found in Fish and Location—Continued

River (location) and species	Lipid percent	PCB residues (microgram per gram) as Aroclor 1240	1254	1260
San Antonio (McFaddin, Tex.)				
Smallmouth buffalo	7.4		.10	
Do.	8.5		.10	
Carp	3.5			
Channel catfish	5.3		.60	
Alabama (Chrysler, Ala.)				
Smallmouth buffalo	10.5		2.70	
Do.	10.4		2.90	
Freshwater drum	5.7			0.60
Do.	15.5		1.90	
Tombigbee (McIntosh, Ala.)				
Smallmouth buffalo	11.4			
Freshwater drum	19.8		2.30	
Apalachicola (Jim Woodruff Dam, Fla.)				
Channel catfish	6.1		.80	
Bluegill	5.7		.60	
Largemouth bass	7.1		1.30	
Do.	3.8		.50	
Mississippi River				
Allegheny (Natrona, Pa.)				
Carp	6.4		10.50	
Do.	5.7		9.60	
Bluegill	4.6	0.19	1.90	
Do.	3.7		1.30	
Walleye	4.4		10.40	
Kanawha (Winfield, W. Va.)				
Carp	4.2		1.80	
Brown bullhead	6.5		1.30	
Black crappie	4.5		6.80	
Do.	2.3		1.50	
Ohio (Marietta, Ohio)				
Carp	12.4		2.20	
Do.	12.3		2.00	
Channel catfish	10.0		6.70	
Spotted bass	6.3		1.70	
Do.	4.3		2.30	
Ohio (Cincinnati, Ohio)				
Carp	9.3		9.10	
White sucker	5.6		[r] 4.10	
Channel catfish	4.4		39.00	
Do.	6.7		[1] 25.00	
Wabash (New Harmony, Ind.)				
Carp	4.9		5.10	
Do.	5.1		4.50	
White sucker	2.4		.85	
Channel catfish	6.6		[1] 1.40	
Do.	6.4		[1] 8.10	
Ohio (Metropolis, Ill.)				
Carp	4.3		[2] 2.50	
White sucker	1.5		1.30	
Do.	1.8		1.20	
Channel catfish	7.8		2.20	
Cumberland (Clarksville, Ind.)				
Carp	4.3		4.50	
Do.	2.7		3.80	
Do.	5.0		3.50	
Bluegill	4.6		3.20	
Largemouth bass	2.4		.88	
Tennessee (Savannah, Tenn.)				
Carp	1.1		1.30	
Do.	1.5		1.20	
Channel catfish	8.4		1.10	
Largemouth bass	8.1		.85	
Illinois (Beardstown, Ill.)				
Bigmouth buffalo	5.4		.90	
Black bullhead	3.7		1.10	
White crappie	3.5		4.70	
Wisconsin (Woodman, Wis.)				
Carp	9.2		5.7	
Channel catfish	2.2		3.10	
Smallmouth bass	4.2		23	
Do.	4.1		2.60	
Do.	4.1		2.40	

MONS 216596

PCB Residues Found in Fish and Location—Continued

River (location) and species	Lipid percent	PCB residues (microgram per gram) as Aroclor 1240	1254	1260
Mississippi River—Continued				
Mississippi (Lake City, Minn.).				
Carp	11.8	.....	7.60	.....
White sucker	6.0	.....	7.50	.....
Sauger	2.7	.....	14.00	.....
Do.	10.2	.....	15.00	.....
Yellowstone (Sidney, Mont.):				
Goldeye	13.9	.....	.....	.....
Do.	12.8	.....	.....	.....
Do.	22.8	.....	.22	.....
Channel catfish	14.7	.....	.67	.....
Sauger	1.4	.....	3.00	.....
Missouri (Garrison, N. Dak.):				
Goldeye	13.4	.....	.....	.....
Do.	10.3	.....	.....	.....
White sucker	1.2	.....	.....	.....
Walleye	5.9	.....	.....	.....
James (Olivet, S. Dak.):				
Goldeye	6.6	.....	.20	.....
Do.	9.1	.....	6.30	.....
Carp	3.0	.....	.09	.....
Freshwater drum	5.8	.....	.....	.....
Channel catfish	9.0	.....	.33	.....
North Platte (Lake McConaughy, Nebr.):				
Carp	8.1	.....	1.36	.....
Do.	7.6	.....	.43	.....
Do.	9.3	.....	.40	.....
Channel catfish	7.3	.....	.51	.....
Walleye	6.2	.....	.05	.....
Platte (Louisville, Nebr.):				
Carp	5.8	.....	.20	.....
Do.	5.2	.....	.21	.....
Channel catfish	2.6	.....	.26	.....
Miscellaneous	9.2	.....	2.20	.....
Do.	8.5	.....	2.40	.....
Missouri (Nebraska City, Nebr.):				
Goldeye	10.4	.....	.....	[1] 1.30
Carp	5.8	.....	.....	.30
Do.	6.7	.....	.....	.....
White sucker	1.1	.....	.....	.....
Kansas (Desmet Springs, Kans.):				
Carp	10.7	.....	.50	.....
Do.	6.6	.64	.49	.....
Freshwater drum	5.8	.....	.64	.....
Channel catfish	10.9	.....	.55	.....
Missouri (Hermann, Mo.):				
Goldeye	10.4	.....	.....	[1] 1.30
Carp	5.8	.....	.....	.30
Do.	6.7	.....	(1)	.....
White sucker	1.10	.....	.32	.....
Des Moines (Keosauqua, Iowa):				
Carp	8.3	.....	.50	.....
Do.	8.7	.....	.80	.....
Channel catfish	7.1	.....	.90	.....
Walleye	4.0	.....	.20	.....
Mississippi (Guttenburg, Iowa):				
Carp	8.5	.....	1.50	.....
Bluegill	2.9	.....	1.10	.....
Do.	3.3	.....	.60	.....
Largemouth bass	3.7	.....	1.20	.....
Mississippi (Cape Girardeau, Mo.):				
Carp	4.3	.....	2.30	.....
Do.	3.2	.....	.....	2.50
White sucker	1.0	.....	1.20	.....
White (DeValls Bluff, Ark.):				
Smallmouth buffalo	7.0	.....	.....	.....
Do.	7.8	.....	1.30	.....
Channel catfish	7.6	.....	.....	.....
Arkansas (Keystone Reservoir, Oklahoma):				
Carp	.7	.....	.....	.....
Do.	.5	.....	.....	.....
Do.	.8	.....	.....	.....
Bluegill	3.1	.....	.....	.....
Largemouth bass	.6	.....	.31	.....
Arkansas (Pine Bluff, Ark.):				
Carp	8.5	.....	1.20	.....

MONS 216597

PCB Residues Found in Fish and Location—Continued

River (location) and species	Lipid percent	PCB residues (microgram per gram) as Aroclor 1240	1254	1260
Mississippi (Memphis, Tenn.):				
Smallmouth buffalo	11.2			
Freshwater drum	6.2		2.80	
Do.	8.8		1.70	
Channel catfish	17.5		.85	
Yazoo (Redwood, Miss.):				
Carp	6.8			.30
Channel catfish	8.8		1.80	
Red (Alexandria, La.):				
Carp	7.4		.50	
Do.	8.7		.50	
Freshwater drum	6.8		.30	
Do.	7.1		.50	
Channel catfish	6.4		.40	
Pacific Coast				
Sacramento (Sacramento, Calif.):				
Carp	7.5		2.5	
Do.	2.0		2.6	
White catfish	6.2		1.3	
Largemouth bass	5.7		.56	
Do.	6.5		.81	
Klamath (Hornbrook, Calif.):				
Klamath sucker	6.8		.07	
Do.	6.3		.10	
Yellow perch	3.2			
Do.	3.1			
Largemouth bass	3.1		.80	
Willamette (Oregon City, Oreg.):				
Carp	6.0			.12
Largescale sucker	3.7		1.30	
Do.	8.1	4.5	2.70	
Northern squawfish	6.4		2.30	
Columbia (Bonneville, Oreg.):				
Carp	6.4		.18	
Largescale sucker	3.0			
Do.	2.5			
Northern squawfish	6.8		2.60	
Yakima (Granger, Wash.):				
Carp	4.9			.18
Do.	4.8			.14
Do.	6.1			.20
Largescale sucker	5.1			.19
Smallmouth bass	4.8			.19
Columbia (Pasco, Wash.):				
Carp	5.6			.20
Do.	5.2			.20
Largescale sucker	4.4		.21	
North squawfish	2.4			1.20
Columbia (Grand Coulee, Wash.):				
Bridgelip sucker	7.1		.18	
Northern squawfish	1.8			.28
Do.	1.8			.29
Walleye	3.8			.18
Do.	5.2			.43
Snake (Ice Harbor, Wash.):				
Bridgelip sucker	10.7			
Common sucker	4.3			
Do.	5.0			
Channel catfish	11.3		.45	
Snake (Lewiston, Idaho):				
Common sucker	8.4		*	
Do.	8.1			
Northern squawfish	4.7		1.10	
Black crappie	7.5		.27	
Salmon (Riggins, Idaho):				
Carp	3.1			
Common sucker	5.8			
Do.	5.5			
Smallmouth bass	2.1			
Snake (Hagerman, Idaho):				
Carp	8.8		.14	
Do.	6.7		.11	
Northern squawfish	3.1		3.30	
Rainbow trout	2.0		.53	

MONS 216598

PCB Residues Found in Fish and Location—Continued

River (location) and species	Lipid percent	PCB residues (microgram per gram) as Aroclor 1242	1254	1260
Interior				
Truckee (Fernley, Nev.).				
Common sucker	8.9	.....	8.44	.....
Do.	9.6	.....	.53	.....
Brown bullhead	7.3	.....	.15	.....
Largemouth bass	6.8	.....	.91	.....
Green (Vernal, Utah).				
Carp	4.4	.....		
Flannelmouth sucker	7.5	.....		
Do.	7.9	.....		
Channel catfish	7.7	.....		
Do.	3.6	.....		
Colorado (Imperial Reservoir, Ariz.)				
Carp	5.8	.....		
Bluegill	2.0	.....		
Do.	2.5	.....		
Largemouth bass	1.8	.....		
Colorado (Lake Havasu, Ariz.)				
Carp	1.2	.....		
Do.	3.6	.....		
Do.	3.5	.....		
Channel catfish	10.9	.....	.24	
Largemouth bass	4.0	.....		
Colorado (Lake Powell, Ariz.)				
Carp	2.5	.....		
Rainbow trout	12.2	.....		
Largemouth bass	6.4	.....	.10	
Do.	7.2	.....		
Hudson				
Red (Noyes, Minn.)				
Goldeye	11.6	.....	1.00	.....
Do.	11.9	.....	.95	.....
White sucker	6.1	.....	.23	.....
Sauger	6.0	.....	.92	.....
Do.	8.1	.....	2.60	.....
Alaska				
Kenai (Soldotna, Ala.).				
Round whitefish	1.9	.....		
Do.	3.8	.....		
Rainbow trout	12.6	.....		
Lake trout	9.5	.....		
Hawaii				
Manoa (Honolulu, Hawaii):				
Tilapia	2.6	.....		
Do.	2.7	.....		
Chinese catfish	6.0	.....	1.8	.....
Do.	2.6	.....	.50	.....
Cuban limia	8.0	.....		
Waikele (Waipahu, Hawaii).				
Tilapia	1.3	.....		
Chinese catfish	5.6	.....		
Do.	8.4	.....	1.60	.....
Cuban limia	4.3	.....		

Mr. LEGGETT. Good. I would hope you would get that to us just as soon as you can.

Now, the voluntary restraints——

Mr. DE LA GARZA. Mr. Chairman, may I interrupt?

Mr. LEGGETT. Yes.

MONS 216599

Mr. DE LA GARZA. I have another question.

Mr. Reed, you stated residues had been found in fish samples. Now, you just answered the Chairman; would you add who did the sampling and where?

Mr. REED. These are samples from the Federal Pesticide Monitoring program, Mr. de la Garza, and they are also from other activities, both Federal and State and analyzed by laboratories, that have the equipment and the ability to make the analyses.

Mr. DE LA GARZA. Could you expand on your statement of fish samples by citing who, how, and when?

Mr. REED. Indeed, sir.

Mr. DE LA GARZA. Will you mention the details of the monitoring? wherein birds and fish are monitored on a year-to-year basis to description of the nationwide fish and wildlife monitoring program wherein birds and fish are monitored on a year-to-year basis to determine the environmental levels and trends of various toxic compounds. We will send you that immediately. (See reference 48).

Mr. DE LA GARZA. Thank you.

Thank you, Mr. Chairman.

Mr. LEGGETT. Have you made any recommendations with respect to the banning of this material?

Mr. REED. Yes, sir.

Mr. LEGGETT. And who have you made those recommendations to?

Mr. REED. To the administration and to the Administrator of the Environmental Protection Agency, and today, to the Congress.

Mr. LEGGETT. And when did you make those recommendations?

Mr. REED. I made the recommendation at the Chicago conference in November 1975.

Mr. LEGGETT. All right. And did EPA indicate they would consider your recommendation?

Mr. REED. I have been in close contact with the Administrator, Mr. Train, who will be testifying before you on the problems with the Water Pollution Control Act and the lack of clear definition of his authority to control PCB emissions, and of our intense interests in the passage of a strong Toxic Substance Act.

Mr. LEGGETT. Now, have you found that there are any PCB's in salt water?

Mr. REED. Yes, sir, in fish and in fish eating birds.

Mr. LEGGETT. And do those appear to be uniform around the country or are they concentrated?

Mr. REED. Sir, they are concentrated in fish and wildlife at the mouths of great rivers.

Mr LEGGETT. From the mouth of the St. Lawrence?

Mr. REED. Yes, there are also other significant problems on the east coast, in the Hudson, and we note with increasing alarm as we monitor fish from the Chesapeake Bay. The two greatest breeding areas of the striped bass in the East are the Hudson River and the Chesapeake Bay, and both appear to have serious levels of PCB.

Mr. LEGGETT. What levels do you find at the mouth of the Sacramento River? So my adrenalin will run.

Mr. REED. I will have to ask Mr. Walker if he had anything with him for the Sacramento.

MONS 216600

I would hate to shock the chairman so early in the hearing on the PCB debate.

While he is digging that up, I am sure he does—Mr. Walker is armed with all kinds of information.

Mr. LEGGETT. Mr. De la Garza, you are recognized.

Mr. DE LA GARZA. What about the quorum call?

[Discussion off the record.]

Mr. LEGGETT. Why do you not commence.

Mr. DE LA GARZA. All right, sir.

Mr. Reed, also you state that scientists have repeatedly demonstrated in laboratory and pen studies that PCB's affect the growth.

Do you have any information, what scientists where?

Mr. REED. Yes, sir. We will be able to cite the scientists and we will be able to give you the study. (See references 10, 12, 13, 19, 22, 28, 29, 33, 44, 49.)

Mr. DE LA GARZA. You also say "Our scientists state that this threshold concentration in the eggs would be equivalent to residual PCB levels in whole fish of 2.5 to 5 p/m."

Would that be the Interior scientists?

Mr. REED. Yes, sir; Fish and Wildlife Service scientists.

Mr. DE LA GARZA. Would you supply that also?

Mr. REED. Yes, sir; with pleasure.

(See references 31 and 49.)

Mr. DE LA GARZA. On page 3, also you state, "Another test demonstrated that fish may accumulate more than 40,000 times the concentration of PCB in the water."

May we have——

Mr. REED. The biomagnification figures are from the Fish Pesticide Research Laboratory.

We will be delighted to furnish those to the committee. See reference (31).

Mr. DE LA GARZA. I sure would appreciate that.

Mr. REED. They interested me, I must admit, and I had them checked just before lunch and the data has been recently updated, also the studies have been supported by studis conducted by EPA (53, 65, 66).

Mr. DE LA GARZA. Very good.

Would you make them available so that we might have the benefit of that information?

(See references 31, 37, 39, 49, 53, 65, 66.)

Mr. REED. Yes, sir.

Mr. DE LA GARZA. Also you state it appears highly probable that the primary cause for failure of PCB's to decline is that their sources have not been curtailed any significant degree.

Now, besides your statement in support of a ban, do you have a program or a plan as to how to—what would your ban be, or what would be your program, or how do you keep PCB's from getting into the waters of——

Mr. REED. I have got to turn that responsibility over to the Administrator of the EPA. That is a function it would seem to me of that Office and of that Agency of government.

Mr. DE LA GARZA. Have you not looked into your input into such plan?

Mr. REED. We have been involved with EPA in developing our comments on the toxic substance legislation, which is before the Congress, and I know that the Administrator will want to speak more fully about that, but we were preparing to send amendments to the Congres on Friday of this week.

Mr. DE LA GARZA. All right, sir.

And then you made a statement that 9 out of 10 liveborn babies had unusually grayish, darkened skin, and most were born underweight.

Could we have the benefit of the source for that?

Mr. REED. Yes, sir; these studies were reported by Dr. Keratsune (60, 62).

Mr. DE LA GARZA. I do not know that darkened skin is necessarily bad.

Mr. REED. No, nor do I sir. If it is artificially done, though, it is a cause of concern.

Mr. DE LA GARZA. Now, can you tell me anything about what your Department has done here to find out what the big bird of the Rio Grande is?

Mr. REED. I am not certain what bird you are referring to.

Mr. DE LA GARZA. I am talking about the big bird you heard about on Harden and Weaver, 9 foot wing span, 14 feet high.

Mr. REED. I have not run into him yet.

Mr. DE LA GARZA. Thank you very much. We are always happy to have you here. I appreciate your cooperation in supplying for the record the requests that I have.

Thank you, Mr. Chairman.

Mr. LEGGETT. Very good. Thank you very much, Mr. De la Garza, for your questions.

Mr. FORSYTHE. I might state that the second bell has rung. We have got a lot of important witnesses here. I would just as soon proceed, and get as many questions as we can. I am sure the staff has questions.

Very good, proceed.

Mr. FORSYTHE. Mr. Reed, thank you for the usual good statement. It was very helpful. NOAA, EPA, and the Fish and Wildlife Service all have toxic substances research programs. How do you coordinate between the agencies and are we duplicating their work?

Mr. REED. I do not think so. As a matter of fact we have a memorandum of agreement with EPA that addresses this specific subject. Under the Fish and Wildlife Coordination Act we have the primary responsibility for the welfare and well-being of fish and wildlife in the United States. We have ironed out most of our problems with the establishment of NOAA in 1970 in the transfer of functions to Commerce. Basically we have laboratories and staffs for monitoring and research activities. We exchange information with NMFS and EPA on environmental contaminants and have furnished expert witnesses, and scientists for committees and technical advice.

MONS 216602

With the establishment of the Environmental Protection Agency and the transfer of the Federal Water Pollution Control Administration and other agencies there may appear to be some duplication in laboratory testing, but our function primarily involves fish and wildlife and is a unique management responsibilty.

We have found that deliberate duplication is desirable and necessary especially in the area of analytical methodology. Several important scientific developments have resulted from these deliberate duplications. As an example, in an effort to distinguish PCB from pesticides, our scientists developed reliable methods and specialized equipment that are used by EPA, FDA, USDA and other private and State laboratories. (For other examples, see references 24, 25, 26, 38, 40, 41, 43, 44, 47.)

[The following was submitted.]

U.S. ENVIRONMENTAL PROTECTION AGENCY,
Washington, D.C.

DR. RICHARD SCHOETTGER,
Fish Pesticide Research Laboratory,
Route One,
Columbia, Mo.

DEAR DR. SCHOETTGER: As you know Dr. Stalling prepared and presented a statement summarizing data from the National Pesticide Monitoring Program when he appeared as a rebuttal witness for EPA in the Heptachlor/Chlordane Suspension Hearing. His testimony was crucial to EPA's case in that it refuted testimony of Velsicol Corporation regarding the presence and proliferation of Heptachlor and Chlordane residues in fish, ratios of cis-chlordane to transnonachlor, and bioaccumulation ratios of chlordane in fish. The effectiveness of his statement and appearance is best illustrated by the failure of opposing counsel to contest Dr. Stalling's testimony in their brief.

The quality of Dr. Stalling's performance in the preparation of his statement and on the stand as well as the quality of work of the Fish Pesticide Research Laboratory has been well demonstrated in the Heptachlor/Chlordane suspension proceeding. We are currently engaged in preparations for additional potential cancellation and/or suspension proceedings which would benefit greatly from similar contributions from your laboratory and personnel. Specifically, it appears that the monitoring program included analysis for residues of toxaphene and lindane- BHC. Both compounds are currently under review by EPA. We would appreciate the opportunity initially, to consult with, and if necessary to request statements from your staff regarding studies and monitoring data on these compounds. I trust that our future cooperation in these matters will be as beneficial to the environmental as was achieved in the Heptachlor/Chlordane suspension proceeding.

Sincerely yours,

KEVIN LEE.

U.S. DEPARTMENT OF THE INTERIOR,
FISH AND WILDLIFE SERVICE,
FISH-PESTICIDE RESEARCH LABORATORY,
Columbia, Mo., January 19, 1976.

MR. KEVIN LEE,
Office of General Counsel,
U.S. Environmental Protection Agency,
Washington, D.C.

DEAR MR. LEE: I want to thank you for your letter concerning Dr. Stalling's testimony during the recent heptachlor/chlordane suspension hearings. I am pleased that his testimony, and results of our research and the monitoring program were pertinent to the proceedings. Naturally, we think highly of our total program here at Columbia, so your acknowledgement is most welcome.

MONS 216603

If we have data pertinent to your needs in the future, we would be happy to share it with you.

Again, thanks for the acknowledgement.

Sincerely yours,

RICHARD A. SCHOETTGER, PH.D.,
Director.

Mr. FORSYTHE. You are satisfied that you do have the responsibility and it is not being bled away?

Mr. REED. Mr. Forsythe, I am satisfied that the clear understanding that I got when I came before this committee in 1971, which was to make the Fish and Wildlife Service responsive to the country and to the Congress as the primary fish and wildlife agency, is being met with a new Director with a very, very topflight group of young men whom we brought to Washington, the best regional directors I could find. With the amount of time and effort we put on it we hope you will see a great transformation in that agency if we keep up with the funding level.

I think we have a winner.

Mr. FORSYTHE. Good.

So far as monitoring, again we are in a multiagency area, are your monitoring programs coordinated so you are sure you are getting maximum effectiveness.

Mr. REED. Mr. Walker is chairman of an interagency coordinating committee that has responsibilities for testing and monitoring pesticides and organochlorines throughout the entire environment. He assures me that type of coordination and communication has really been uplifted enormously in the last 2 years.

Mr. FORSYTHE. Good. I think that is all I have.

Mr. REED. Mr. Chairman, the Sacramento is not as bad off as many other rivers are. The PCB levels in composite samples of three species were: 2.5 and 2.6 parts per million for carp; 1.3 parts per million for white catfish; and 0.56 and 0.81 parts per million for large mouth bass.

These are 1974 samples, but you would lose only one of those species, if the Canadian recommendation limit of 2.7 parts per million were applied.

I want to work to keep the Sacramento River clear of pollutants because of the tremendous interest in that anadromous fish run you all have out there.

Mr. LEGGETT. Now, have you established a correlation between the utilization of these PCB's and the levels you find in adjacent waters?

Do you understand the question?

Mr. REED. No, sir.

Mr. LEGGETT. The question is you use these PCB's apparently in insulative fluids, plasticides, lubricants, carbonless paper, duplicating paper, et cetera.

Now, I do not recall whether I have gotten any of those kinds of facilities in the Central Valley of California which might relate to the fact that some of these levels might be low.

Now, in the Great Lakes region, do you have manufacturing plants that are using these substances in the proximity?

MONS 216604

Mr. REED. We obviously have, because we are picking them up in areas associated with sewage and in industrial wastes. But more importantly, up until the voluntary ban went in in 1972, a great deal of Americana was made partly out of PCB's and that is still out there in the dump or still out there in use.

On top of that, since——

Mr. LEGGETT. What is it?

Mr. REED. Since 1970.

Mr. LEGGETT. What are plasticizers?

I am trying to figure out where does this stuff get into the environment? I do not recall.

Mr. REED. Good question.

Mr. LEGGETT. I do not recall reading, seeing any carbonless duplicating paper.

Mr. REED. Oh, yes, sir, there was a great deal of carbon duplicating paper, up until 1972, and it was——

Mr. LEGGETT. Now, you mean like Xerox paper, stuff like that?

Mr. REED. Exactly.

Mr. Walker will amplify, but it is a very good question, Mr. Chairman.

Mr. LEGGETT. Xerox machines are likely to be contaminated like people with black lung?

Mr. REED. No, if you were not ingesting that paper, which I do not think you were, Mr. Chairman.

Mr. WALKER. Mr. Chairman, I feel that perhaps EPA expertise in this area would be most appropriate to bring to bear on that question when you have that opportunity. However, as we have conducted our own studies and interrogated many of our associates and friends who know more about it than we do, there are certainly instances where we can find high PCB concentrations associated with industrialized areas. Not only in fish but in starlings and in other wildlife.

Also many of our colleagues in the States have been following this problem and have tried to identify the sources of PCB associated with our waterways and fish and wildlife populations. This has been an exceedingly difficult matter. And as mentioned before, Stan Kleinert (58), in Wisconsin, presented some very good information on sources of PCB. But their information is very bothersome inasmuch as they found from 0.17 to 0.27 parts per billion in snow-melt water from Racine, Kenosha, Madison, and Milwaukee. These levels indicate that fallout of PCB's is a major atmospheric pollution problem. And this, of course, would lead to some difficulty in finding some specific sources.

Mr. LEGGETT. Thank you.

Mr. Ruppe.

Mr. RUPPE. Thank you, Mr. Chairman.

I want to thank you, first of all, for bringing this matter before the subcomittee, because I would say to a very great degree in the Great Lakes area, the PCB problem has probably the potential of being the most devastating to all sports fishery and commercial fishery since the introduction of lamprey eels.

MONS 216605

I am very happy that this subcomittee is taking up the issue at the present time.

Mr. Secretary, at this moment does the Government have authority to ban PCB?

Mr. REED. The Department of the Interior or the Assistant Secretary of Fish and Wildlife does not have this authority.

Mr. RUPPE. Does anyone in the Government have that authority?

Mr. REED. It would appear that a close reading of the Water Pollution Control Act does not give the Administrator of EPA that authority.

Mr. RUPPE. So therefore at this time he could really not ban, in your opinion, PCB's?

Mr. REED. Not without a toxic substance bill.

Mr. RUPPE. Yet you would say at this moment—or would you say at this moment any level of PCB's are harmful?

Mr. REED. I would say any level of PCB is potentially harmful and that we should accelerate our efforts in ending the use of PCB's in the United States of America.

Mr. RUPPE. I am very interested in your testimony on page 4 and would like to know whether you recommend that the FDA lower the permissible level at the present time?

You state that, "If FDA lowers the current permissible level, virtually all species would be unmarketable and the Great Lakes commercial fishery would be dead," in your opinion.

Does that mean that you do favor the FDA lowering the current permissible level, or you are concerned if it does lower it, then the fishing industry, commercial and sports fishery, would suffer accordingly?

Mr. REED. I am fearful the lowering would cause the repercussions.

I am not an expert on FDA regulations and am unable to comment on the effectiveness of Canada's reduction to 2 compared to our 5 parts per million, except FDA is thinking very hard about it right now.

Mr. RUPPE. Are you not kind of on the horns of a dilemma? You indicated all levels of PCB's are bad in your opinion, and I presume should be banned, or substance, utilization of any substance with PCB should be banned. And yet you do indicate that if we were to carry out what I feel is your suggestion, you fear for the commercial and sports fishing industry.

I have to say then which do you put first, the suggestion you make for banning consumption of any product with PCB or perhaps the maintenance of a sports and comercial fishery industry with some level of PCB tolerated?

Mr. REED. The two go together, Mr. Ruppe. The sooner we ban, the sooner we get a reduction in total PCB's in the environment, the faster we will see a rebirth of the commercial and sports fishing interests around the lake.

At the moment, at 5 parts per million or less, one has to be conscious of how much fish one is going to eat out of the Great Lakes.

Mr. RUPPE. Would you recommend that the FDA lower the current——

Mr. REED. I am not competent to make that recomendation.

Mr. RUPPE. I see.

Is your agency or any other agency in Government doing anything in the way of research to find out if there is a possibility of neutralizing PCB's in the environment or perhaps neutralizing PCB's that may turn up not only in your fish and wildlife, but in humans as well?

Mr. REED. Yes, sir. We have done a great deal of head scratching on this point and at the moment we only know one thing, and that is to harvest the fish as rapidly as possible at the top of the food chain.

But what do you do with the fish you capture? Because what you capture at the top of the food chain is the most contaminated with PCB's.

Mr. RUPPE. I presume that there is—this perhaps is a little out of your level of expertise or authority, I presume as a result of people being in contact with this type of discharge or contaminated because of consuming contaminated fish and so forth, there are people with a fairly high parts per million count PCB's in their system. Would that be correct?

Mr. REED. Yes, sir, that is correct.

Mr. RUPPE. Is there any indication that you know of at what level PCB's in the system can be harmful?

Mr. REED. No, sir, I am not competent to answer that.

Mr. RUPPE. Would you recomend that we undertake research in two areas to determine at what levels PCB content would be harmful and injurious to humans and, second, would you not consider it advisable to conduct research to determine how to flush out literally PCB out of the individual human system?

Mr. REED. Yes, sir.

Mr. RUPPE. We have not made any effort in your mind, frankly, to the best of your opinion, in that direction?

Mr. REED. No, sir. I am unaware of any work on that.

I imagine that PCB's have shown up in the nationwide cadaver testing program that was initiated a few year sago when there was ongoing research as to the levels of various chemicals in human beings (67).

However, those figures are very, very difficult to obtain. Having attempted to obtain them while in office in the State of Florida, I know how extremely difficult it is to get those figures, but they certainly would make interesting reading on PCB's.

Mr. RUPPE. The reason I bring that up, I have done some work on PBB's and there is really no knowledge today on the part of FDA, although I suspect they sought that knowledge, but there is no current knowledge as to at what level a parts per million individual, PBB's——

Mr. LEGGETT. If the gentleman will use initials, explain.

Mr. RUPPE. Polybrominated biphenyls.

I appreciate your asking and I feel very fortunate that I can respond.

[Laughter.]

Anyway, there has been some real problems with PBB's in Michigan.

FDA does not know at what level—although at three parts per million, animals will wither away and die.

They also do not know, you bring up the point how to get or flush out, if you will, the PBB's out of the individual system, human system. I presume the same problem will occur in the case of PCB's; if they are not biodegradable, there is really no way of knowing if they will be flushed out of the human system and at what rate. So I think we need a lot of action.

I am very sympathetic with your fish and wildlife. I even get more concerned about individuals who have consumed PCB's or PBB's, have the PCB's in their system, and may be literally sitting on a keg of dynamite because you do not know at what level they are injurious to the individual. We do not know if they are injurious, what we can do to actually flush them out of the system or remove them from the system.

Mr. REED. Mr. Ruppe, we do not know a lot of things, but we are getting there quickly, all too quickly.

Two years in a row the Great Lakes Commission has puzzled over the loss of lake trout egg plants on offshore reefs in Lake Michigan. We have our suspicions why those eggs did not hatch; PCB is a concern to our scientists.

Mr. RUPPE. I appreciate your interest and your knowledge and simply want to say that while you are doing a lot of work on fish and wildlife research, I hope somebody else is doing a lot of work studying and thinking about the human side of the situation.

Thank you, Mr. Chairman.

Mr. LEGGETT. Thank you very much, Mr. Ruppe, it is very helpful.

Let me ask this, your scientists have not detected any PCB's in wildlife besides fish?

Mr. REED. Yes, sir.

Mr. LEGGETT. Have they detected PCB level in wildlife and is that correlated with the levels for the areas in which we find the high PCB levels in fish?

Mr. REED. Yes, sir, I am going to ask Mr. Walker to go very briefly over the Nation pesticide monitoring program. It is in some papers we sent up to you, but I would like him to summarize those in 2 or 3 minutes.

Mr. WALKER. I believe the committee has copies of the paper I presented to the Chicago Conference on Polychlorinated Biphenyls, (48) concerning the monitoring program. There I itemized, in table 5, the occurrence of PCB's in Mallard duck populations, by flyway, and by ambient concentrations. The same kind of information was made available to you on starlings, a bird species we have selected to monitor nationwide trends of PCB contamination [Table 6].

Mr. LEGGETT. How about coyotes?

Mr. REED. I have not done the coyote yet, Mr. Chairman. I suspect the levels are low though, because the coyote seems to be doing very well.

Mr. LEGGETT. It seems to me they are doing very well. It does not really affect their reproduction.

Mr. REED. Unfortunately, that would be the answer to all our problems, Mr. Leggett, if we could somehow selectively dose them. I think the Wyoming wool growers and you and I ought to get together on that one.

[Laughter.]

Mr. LEGGETT. Do we have any studies done on domestic animals that you know of, Doctor?

Mr. WALKER. There is quite an extensive body of information on both laboratory and domestic animals, chickens; in particular much of this information dates back into the 1930's. In another paper, which I presented at the national conference (40), I cite a great deal of work that was done prior to 1972, on both domestic livestock and laboratory animals. And, as a matter of fact, if you were to compare the effects, side by side, from fish to mallards to chickens, to rabbits, to monkeys, to rats, to mink many of the same types of pathology, the consequence of exposure, have definite correlation. (44, 49).

Mr. LEGGETT. And now can you present to the committee all of these working papers, Mr. Secretary?

Mr. REED. Yes sir, with great pleasure.

(See references 44, 48, 49, 52.)

Mr. LEGGETT. It is an extremely serious matter that you are presenting to the committee, and we are going to have to, in light of your strong stand which I do not take lightly, we are going to clearly evaluate technologically all of the material that your people have come up with, and hopefully we can get an office of technological assessment review of this, short of 6 months or a year, and I think it is something that we ought to have a thorough and effective comprehensive analysis of.

Mr. REED. I agree with you. When I came back from Chicago, discouraged as I was, I wrote a note to the head of the National Academy of Science and urged him to get deeply involved and to be responsive to the Congress. I knew that you were going to be deeply concerned, and I got a fine letter back from him saying they are applying their resources to this problem in order to be able to give you the kind of backup you need.

I have talked to the Secretary and called upon experts beyond the Fish and Wildlife Service to look over my shoulder, and over the shoulder of the Fish and Wildlife Service, to see if we had gone off into troubled waters. He came to the conclusion, after having the best scientific review, that we were on sound grounds and that we have a national problem of the greatest possible consequence to all of us.

Mr. LEGGETT. And just one final question before I let Mr. Studds ask questions. Do you find a correlation, Doctor, between the levels of PCB's you find in water and the fish you find in the same waters?

Mr. WALKER. We recognize that there are two routes of entry into fish: either through the diet or by contact with the water. We have shown PCB biomagnification and bioaccumulation definitely from the water and the diet. These are direct correlations: the magnitude exceeds 100,000 times the water concentration or 50,000 times the dietary level.

MONS 216609

In case of fish, the rate of bioaccumulation appears to be related to its residence time in the contaminated water; its lipidor fat content; its position in the food chain and its association with the bottom sediment. Hence, carp are fat, long-lived, live close to the bottom, eat penthic organism, and have the highest residues.

In the case of bottom feeding fish in the Hudson River, we found an average residue in our 1974 sampling year, of 75 parts per million.

Mr. LEGGETT. Pretty good.

Mr. Studds.

Mr. STUDDS. Thank you, Mr. Chairman.

It has been such a good day so far, I should have known something like this was coming. It takes your breath away—it is sobering testimony.

I have to ask you, first of all, about a sparrow on Normans Land Island—I assume he is all right?

Mr. REED. We are determined to keep your sparrow in good order, just short of passing that bill.

[Laughter.]

Mr. STUDDS. Are we going to confine ourselves to bombing and strafing——

Mr. REED. Through a cooperative agreement we have some, but not complete control over the island.

I have not written a letter asking for that yet, but if you will remind me again——

Mr. STUDDS. I do every year at this time.

May I pursue a little bit the question of the sources of PCB's. As I understand it, laying aside for the moment the question of ongoing current industrial discharges, we suspect there is a significant amount already in the environment in a variety of ways; is that correct?

Mr. REED. That is correct.

Mr. STUDDS. Do we have any way of estimating roughly what percentage is already there as opposed to what we may be adding on a monthly or annual basis?

Mr. WALKER. Sir, I cannot answer that. My impression from consultation with others is that EPA may be in a better position to answer this question.

Mr. STUDDS. Could you elaborate a little bit, Mr. Secretary, on the nature of the sources of that which we already know to be in the environment? I know you mentioned things like solid landfills and others.

Mr. REED. This is the one that troubles us the most, Mr. Studds, where in the devil are these tons and tons of PCB coming from?

Since the Chicago conference, the EPA has sent out to their field representatives the strongest orders to try to come to terms with this question. I would be very interested to see what their testimony produces in this. But it is coming from a vast variety of sources.

It was a wonderful chemical or appeared to be, and it was involved in every kind of Americana. And it is in our dumps, it is in our cars. it is in our transformers and capacitors, and it is in our heat exchangers—it is everywhere.

MONS 216610

Mr. STUDDS. For how many years has it been in widespread use?

Mr. REED. Since the late twenties. It became America's favorite and it accelerated in use on an annual basis—1930's, 1940's, reached a high in the 1950's and 1960's. We have got that terrible itchy feeling on the back of our neck which says it is going to be around for a long time.

Mr. STUDDS. So we were using something half a century, approximating half a century, before we knew with what harmful effects we have been depositing it in vast quantities.

Mr. REED. That is correct.

Mr. STUDDS. What effects are we going to have, if any, by prohibiting further discharges from this day on?

Mr. REED. I can only look to mercury and DDT, by saying we never know——

Mr. STUDDS. I understand.

Mr. REED [continuing]. Unless we call a halt, and then, thank God, we have seen in spite of our projections of long persistance or half life, that the DDT residues have gone to the bottom and are becoming increasingly fixed or degraded and they are being removed from the chain of life, and the only hope that I hold is that we can get over this great hump of PCB's in the environment.

Mr. STUDDS. All right, certainly. Some people have suggested it is inaccurate to simply use the generic term PCB. one must distinguish between various kinds of materials, all of which may qualify for the general categorization. Most particularly people have made reference to Aroclor 1016 as a product used in the production of small capacitors as more readily biodegradable than many other PCB's.

Is it possible to make distinctions between various kinds of PCB's?

Mr. REED. Let me ask Mr. Walker to answer that, sir.

Mr. WALKER. I would say most definitely, yes. It was well presented at the conference in Chicago, that PCB is certainly, if you want to use it in a singular form, a misnomer. Actually it is a mixture of chlorinated biphenyls, 209 isomers in all.

These mixtures, or isomers, are represented by various percentages in different formulations.

Certainly in our experience from a toxicological viewpoint, the PCB isomers with higher chlorine content are less acutely toxic to fish. On the other hand there are more toxic to many kinds of birds and mammals. The PCB formulations with the lower percentages of chlorine contain less chlorinated biphenyls and slightly more biogradable. They are nonetheless still quite serious in their toxicological implications. As I suggested in the paper (49) even very low concentrations, of the more biodegradable formulations have a very profound toxicological significance insofar as different forms of life are concerned.

Mr. STUDDS. So biodegradability is not necessarily a measure of toxicity in your opinion?

Mr. WALKER. Biodegradability can be an advantage; however we must keep in mind that it is only in comparative terms. PCB's in general are highly persistent and biodegradability in those terms is only slight in comparison to what we would call biodegradable

MONS 216611

pesticides. So toxicity, yes, biocumulations yes. If materal is accumulated, and deposited in fat, it may not harm the animal until those fat reserves are mobilized.

Mr. REED. Good point.

Mr. WALKER. Such as in a spawning run, starvation, disease or migration.

Mr. REED. Whenever you get into stress conditions this is where adverse effects show up. For example, in toxication DDT shows up. When the residues are mobilized and transported to the brain and vital organs.

It does not show up in us well-fed human beings very often; it depends on if we are on a crash diet. We very rarely call upon fat reserves.

If a bird is unable to feed for 3, 4, 5 days, bad weather, a pelican unable to get at a mullet—Paul Rogers is here and has got lots of pelicans as friendly constituents.

I watched a pelican this year unable to feed for 3 or 4 days during a heavy wind storm, during the Christmas holidays in Florida. That is when a wild animal calls upon fat reserves.

Women call upon fat reserves during pregnancy, but men do not call upon them frequently.

We should be aware that wildlife feed heavily at times when food is readily available and lay down fat stores in their bodies. At times of food scarcity and during periods of stress, they live off that body fat. That is when they are in trouble.

Mr. STUDDS. Thank you.

Mr. LEGGETT. Very good. Thank you very much. That is very helpful.

Mr. Lent.

Mr. LENT. Thank you, Mr. Chairman.

The New York Environmental Commissioner Ogden Reid has banned striped bass in the Hudson River because of the PCB contamination.

It is my understanding that striped bass from the Hudson and the Chesapeake Bay migrate in a northeasterly direction.

Now, the striped bass are important gamefish off the Coast of Long Island, which I represent, and although the latest information I have is that these striped bass have not been contaminated, do not indicate they are contaminated, my question is will the influx of PCB contaminated bass from the Hudson or the Chesapeake necessitate the reduction of striped bass harvesting off Long Island?

Mr. REED. Mr. Lent, that is the damnable position we are in. If there is a change made in the FDA limitation, which is for reasons of health, we may have problems with fish coming out of the Hudson.

We have samples right now of striped bass well in excess of 5 parts per million. I am sure Commissioner Reid will give you a broadscale look at the Hudson River situation. He is extremely worried and with good reason.

This has apparently been going on for years and was not picked up until Commissioner Reid came into office and was able to obtain this information from his staff.

I would hope that this committee might hear from the distinguished Commissioner from New York State who has done so much to highlight the real problems of PCB's and our fishery resources, for you and your constituents, not only for your sport fishermen, but for the striped bass in the New York market. It is one of the highest valued fish on the market.

Mr. LENT. Thank you.

Mr. LEGGETT. Thank you, Mr. Lent.

Mr. Oberstar.

Mr. OBERSTAR. Thank you very much, Mr. Chairman.

I would like to inquire of the Chair whether the FDA will be called to testify?

Mr. LEGGETT. We are going to have everybody in Washington here, I am sure.

[Laughter.]

Mr. OBERSTAR. I just wanted to be sure we would have them here.

Yours is a very enlightening and straightforward presentation, Mr. Secretary, for which we thank you and recognize the very considerable effort you have made.

There are a number of areas I would like to look into. First of all, the impact of PCB's on the recycling industry. We have made a great effort in recent years to encourage recycling as a means of conservation, recycling of all kinds of materials, including paper, in which PCB's show up.

There is also the question here, and I would like to know to what extent you have looked into it: the migration of PCB's from waste paper recycled into paperboard, which is used for cereal boxes—the FDA alleged at one time that PCB's mgirato into the cereal in those boxes.

Mr. REED. Mr. Oberstar, let me answer that question very directly; that is the responsibility of the Environmental Protection Agency. We have been very much involved in all areas of conservation in the last 5 years, including supporting recycling efforts in this country. But I would rather have Administrator Train address himself to that, because he is up to date on that specifically.

Mr. OBERSTAR. Do you have information about the levels of PCB in Lake Superior in contrast to Lake Michigan, which you cite as flushing rate of 50 years, Lake Superior has a flushing rate of 500 years?

Mr. REED. Yes, we have. We can give you that.

Mr. OBERSTAR. Are you working closely with the National Water Quality Laboratory, Duluth?

Mr. REED. Yes, sir.

Mr. OBERSTAR. They have done extensive work under the leadership of Don Mount, director of the lab?

Mr. REED. Yes, sir.

We have worked very closely with them and continue to work very closely with them, and the Great Lakes Fishery Committee is working closer and closer with them also.

Mr. OBERSTAR. What levels of PCB have you found and in what species of fish in Lake Superior?

Mr. REED. Give us a moment and we will give you those figures.

MONS 216613

Mr. LEGGETT. This is Lake Superior we are getting now?

Mr. OBERSTAR. Yes.

Mr. REED. This is on Superior.

Lake Superior, I have whitefish, lake trout——

Mr. LEGGETT. If you do not have that handy, you can provide that for our records.

Mr. REED. Yes, it would probably be easier.

Mr. WALKER. There is information on lake trout, lake whitefish, bloater, yellow perch, from the National Pesticide Monitoring Program Reference (48).

Mr. LEGGETT. Keep your voice up if you will.

Mr. WALKER. Wayne Wilfred, a biochemists from our Biological Laboratory in Ann Arbor, Mich., presented a paper at the Chicago conference that will be made available to the committee. Reference (52).

Mr. OBERSTAR. The main problem, though, from your research is Lake Michigan, which has the highest levels of PCB?

Mr. REED. Yes. Lake Michigan has the highest level.

Mr. OBERSTAR. And do you have information on the persistence of the PCB's in the food chain or is that something that EPA or FDA will present to us?

Mr. REED. Go ahead and take a crack at it.

Mr. WALKER. We have conducted a number of food chain studies, and we have conducted field surveys. A very recent one that might interest you was on the Mississippi River that involved Lake Pepin.

Mr. REED. Yes.

Mr. WALKER. We investigated the mayfly, an important fish food organism, and found that the PCB concentration in adult mayflys was directly correlated with the down river proximity to Lake Pepin. This is an important resting area for migrating canvasback ducks.

Mr. OBERSTAR. Yes.

Mr. LEGGETT. Mr. Oberstar, your time has expired.

I announce at this time it is necessary for us to vote on the conference report on S. 2174, the Railroad Reform Act, and I intend to come right back and I will recognize anybody who is here when I come back with questions. So it is going to be a race. And if nobody is here, we are going to be done with this witness, so—yes.

Mr. EMERY. Mr. Charman, since I will not be able to return after this vote, I would like to request permission to offer some questions in writing.

Mr. LEGGETT. Certainly; anybody who would want to offer questions in writing may do so and submit them and those answers will be incorporated in the report.

We will stand in recess until we get back.

[Whereupon, a short recess was taken.]

Mr. LEGGETT. The meeting of the subcommittee will resume.

Members who have not previously been recognized will be recognized for questions at this point.

Apparently, there are no members who have returned at this point, who have not asked questions and therefore I want to thank you very much, Mr. Secretary, for your testimony today.

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Undoubtedly, we will be recalling you on this subject matter. I would appreciate again your presenting to the committee all of your internal working documents that you do not consider beside the point, but particularly which are probative on this issue.

We are going to go over them with a fine-tooth comb and we hope mutually the results will be satisfactory to all parties concerned.

Mr. REED. We will give you anything we have and any person in the field working on this problem will be available to you and your staff.

Mr. LEGGETT. If you have any conflict, I would appreciate your servicing that conflict.

Mr. REED. If there is conflict I can honestly tell you that I will look into it and I can state that the service stands behind my statement today.

Mr. LEGGETT. Thank you very much.

At this point we are very privileged to have the distinguished Administrator of the Environmental Protection Agency, Mr. Russell Train, with us, and I want to welcome you, Mr. Train before the committee.

We have your statement which is of some volume, and I believe you have some charts.

We would like to include your statement as though you read it completely, and you can feel free to speak anyway you care to and if you wish to read it, you may do so.

STATEMENT OF HON. RUSSELL TRAIN, ADMINISTRATOR, ENVIRONMENTAL PROTECTION AGENCY; ACCOMPANIED BY DR. ANDREW BRIEDENBACH

Mr. TRAIN. Good afternoon, Mr. Chairman, and members of the subcommittee.

I am appearing today to discuss the problem created by the widespread presence of polychlorinated biphenyls, or PCB's, in the environment, and actions which the Environmental Protection Agency is taking to reduce or eliminate those problems.

Let me inject one general statement at this point, Mr. Chairman.

So far as I am concerned, there is absolutely no disagreement whatsoever that PVB's should be eliminated, all uses should be gotten rid of just as rapidly as we can.

This is not a matter really of debate, so far as I am concerned.

I think there are substantial problems as to just how we go about doing that, how we achieve that kind of goal.

Insofar as the goal is concerned, and our overall national policy, I do not think there should be any question about that whatsoever.

Mr. LEGGETT. To amplify your agreement, do you agree with all of these things that were stated by the previous witness and his supporting witness. so far as you are knowledgeable?

Are you knowledgeable of any disagreements?

Mr. TRAIN. I am not aware of any disagreements, though it is dangerous to say you agree with everything somebody else has said.

Mr. LEGGETT. I presume you heard everything he said.

Mr. TRAIN. I did not get here until after he had started his statement.

So far as I know, I am in agreement with what he has said.

We all had a crack at each other's testimony in advance, as part of the OMB's clearance process.

You can be sure whatever was said represents the administration's position.

Mr. LEGGETT. I understand.

Mr. TRAIN. And the objective of banning all usage of PCB's is what I called for some while before publicly in a press conference in December and the statement coincides with that policy, and I think I probably will read a fair amount of this statement today, Mr. Chairman.

Mr. LEGGETT. Now, that statement you referred to that you announced about Christmas time, that probably reached the Chicago Conference, is that correct?

Mr. TRAIN. That is correct.

I followed an analysis we made of the testimony at the Chicago Conference.

Mr. LEGGETT. Now, do you feel you would need legislation to ban PCB utilization?

Mr. TRAIN. Absolutely.

There is no question about that. There is absolutely no authority whatsoever for any general ban on uses of PCB or any other chemical other than through pesticide legislation.

Mr. LEGGETT. You have not prepared a bill as yet, inhouse?

Mr. TRAIN. Mr. Chairman, we submitted the administration's Toxic Substances Control Act in February 1971, which was written in my office, and I was then chairman of the Council on Environmental Quality.

That bill and in all of the various forms in which it has since been considered would so far as I am aware, in each case, provide ample authority for dealing with the PCB problem.

That bill passed the Senate once as you may know, and passed the House in different Congresses.

It passed both Houses in one Congress and then spent 9 months in conference where it died.

It is now being considered in the Senate Commerce Committee and the House Interstate and Foreign Commerce Committee, and we are exceedingly hopeful that the Congress will act on that legislation in this session.

That really is the appropriate legislative mechanism in my view for dealing with this problem.

Mr. Chairman, I think it would be a mistake to legislate just on PCB because before you are through legislating on PCB's we will have another chemical problem.

I think it much better to deal with this generically, as a class of problems, and utilize the toxic substances legislation to fill the gaps between pesticides authority, Food and Drug Administration authority, and OSHA and all the various bits and pieces of regulatory authority which exists at the present time.

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Mr. LEGGETT. But considering the fact that we apparently have a stalemate, what is your comment?

Mr. TRAIN. No. I would not say there is any stalemate, but I am hopeful that there will be more forward motion, perhaps.

I do not think there is necessarily a stalemate, Mr. Chairman.

Mr. LEGGETT. Have you presented testimony that you are about to give to me to the committee, and I suspect that would be what, the Interstate and Foreign Commerce Committee?

Mr. TRAIN. Interstate and Foreign Commerce, yes, sir.

Mr. LEGGETT. Have you presented this testimony to them?

Mr. TRAIN. EPA has testified on toxic substances before that subcommittee.

Mr. LEGGETT. How about the PCB's?

Mr. TRAIN. Not the House committee.

I testified on the Senate side.

PCB's have been referred to in that testimony, going back, I think, to 1971.

We have always considered PCB's as sort of a prime example of the need for toxic substances legislation, going back to the early 1970's.

I believe I am correct in saying that and I believe you will find references to PCB's in substantially all of the testimony which we have submitted to committee on toxic substances over the years.

Mr. OTTINGER. Would the gentleman yield with respect to that?

Mr. LEGGETT. Yes.

Mr. OTTINGER. I am very disturbed that EPA has taken that posture.

I think that it has been used as an excuse not to act.

Mr. TRAIN. I am not putting it forward as an excuse, Mr. Ottinger.

Mr. OTTINGER. Why was action not taken under the Refuse Act of 1899 when it was in effect and presently under section 504 of the Water Pollution Control Act which seems to give you clear authority to go to court to get an injunction to stop action which threatens health with respect to matters which are polluting the waters.

Mr. TRAIN. We are proceeding and all of this is in my testimony and we will get to it.

We are proceeding under the permit program to set a zero discharge limit for PCB's in every possible manufacturing case where we can do that.

Let me point out, however, that it is our best estimate that approximately 10,000 pounds of PCB's are entering the environment annually in the United States through what we might call direct discharges of that sort.

Some 35 million pounds a year are being manufactured, produced, and utilized every year in the United States and we would estimate roughly, although this is hard to get a handle on, that something like 10 million pounds are probably lost to the environment every year.

Of those 10 million pounds, some 9,900,000 pounds are not involved in the kinds of discharges which can be dealt with under the Federal Water Pollution Control Act.

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That is not to excuse any lack of aggressiveness in dealing with those 10,000 pounds, but I think the committee should be aware that no matter what utilization we make of the Federal Water Pollution Act authority you are not dealing successfully with the total problem.

Mr. LEGGETT. Very good.

It might be well if you proceed with your case in chief, Mr. Train, and then we can proceed to examine you.

Mr. TRAIN. I think I will probably be touching on most of the points and we can explore them further in questions.

PCB's are a significant hazard to human health and the environment. Laboratory tests show they cause reproductive failures, gastric disorders, skin lesions, and tumors in mammals. Their destructive effects on fish and wildlife are well documented.

However, the PCB problem is but one dimension of a much larger picture of environmental degradation by toxic chemicals. The picture is a dismaying one, as the numbers of different chemicals, amounts manufactured, the uses, and the accumulation in the environment each increase. Incidents of adverse effects on health or the environment have in recent years brought home to us that our ever-increasing use of toxic chemicals poses an ever larger and more hazardous threat to the environment.

Further, the history of governmental response to these incidents reveals that, while our authority to act and ability to develop some form of remedies have both improved, we are still fighting a rear-guard action, all too often in a position only to cure and not prevent. While one problem is being solved others are suddenly exploding, or incubating unknown to those who will have to deal with the unhappy results. In the meantime, those other factors—increased numbers, amounts, uses, and accumulation of chemicals—mean the environmental burden grows heavier and heavier.

Let me recall for you some of the warning signs of recent years.

Hexachlorobenzene is a chemical produced as a byproduct during the manufacture of several other chemicals. Relatively small amounts have been used as a seed dressing. EPA's concern was triggered with cattle grazing near a chemical wastes disposal dump in Louisiana were found to have levels of the chemical that exceeded the guidelines for meat.

The inadvertant mixing of polybrominated biphenyls, a fire retardant added to plastics with cattle feed has resulted in tens of millions of dollars in damages sought by farmers owning contaminated animals.

For many years we were unaware of the carcinogenic potential of the major industrial chemical vinyl chloride, and only now are we beginning to effectively contain that chemical.

Asbestos, which is used widely throughout our economy, is known to be a serious health hazard when inhaled. There remain many questions concerning the relative effect of several forms of asbestos fibers, as well as uncertainty as to the effects of ingestion. Finally, limited steps have been taken to reduce exposure to asbestos.

Gross population declines of several flesh-eating wild bird species in the United States have been caused by DDE residues resulting

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from DDT use. In 1969–70, for example, 1,852 nesting attempts by brown pelicans on Anacapa Island off the coast of California produced but nine young.

Reproduction of grebes was halted on Lake St. Clair, near Detroit. This was traced to mercury from chlor-alkalie plants in the region.

Dozens of dead blue and snow geese were found in Missouri in April 1974 during the bird's northward migration. These birds contained lethal levels of dieldrin in the brain although ths compound was not used locally. It was hypothesized that exposure occurred 600 miles to the south in rice growing areas.

These examples have one thing in common—damage to fish and wildlife or man from chemicals in the environment—but they differ in that EPA has authority to deal with some problems but not others. Thus, DDT and dieldrin are both pesticides and have no other uses; we have therefore acted under the Federal Insecticide, Fungicide, and Rodenticide Act to eliminate most uses.

Thus, we have controlled their adverse environmental effects, although the full environmental benefits may not be realized for some time, as the amounts already in the environment only gradually degrade or are removed from active biological cycles. The uses of hexachlorobenzene and mercury include pesticides, but pesticide uses are only a small part of those substances entering the environment.

We have no authority to control other uses and must rely on the Federal Water Pollution Control Act and the Clean Air Act to achieve partial control.

In the case of mercury we have succeeded in reducing the flow into the aquatic environment, which we judge to be the critical element. On the other hand, reductions in hexachlorobenzene reaching the environment have been due largely to voluntary actions by industry coupled with State regulation.

Asbestos and PCB's are illustrative of substances where our authority is limited to regulating air and water emissions and ambient levels—a particularly awkward situation in that persistent chemicals are occurring in different media and having different uses. PCB's offer an excellent example of the need for more comprehensive authority.

We now estimate that over the past 45 years, some 1.4 billion pounds of PCB's have been produced in the United States. Of that amount more than half has already entered the environment through discharges to the air, water, and land. Although some of this has been chemically or biologically degraded, the vast majority is contained in landfills, contaminated soils, bottom sediments of rivers, lakes, and coastal waters. Unfortunately, there appears to be relatively little we can do to remove PCB's from the environment, and it may be many years before some of our waters will again be suitable for commercial or recreational fisheries.

At present there are over 700 million pounds of PCB's currently in use or inventory in electrical equipment such as transformers and capacitors, hydraulic equipment, paper products, and other commercial and industrial products. Without preventive measures, es-

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sentially all of these PCB's could ultimately enter the environment and add to the existing soil, sediment, air and water concentrations that I have just described. A large part of this amount can be kept from entering the environment if effective disposal and use practices are followed. The remainder may be virtually uncontrollable and will result in a continuing addition to the environmental burden.

We are producing domestically 35 million to 40 million pounds per year. We are importing about one-half million pounds as a chemical, and an unknown amount in PCB-containing products.

Having mentioned imports, I might also comment, Mr. Chairman, that under existing law EPA has no authority whatsoever to control or ban or otherwise restrict imports.

Mr. LEGGETT. How many companies produce that 35 million to 40 million pounds a year?

Mr. TRAIN. There is only one producer in the United States.

Mr. LEGGETT. What is the name of that company?

Mr. TRAIN. It is Monsanto.

Mr. LEGGETT. How many plants do they produce that at?

Mr. TRAIN. I believe only one.

Monsanto, Mr. Chairman, I believe is listed as a witness today and could answer that question for you.

Mr. LEGGETT. Very good.

Mr. TRAIN. In 1975 we found that although PCB levels in most foods have steadily declined, PCB's remain present in our environment to a far greater degree and at higher levels than we would have thought. PCB's are highly persistent—more so than DDT—and bioaccumulate in the food chain. PCB contamination is pervasive in the environment. We have found high PCB levels—levels greatly exceeding FDA guidelines of 5 p/m—in fish taken from the Great Lakes, the upper Mississippi River, off the southern California coast, streams entering the Gulf of Mexico, in the Hudson River and other waterways in New York State. Specifically, high concentrations of PCB's have been detected in recent months in fish in Lake Michigan—up to 165 p/m—Lake Pepin—up to 40 p/m—and in the Hudson River—up to 350 p/m—although the average levels are significantly lower.

The presence of PCB's in these waters threatens to destroy commercial and sport fishing and associated industries, since contaminated fish are rendered unfit for human consumption and some fish become incapable of effective reproduction.

The evidence we have accumulated over the past 3 years has underscored our original concern over the toxicity of PCB's and over the potential health hazard posed by the presence of high PCB concentrations in water and in fish. It indicates that the most serious potential health problem from PCB's which we are able to identify today would come from eating fish which contain high levels of PCB's. Until environmental levels go down substantially, the human health threat from PCB's can only be controlled through not eating fish that exceed the limits prescribed by FDA.

With hindsight, EPA probably should have moved more aggressively to attack PCB discharges into the aquatic environment during the

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past several years. However, it is important to recognize that annual point source discharges from manufacturers of PCB's and electrical equipment containing PCB's—which represent the bulk of the discharges which we can effectively address existing authorities—probably total less than 10,000 pounds per year. At the same time we estimate that many millions of pounds of PCB's are probably entering the aquatic environment annually through other sources.

The PCB problem, and expected similar problems, can be effectively dealt with only through authority we do not yet have. Until the Congress passes toxic substances control legislation, we must rely to a large extent on voluntary actions by industry.

Let me explain.

In 1971, a Federal interagency task force was formed to address the question: What do we know and what should be done about PCB's in the environment?

At that time, PCB's had been in wide industrial use in the United States for about 40 years. Approximately 80 million pounds were being domestically produced annually.

Mr. LEGGETT. At what time was that?

Mr. TRAIN. This would have been 1971.

These PCB's were used in a great variety of commercial and industrial products. The task force concluded in 1972 that PCB's were highly persistent, could be found in all parts of the environment, could bioaccumulate to unacceptably high levels in fish, and could have serious adverse effects on human health.

The task force recommended—and the Federal Government adopted—a policy of urging private industry to confine PCB use to closed electrical systems, where there were no adequate and safe substitutes.

The Monsanto Co., the sole American producer of PCB's had already voluntarily restricted sales of PCB's to uses in closed electrical systems. The American National Standards Institute issued guidelines for industry on the use, disposal and labeling of PCB's. The Environmental Protection Agency announced that it would take steps to limit discharges of industrial effluents of PCB's into rivers and lakes.

The Food and Drug Administration established temporary tolerances for PCB's in several types of food and set limits on PCB contamination in food-packaging and in food-processing plants.

In addition, the General Services Administration stopped purchase of PCB-containing paper by the Federal Government and the Department of the Interior prohibited future use of PCB's in offshore oil operations. Other nations also took action.

I might say this was largely under issues put forward by representatives of the U.S. Government.

Under an Organization for Economic Cooperation and Development Council decision in 1973, member countries agreed to severely restrict uses of PCB's to certain closed systems; additionally, the OECD Council decision recommended that member countries further restrict PCB uses whenever possible.

At that time, we believed that these measures would take care of the PCB problem and enable us to continue to take advantage of the

unique properties of PCB's while protecting the public and the environment from exposure to hazardous levels of these chemicals.

Since 1971, annual U.S. sales of PCB's have been cut in half.

Today, however, we know much more needs to be done.

Despite the voluntary actions described, high levels of PCB's remain in and continue to enter the environment. Last November, EPA sponsored a National Conference on PCB's in Chicago to examine the latest scientific findings on PCB's environmental and health effects, and to identify needed control actions. As a result of new evidence indicating the urgency of the problem, I announced on December 23, 1975, these actions:

One: The immediate establishment of requirements to virtually eliminate PCB's from the process wastes of all manufacturers of PCB's and of capacitors and transformers that utilize PCB's. I instructed each of our regional offices to take steps to review and amend, if necessary, all wasto water discharge permits for such installations, and this activity is currently underway. By March 1, onsite surveys of 50 facilities will have been conducted and by April 1, the process of revising discharge permits for each of these facilities will have been initiated.

Two: The issuance of proposed regulations to control the environmental damage that results from spills of hazardous substances, including PCB's. EPA will move as rapidly as possible to finalize these regulations after a public comment period.

Three: A request to all State Governors asking them to examine carefully and to apply their authorities to deal with the PCB problem. We are particularly concerned about solid waste disposal problems and effluent discharges into municipal systems, and believe that the States can be particularly helpful in these areas.

Four: A request to the heads of selected Federal agencies asking them to inventory their uses of PCB's and PCB-containing materials and to develop plans to assure adequate management and safe disposal of these materials. Followup meetings with those agencies have been held, and detailed activities are being worked out.

As an example, Mr. Chairman, there was some talk earlier and you may want to talk about this further, about the use of carbonless copy paper.

This is not a Xerox type of operation, but for several years, for example, the Internal Revenue tax forms were made so that by writing on the front sheet an imprint was put through on the second sheet, even though there was no black carbon on the back of the first sheet.

This kind of usage was stopped back in 1971 or 1972, but these papers remained in large quantities in storage in the Federal Government, and I presume still do since the statute of limitations may not have yet run on some of these tax returns.

Our concern is that as the time comes for the discard of these paper stocks, they not simply be put into the recycling system as used paper and perpetuate the PCB's in commercial usage in that way.

Mr. LEGGETT. How would you suggest we destroy them?

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Mr. TRAIN. I suppose this is part of the work we have underway by way of research at the present time.

High temperature incineration is one of the alternatives that we are testing this spring on PCB's both in terms of the efficacy and the destruction of PCB's and also in terms of identifying any by-products and the effects of by-products that might result.

We cannot immediately say that is the answer, but it would seem to me this is a very possible answer.

Mr. LEGGETT. How about burying them in the limepits that we have out in Kansas?

Mr. TRAIN. I am not a great one for burying.

We have had enough concern over radioactive materials in that respect.

On the other hand, secure landfills that are sealed presumably would provide one avenue of dealing with a problem of this sort.

I would think that high temperature incinerating is probably the best way.

Five: Initiation of a number of other programs to find ways to eliminate the environmental discharges from other sources of PCB's including paper recycling operations, the investment casting industry, uses in hydraulic systems, and the disposal of electrical consumer products which contain PCB's.

In addition, during the past several weeks, I have met with representatives of more than 25 companies and trade associations involved in the manufacture of transformers and capacitors containing PCB's and urged their cooperation in seeking alternative approaches to PCB's.

Also, I have met with representatives of a number of electrical utilities, transit authorities, and railways who are principal users of electrical equipment containing PCB's to begin to develop additional ways to prevent PCB's from being discharged into the environment.

These consultations will continue in the months ahead until we have these aspects of the problem under control.

I might add at that point that I made abundantly clear at both of these meetings our commitment to a goal of eliminating all uses of PCB's in the environment as doubtless will be mentioned to you and since that time—I think within the last couple of days—the Monsanto Co. has announced its policy of phasing out all manufacturing of PCB's as rapidly as safe and effective substitutes can be developed.

Undoubtedly, you will want to explore that with them, Mr. Chairman.

These actions are based on our conclusion that, in order to stop the growth of the PCB threat, the Nation must phase out production and importation of PCB's and products containing PCB's, and assure to the extent possible that PCB's presently in use do not enter the environment.

But the important question is, how do we get beyond cure to prevention of this kind of problem?

I wish to assure the committee and I am sorry Mr. Ottinger has left but I would assure him if he were present, that I am not making

this statement with any purpose of diverting attention from PCB's or any possible derelictions on the part of any Federal agencies in dealing with the existing problem, but having said that, I also do not want to be diverted from what I consider is a very high priority concern on our part in terms of legislation.

Over the 5 years since Toxic Substances legislation was first proposod, an estimated 1,000 chemical compounds have been introduced into the commercial market each year. This has happened without systematic advance assessment of their potential impact upon public health or the environment.

I stress the word "systematic" because I know a number of companies, and I presume most responsible companies have testing systems of some sort.

All of the toxic substance control bills now before the Congress set forth essential authorities which would greatly strengthen our hand in beginning to control the problem of toxic substances entering the environment. The bills would enable us to keep track of chemical substances being manufactured, processed, or imported. We could require the testing of chemicals which appear to pose a risk to health or the environment and are not covered adequately by other laws. We could take immediate action against particularly hazardous chemicals.

There are other important authorities common to all the bills as well, but the point is clear; the bills would plug the serious gap in Federal authority revealed by some of the cases I have described today. The administration has announced its support for H.R. 7664 with amendments and I understand that a formal communication on this bill will be forwarded to the Congress in near future, that communication which the administration considers would strengthen and perfect that particular bill.

In conclusion, Mr. Chairman, I believe that the PCB's and similar problems can be viewed as warning signs. In the face of the burgeoning role of chemicals in the world, we must be able to take all due action to prevent the sort of environmental contamination which PCB's have caused. We cannot rely on half-measures and spotty, limited authority. We cannot wait until a risk-posing chemical is out in the economy before beginning to address the problems it presents. And we should not use our citizens and the nation's fish and wildlife resources to learn what the problems are.

Mr. Chairman, that concludes my prepared remarks. I will answer any questions you may have.

Mr. LEGGETT. Accepting your conclusion that PCB's pose a greater threat to fish than anything else we have yet determined, recognizing also that you have an omnibus interest in the great number of matters as do many Members of Congress, but also recognizing the limited scope of the jurisdiction of this Committee and our responsibilities and further, the hiatus in enactment of adequate legislation and considering the fact that you are in total agreement with the prevous witness that PCB's should be totally banned, would you support a bill that could be jointly drafted by agencies and this Committee that would totally ban the manufacture and import and uti-

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lization in industrial products of PCB's, say in either 6 months or a 1-year time period?

You can answer that yes or no.

Mr. TRAIN. I would doubt very much that the committee would want to adopt a bill of that sort and I doubt whether the previous witness would support a bill of that sort.

Mr. LEGGETT. All right.

Why do you say that?

Mr. TRAIN. While I believe that broader toxic substances legislation is the proper vehicle, I certainly would have no basis for opposing legislation giving EPA a specific authority with respect to PCB's which it would otherwise have through the toxic substances legislation.

But I would not believe it would be wise for the Congress to specify a deadline of 6 months or 1 year for a total ban on all uses of PCB's.

The PCB's, for example, are used at the present time among other things in transformers, in engines on railroad trains, and on subway systems.

They were introduced because of the large number of fatal fires in tunnels and in subway systems due to the flammability of the substances such as mineral oil and others which had been used prior to PCB's.

I am not here as a defender of PCB's, but I think we must realize that there are very substantial health and safety tradeoffs if we suddenly eliminate them without being assured that there are effective and safe substitutes.

Mr. Chairman, that is the problem.

There may well be some uses—and I think we may have identified some of thees already—where safety considerations are probably not sufficiently significant as to warrant continued use of PCB's.

I have yet to hear from any utility operator and the utility operator would have no self-interest in continued use of PCB's.

But I have yet to hear anyone tell me there is an effective substitute for all uses in transformers and capacitors of PCB's.

They are only used in a small fraction at the present time.

Mr. LEGGETT. You have some 40 companies on this subject matter and also you have had your symposium in Chicago.

Outside of the transformers and vehicles that go through tunnels, have you isolated anything else that would be required or be perhaps subjected to a tradeoff?

Mr. TRAIN. All the capacitors in the country which are used in fluorescent lights and television sets and I believe in refrigerators and air-cooling systems are very, very widely used throughout American industry.

I would say at the present time an outright ban on PCB's would be tantamount to turning the electricity off in this country within a very short period of time and I do not think you are ready to do that, Mr. Chairman.

Mr. LEGGETT. Whatever the previous witness said to the contrary, you would not support it?

Mr. TRAIN. I did not hear him say anything to the contrary.

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He said it should be banned as rapidly as possible and I totally agree with that, but I think you have to realistically understand the nature of the problem involved.

The PCB's are a highly valuable material that has a very high degree of flame resistance which is one reason why they are so desirable.

It is not an economic issue so much as it is a human safety issue.

Mr. LEGGETT. Let me read to you, and this is Nat Reed talking, our previous witness, and he said:

> The insidious character of PCB's is now obvious and presents a serious problem to all of us.
>
> This pollutant affects the very core of State and Federal resource management programs throughout the United States.
>
> We urgently need an effective program to control rapidly eliminating the release of PCB's into our environment because of my deep concern with the problem. I support a national ban on all domestic and imported PCB's.

That is unqualified.

Now, I ask you, do you agree with that statement?

Mr. TRAIN. I certainly do as a goal, Mr. Chairman, but I know Mr. Reed does not support and could not support a national ban on PCB's within the kind of period you described.

If we have some kind of happy breakthrough, yes, because it would be possible to ban then.

Mr. LEGGETT. His next statement is, and I quote:

"We must have as our goal the elimination of PCB's from the environment of the United States as rapidly as possible."

Mr. TRAIN. And that is my position, Mr. Chairman.

Mr. LEGGETT. Now, the implication from that is that you achieve the goal, you know, of safeguarding the environment by the immediate national ban on all domestic and imported PCB's.

He goes on to state:

"I recommend that the critical or essential use of PCB's in transformers or capacitors be immediately and critically reviewed in light of current potential replacement products."

That hedges your previous statement.

Mr. TRAIN. That is my position, Mr. Chairman.

Mr. LEGGETT. All right.

So, if we pass a bill out of this committee, recognizing that there was an emergency, a national emergency, and we do not know when the toxic substances bill will get to the President or whether or not he will sign it and limit our ban to include limitations as described here, would it have the support of your agency?

Mr. TRAIN. Yes, I would want to see, obviously, the final language of the bill to assure myself essential uses are allowed, but in principle, I have no objection to it, and would support it.

I still urge you—and this was the reason we developed the toxic substances legislation in 1970, because the mercury scare attracted great public attention, and I recall getting my staff together and saying, look, we cannot deal with these toxic chemical problems on a case-by-case, ad hoc basis; we need some general authority.

That is still the case, Mr. Chairman, and I promise you before you get through passing a bill on PCB's, you are going to have another toxic substance problem arise.

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We have had several vinyl chloride cases, a good many of them requiring toxic substances control legislation, but having said that I certainly cannot object to the PCB's authority you propose.

Mr. LEGGETT. Very good.

Mr. Studds, any questions?

Mr. TRAIN. The fluorocarbon problem is another ideal example posing serious questions about the ozone, the integrity of the ozone layer and the introduction of excess ultraviolet radiation on human populations, and the adverse health effects that would follow from that.

That is another problem that we have right now, Mr. Chairman.

Mr. LEGGETT. Does that affect fish?

Mr. TRAIN. The expert here says no.

Mr. LEGGETT. Very good.

Considering the fact there is a conflict we cannot act on that statement.

Mr. TRAIN. You have our balanced answer on the need for general toxic substances control authority.

Mr. LEGGETT. Mr. Forsythe?

Mr. FORSYTHE. Mr. Chairman, I would have to take issue with you on passing that kind of bill because we would be in real trouble before we got it passed.

Mr. LEGGETT. What we need is a good partisan scrap on this committee now and then.

Mr. FORSYTHE. Just once in a while, Mr. Chairman.

I thank you, Mr. Train, for your statement, and really I do not know that I have too much in the way of questions, except to explore one area with you.

I asked Mr. Reed about this area of coordination in research. I am a bit concerned that you may get two or three agencies that are going to have a piece of the action.

Are you working closely so that you are not duplicating efforts and are maximizing research efforts.

Mr. TRAIN. Yes.

In fact, I think we are probably overstretching, if anything, the limits of existing authority in order to find as much of an answer to this problem as we can.

We are working very closely with the Fish and Wildlife Service, the Food and Drug Administration, Health, Education and Welfare, generally, and GSA on government procurement policies and other agencies, including the States that have some role in this in terms of the health research that was referred to in questions earlier.

There is an interagency task force headed by the Food and Drug Administration on the health effects of PCB's and PBB's.

This includes a subgroup on chemistry, one on metabolism, one on chemical toxicity, one on animal toxicity, carcinogens and human exposure among others.

The task force is pulling together all the Federal agencies involved with this issue so that we in EPA have a very large number of research projects underway in this area.

I would say, Mr. Forsythe, there is a very high level of cooperation.

It might be late in coming, but as things stand right now it is very good.

MONS 216627

Mr. FORSYTHE. You mentioned the problem of the government holding the paper and what are we going to do with it, have you been able to stop the government from procuring other PCB contaminated materials?

Mr. TRAIN. To a very great extent.

Mr. Forsythe, the only new uses in the economy are these closed system transformers and capacitors.

The paper usage has stopped some time ago.

The use in hydraulic equipment is primarily in mining. I believe that is not a continuing use and is another example, Mr. Forsythe, of interagency cooperation with the Bureau of Mines.

It is being used to a limited extent.

I think it is primarily utilized by the Joy Manufacturing Co. in their mining equipment for safety reasons, below ground; this is an example of the use for PCB's for safety purposes.

There, the Bureau of Mines has the lead in working with the industry to try to see if substitutes can be developed, to have that use phased out.

Transformers and capacitors are, of course, found throughout the Federal Establishment. I would imagine they are found extensively in military equipment of various kinds, in the Navy and in the aircraft, but much more widely all through the government.

Let me introduce Dr. Briedenbach, our Assistant Administrator of the Environmental Protection Agency for Water and Hazardous Material.

I should have introduced him at the beginning.

My understanding is, we have been having meetings with other agencies on this aspect of the matter.

Mr. FORSYTHE. It is encouraging to know that the government may be out front in trying to eliminate the uses of PCB's.

Mr. TRAIN. You might be interested to know that in my discussions with the utility industry in which these transformers are extensively found, it is my impression that the industry works under very excellent housekeeping rules insofar as PCB's are concerned; that for example those people who work on changing the material within a transformer that contains PCB's wear special clothing.

Mr. Forsythe, if there is a spill it is wiped up.

Rags and clothes are collected and kept in a special sealed container.

Any used amounts of PCB's that are removed from the transformer are again stored and kept and not disposed of and then, finally, all of these used PCB's and waste PCB's are returned generally to the Monsanto Co. for reprocessing under contract.

Now, I will say I was really quite impressed with the housekeeping standards, which doubtlessly are not perfect, but in my opinion at least, a very good job was being done.

Mr. FORSYTHE. I understand there are many other reprocessors and there is the problem of some large amount of PCB's that may not be flowing through this chain of responsible usage.

Is that a correct assumption on my part?

Mr. TRAIN. Yes.

Our estimate is that there is about 500,000 pounds a year of PCB's as such, imported into the United States.

MONS 216628

We have in EPA, working through the Bureau of Customs, endeavored to identify each of the importers of this material and then proceed to trace through channels of distribution those PCB's from the importer to the ultimate use, and in that fashion, try to get a fix on where these things are going and how they are entering the environment.

A major use of the imported PCB's is in the investment-casting process.

That is mentioned in my statement and we are or will shortly be exploring this particuar use to see whether substitutes can be utilized for the small number of users.

Mr. FORSYTHE. Do imported PCB's include that which is already in the product or is it the raw material?

Mr. TRAIN. I would imagine some enters in capacitors.

We do not know.

The 500,000 pounds I mentioned is a raw PCB's product, as I mentioned.

To what extent it comes in, in other products, we have no other information.

There is no indication of PCB's being in the product and a customs inspector would have no way of knowing.

Mr. FORSYTHE. Do you have any idea whether that is a large element of the problem.

Mr. TRAIN. Well, foreign countries participating in the OECD joined with us in the adoption of national policies to use PCB's only in closed electrical systems.

I would hope that this is the major use in most foreign areas as well as here in the United States.

I cannot give any assurance of that, Mr. Forsythe.

Mr. FORSYTHE. Just one more question, Mr. Chairman.

An Ad Hoc Committee created by CEQ and the Federal Council on Science and Technology reviewed Federal ecological research in 1973 and found serious deficiencies and recommended the creation of a national ecological service, which would investigate responses of individual species to specific pollutants and integrate technological data, to design technological problems requiring such attention.

In your view, has creation of such an institute been useful in reducing the effect of toxic substances on the environment?

Mr. TRAIN. I was chairman of the CEQ at that time, Mr. Forsythe.

I would imagine I supported that study.

Mr. FORSYTHE. Thank you, Mr. Train.

Thank you very much, Mr. Chairman.

Mr. TRAIN. However, I do not think that proposal ever received the support of OMB.

Mr. LEGGETT. That would cost money.

Mr. Studds?

Mr. TRAIN. Do not overlook the importance, Mr. Chairman.

I am sure that you do not overlook the importance of the monetary considerations.

Mr. STUDDS. Mr. Train, at the end of long working days in Washington, especially when it has been raining, I generally reach the conclusion that we are all doomed and I take it you share that conclusion.

MONS 216629

It just occurred to me, and let me ask you sort of as an aside, are all noncarbon papers, is that the phrase, do they contain PCB's?

Mr. TRAIN. The answer is no, but I cannot expand on it, and maybe you would like to have an expert answer.

Mr. STUDDS. The reason I ask, all of our travel vouchers are that way, Mr. Chairman, from the House Finance Office.

Mr. LEGGETT. Just sign them.

Do not touch them.

Mr. TRAIN. Well, that suggests something to me, that is, we might include the Congress in our interagency exploration of procurement policies.

Mr. STUDDS. I thought you might suggest we stop traveling.

May I ask you, sir, if my mathematics are correct, only one-tenth of 1 percent of current discharges in the environment of PCB's constitute a direct identifiable point discharge, 10,000 out of 10 million?

Mr. TRAIN. That is roughly correct.

Mr. STUDDS. Can you elaborate a little bit on how the 99.9 percent gets in that is nontraceable to discharges?

Mr. TRAIN. Yes.

One of the major sources insofar as we are able to identify these, is landfills.

Mr. STUDDS. That is to say, dumps?

Mr. TRAIN. Dumps, even just mixed municipal waste, the disposal sites that have been a repository for both domestic and commercial wastes, and special landfills used, let us say, by a manufacturer.

For example, the landfill at the town where the General Electric plant is located on the Hudson River, is a municipal landfill, municipal dump, and we estimate it may have something like one million pounds of PCB's buried there.

Now, you have to take estimates of this sort with a pretty large grain of salt.

We are doing the best we can to arrive at intelligent estimates.

We are taking core samples of that dump to try to arrive at a better fix, but I do not know that that is so important.

The important thing is that there is no doubt that that is a very important location for dumping PCB's and when it rains you get leaching into the environment from that source.

Mr. STUDDS. And that has been going on for 45 years.

Mr. TRAIN. Undoubtedly been going on for 45 years. I would say that this is a kind of practice that we have some hope of getting a handle on.

Mr. STUDDS. You mentioned, Mr. Train, on page 6, effective disposal and use practices.

Do we have effective disposal and use practices which you prefer?

Mr. TRAIN. We do not, nor do we have the authority to require these.

We can develop guidelines in EPA for solid waste management and these guidelines are binding on other Federal agencies if we can enforce them.

As to the State and local governments and the private sector generally, they are only guidelines.

We are developing those guidelines as rapidly as we can to assist in dealing with this PCB problem.

We are also working, and I believe I mentioned this in my statement, with the American National Standards Association, on procedures for disposal and general housekeeping procedures.

Knowing that organization, I would feel fairly confident that they will do a very good job at this and we are working closely with them.

Mr. Studds, we have had a number of meetings already and it would be my expectation that we develop these new standards, we will embody those standards in guidelines which we will issue, which will then, as I say, have binding force on the Federal establishment and some effect on the rest of the world.

Mr. STUDDS. One final question, Mr. Chairman.

Mr. Train, you were quoted some 2 months ago in the New York Times of November 20, saying that research conducted thus far by the EPA had uncovered PCB's in the drinking water of Illinois and Indiana, and it was suspected the chemicals were in the drinking water of Escondio, Calif., Bridgeport, Conn. and New Bedford, Mass.

Can you tell us anything with precision why those suspicions exist and is there any documentation for it?

Mr. TRAIN. Well, I assume it is more than a suspicion, Mr. Studds, if it is based upon actual water samples.

Mr. STUDDS. You made a distinction.

If you are quoted correctly, you said they have been uncovered in the first two instances and it was suspected in the latter three.

Mr. TRAIN. I cannot explain that.

I will be happy to find out why there is a suspicion of that.

The first two in Illinois and Indiana are based upon actual EPA measurements.

The last three we have been given industry measurements indicating levels of PCB's in this water.

We have not yet confirmed those ourselves.

I would say it is more than a suspicion of this being correct.

Mr. STUDDS. I understand you are in the process of attempting to confirm that suspicion, if you will.

I know we have communicated about that before.

Mr. TRAIN. That is correct, sir.

We are also, as you probably know, including PCB's in our nationwide sampling of some 112 communities for determining levels of organics in the drinking water.

Mr. STUDDS. What step do you take next, once in the first two instances, in the first two communities in Illinois and Indiana, you know there are PCB's in the water. Do you begin testing the animals that drink the water?

Just what do you do?

Mr. TRAIN. The main thing is to try to find out what the source is.

We also have other research going on trying to determine the dose/response levels of PCB's on humans.

This is doubtlessly going to be fairly lengthy. We do not really know what the risk levels are for human beings drinking the water.

MONS 216631

We really have no data of this sort whatsoever, so I think it would be premature to require the installation of a treatment system at this point, until we know something more about it.

Mr. STUDDS. Thus, if we believe, as I understand you suggest, only one-tenth of 1 percent of it comes from site-specific sources anyway, is could be a very difficult task.

Mr. TRAIN. Dr. Breidenbach would add to that.

Dr. BREIDENBACH. You are touching on our drinking water authority and there are a number of things going on there which would be helpful to the community: The setting of standards for drinking water, research to develop adequate treatment protocols to remove organics from the water and the water treatment process.

Those things are going on in separate parts of the organization.

Mr. STUDDS. I would assume if we know there is this quantity in the environment, it is beginning to get into the drinking water, for all we know it may be much more widely spread in drinking water, then we might want to accelerate the research on the humans who drink that water.

Dr. BREIDENBACH. Exactly.

We are moving rapidly to come up with the systems for the removal of organics from drinking water and this is a requirement under the Safe Drinking Water Act.

Mr. STUDDS. Thank you, Mr. Chairman.

Mr. LEGGETT. Mr. Oberstar?

Mr. OBERSTAR. Thank you very much, Mr. Chairman, and Mr. Train, let me compliment you for a very fine and comprehensive statement, and for the very alert and early action of EPA on this very serious and far-reaching problem.

I would also like to take this opportunity to commend the National Water Quality Laboratory in Duluth, Minn., and their fine scientific staff under the direction of Don Mount for the splendid work they have done in providing the scientific basis for the testimony presented and the work EPA has done.

Mr. TRAIN. The laboratory has taken a leading role in all of this and Dr. Mount whom you mentioned earlier has done an outstanding job in directing that laboratory for the agency.

As you know I visited that laboratory and we are very proud of it. It is an excellent facility and we are very pleased to have it.

We just wish the problems were not so difficult.

Mr. OBERSTAR. The Minnesota Pollution Control Agency has also been working on the problem of PCB's.

That agency has assembled an interagency task force on PCB's which for most of 1975 conducted continuing investigations and studies of PCB's located in Minnesota's waters, particularly Lake Pepin, on the Mississippi River, and its tributaries.

I would like to submit for the record a 2-page resolution adopted by the Minnesota PCA of July 1, 1975, including the resolved clauses that the Minnesota Pollution Control Board hereby supports a Federal ban on the sale and use of PCB's.

It supports your and Secretary Reed's testimony.

Mr. LEGGETT. That will be included in our record at this point.

MONS 216632

[The document referred to follows:]

CERTIFICATE OF MINNESOTA POLLUTION CONTROL AGENCY'S AUTHORIZING RESOLUTION

I, Peter L. Gove, do hereby certify that I am Executive Director of the Minnesota Pollution Control Agency, and that the attached is a true, complete and correct copy of a resolution adopted at a meeting of the Board of the Minnesota Pollution Control Agency duly and properly called and held on the 24th day of June, 1975, that a quorum was present at said meeting, that those present unanimously voted for the resolution and that said resolution is set forth in the minutes of said meeting and has not been rescinded or modified.

In witness whereof, I have hereunto subscribed my name this 25th day of June, 1975:

PETER L. GOVE,
Executive Director.

STATE OF MINNESOTA, MINNESOTA POLLUTION CONTROL AGENCY, JUNE 24, 1975
RESOLUTION

Whereas, the Agency is charged with the administration and enforcement of all laws relating to the pollution of any waters of the state as given in Minnesota statutes of 1971, Chapter 115.03, and;

Whereas, no sewage, industrial waste or other wastes shall be discharged into any of the interstate or intrastate waters classified as fisheries and recreation so as to cause any material change in any other substances or characteristics which may impair the quality of interstate or intrastate waters or the aquatic biota in any manner render them unsuitable or objectionable for fishing, fish culture or recreational uses as per Minnesota Pollution Control Agency regulations WPC 14 and 15, (1973 Supplement), and;

Whereas, significant concentrations of persistent organic compounds known as polychlorinated biphenyls (PCBs) have been identified within the Mississippi River near the border areas of Minnesota-Wisconsin known as Lake Pepin, and;

Whereas, the United States Food and Drug Administration has enforced the "Action Limit" of five (5) parts per million total PCBs on several shipments of commercially caught rough fish from the Lake Pepin area resulting in voluntary disposal of the fish by the industry, and;

Whereas, as a result of the above, commercial fishing operations have temporarily been ceased in the Lake Pepin area, and;

Whereas, on May 27, 1975 Dr. Warren R. Lawson, Minnesota Commissioner of Health advised the public to limit consumption to no more than one meal per week of fish taken from the Mississippi River from the Minneapolis-St. Paul metropolitan area and lower Lake Pepin, and;

Whereas, a major study completed by Dr. J. R. Allen of the University of Wisconsin (1974) indicated short-term toxicity to a low-level exposure to PCBs in nonhuman primates, and this study and others suggests that there exists a significant potential for harmful effects to humans, and;

Whereas, and as a result of the above actions significant environmental effects on the aquatic life and economics of commercial and sports fisheries as well as tourism have occurred, and;

Whereas, the Great Lakes Environmental Contaminant Survey (GLECS) conducted yearly by Michigan's Departments of Natural Resources and Agriculture, the U.S. Food and Drug Administration—Detroit Region, and the Great Lakes Fishery Laboratory has determined that Lake Superior trout collected near Isle Royale are showing a pattern of elevated PCB residues similar to Lake Michigan; now therefore be it

Resolved, that the Minnesota Pollution Control Agency Board hereby supports a Federal ban on the sale and use of PCBs.

Mr. OBERSTAR. Thank you, Mr. Chairman.

Mr. Train, to your knowledge, is the PCB chemical biodegradable?

Mr. TRAIN. It is very long lasting and very persistent.

I would assume at some point, ultimately, it would break down.

Mr. OBERSTAR. Its half life would be very long?

Mr. TRAIN. It certainly would, far longer than DDT.

There are different PCB's and there has been some testimony earlier today that some tend to be somewhat more persistent than others.

I think it depends somewhat upon the chlorine structure of the molecule, but I do not know that there is any significant difference for the purposes of either the committee or ourselves.

If we could find a given PCB which is somewhat less persistent than another one and would provide the same benefits, I would say, you know, all things being equal, it should be substituted.

But I do not think you can look to the lesser persistent PCB's as a solution to the problem.

Mr. OBERSTAR. So far the testimony has dealt with the PCB's in animals, fish primarily.

Is there any evidence, given this long persistence, that plants absorb PCB's and that they, in turn, are eaten by fish and carried along the food chain?

Mr. TRAIN. The answer that we have is that they may be absorbed to some extent by plants, both aquatic and terrestrial, perhaps not to a very great extent.

Mr. OBERSTAR. That would be a remote concern because your primary interest is fish, which are directly eaten by humans and the more direct impact on the food chain there?

The reason I raised the question is, that at some point the PCB's settle into the water and get into the river bottom and the Corps of Engineers has an extensive dredging program in the Great Lakes, and in the Mississippi River.

When the dredge spoil is lifted out of the water presumably the PCB's are redistributed and reintroduced into the waterway and each time there is dredging, you have a reintroduction of the PCB's problem.

Would that be a fair statement?

Mr. TRAIN. That is correct.

We are very much aware of this problem, and we do not know what the answer is and here again, I think it very important that the committee be fully aware of this dimension of the problem.

I have no doubt that harbors and river mouths that would normally be the subject of dredging activity to maintain navigation depths have large amounts of PCB's in their sediment and the dredging is going to stir up and redistribute those PCB's in the aquatic environment.

Likewise, as those dredge spoils are taken off somewhere and disposed of by dumping either in water or on land, a certain amount of the PCB's are going to go with them and they will leach out from there.

We have extensive discussions—I do know that it has proceeded much beyond that, but they are going on—with the Corps of Engineers, on this very problem.

Mr. Oberstar, it is a shared problem. Our concern for water quality and their responsibility for dredging is a shared problem and what the answer is going to be, I do not know.

MONS 216634

Mr. OBERSTAR. Is there any effective means of filtering PCB's out of drinking water?

Mr. TRAIN. Carbon filtration, I believe, is reasonably effective, so far as I know, although we are continuing to do experimental work to verify that.

Mr. OBERSTAR. You would not use asbestos filters?

Mr. TRAIN. No, sir.

I do think that carbon filtration probably represents a way of inpipe control of PCB's.

How practical that is in terms of a large flow of water, I am just not sure.

Doctor, do you wish to comment?

Dr. BRIEDENBACH. We do not have the exact data on this yet, but the type of the PCB's chemical structure, its degree of chlorination would suggest that its chances to be absorbed on carbon are rather strong.

It remains to be tested before we can recommend it.

Mr. OBERSTAR. It could be that critics bordering on Lake Michigan, would have to filter their drinking water drawn from Lake Michigan at some point if the presence of PCB's were significant.

Mr. TRAIN. That is conceivable.

I would not want to predict at this point, but PCB's do bioaccumulate not only in fish but in human beings.

There is an awful lot of stuff that bioaccumulates in us.

You and I have high levels of DDT, hexachlorobenzene and dieldrin, as well as other chemicals.

Mr. STUDDS. Mr. Chairman, the gentleman made reference to the Minnesota PCA.

Is that an earlier version of the PCB?

Mr. LEGGETT. What do those initials stand for, Mr. Oberstar?

Mr. OBERSTAR. Pollution Control Agency, Mr. Chairman.

Mr. LEGGETT. We would like initals explained in the committee.

Mr. TRAIN. Let me add, Mr. Chairman, but not on Mr. Oberstar's time.

Mr. LEGGETT. On whose time?

Mr. TRAIN. My own, if you will give it to me.

In view of the interest of this committee in marine problems and fishery problems, you might be interested to know that my information is that a few samples with respect to whales in the Pacific and specifically the sperm whales indicate levels of up to 10 parts per million of PCB's in the blubber, that is, the fatty tissue.

Now, that might be a interest to our Japanese friends who are exceedingly sensitive to PCB's.

Mr. STUDDS. Not in the scrimshaw, however.

Mr. LEGGETT. Very good.

Well, that is a very interesting observation.

I am sure it will help us.

Now, we will hear from the PCB's peninsula in Michigan, Mr. Ruppe.

Mr. RUPPE. Thank you very much, Mr. Chairman.

I regret, Mr. Train, that I was unable to be here due to a conflicting series of meetings.

I do have an opening statement that I would make at this point, Mr. Chairman.

STATEMENT OF HON. PHILIP E. RUPPE, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF MICHIGAN

Mr. RUPPE. I am pleased that the subcommittee has taken the initiative to examine this complicated and difficult problem. The introduction of toxic chemicals into the environment has been a source of continuing concern to the people of northern Michigan and to the entire Great Lakes region. I certainly look forward to the testimony the subcommittee will be hearing on this extremely important question.

Polychlorinated biphenyls which, along with others such as DDT, PBB, and Dioxin possess a very interesting set of characteristics. First, they are fat soluble. In other words, if you are looking for concentrations of such chemicals, you do not look in the inorganic work, but in living organisms such as fish, poultry, and human beings.

Second, these compounds are very poisonous. The Food and Drug Administration currently indicates that PCB concentrations of 5 parts per million in food can be harmful to people.

Furthermore, concentration levels as low at 0.3 parts per million are set for similar chemicals by FDA with which we also have little known environmental experience.

Third, such chemicals are extremely persistent. Because living organisms have little experience with them, it takes a very long period of time to break them down.

In fact, some evidence has existed over the past few years to indicate the half-life of DDT and its relatives may be immortal. Fourth, such chemical compounds are very mobile

They move throughout the environment very quickly and can, as we found in Michigan, with polybrominated biphenyls, become widespread rather quickly.

Finally, to put the "topper" on it, these compounds tend to concentrate as they move up the food chain. This provides an important source of concern for all of us because human beings feed high off oceanic and fresh water food chains.

In my view, there is no more serious threat to our fishery resources and thereby to our citizens than that emanating from PCB's.

On the Great Lakes, the PCB problem is potentially the most devastating blow to sports and commercial fishing since the introduction of the lamprey eel.

The problem, as we will no doubt learn from the witnesses scheduled to appear, is not confined to the Great Lakes, but is present in a great number of streams and waterways in every section of the country.

This, in my view, is a serious definite health threat to extremely large numbers of our citizens. I hope the committee will insist on hard, clear answers from those who manufactured the chemical and those whose responsibility it is to regulate the introduction of chemicals into the environment.

For example, I will be very interested to learn from both the Environment Protection Agency and the Monsanto Co. why it took until only last month for these two concerns to take action against the harmful effects of PCB.

68-706—70——5

MONS 216636

Yesterday, in a curious piece of timing, the Monsanto Co. announced it would phase out the production of PCB. Late last month, EPA announced an "emergency," and largely voluntary program to stem the introduction of PCB into the environment.

Yet, Mr. Chairman, PCB and one of its harmful effects was first identified in several water resource areas in 1970. In each succeeding year since, there have been recommendations for stopping PCB and its deleterious effects.

I will want to know, and hope the committee will insist on knowing what it took, until the committee called these hearings, for action on the part of both EPA and Monsanto.

Many members of the subcommittee may already be aware that in Michigan we have had a scare with PBB's, a chemical closely related to PCB's. In early 1974, large quantities of polybrominated biphenyls, a compound used as a fire retardant, was accidentally placed in the feed additives regularly provided to hundreds of farmers in the State.

Eventually, scores of dairy herds had to be quarantined and finally destroyed and the impact upon people who consumed large quantities of the contaminated dairy products is still not known.

I simply do not want what was an accident in Michigan with PBB to become a permanent phenomena with PCB's because of their continuing large-scale introduction into the Great Lakes environment.

I am also hopeful the committee will address itself to the question of how PCB was detected. Was it because there is an ongoing, cooperative effort among Federal agencies to test Great Lakes and other waters for toxic chemicals? Or was the presence of PCB discovered by accident?

If an effort is not underway to systematically and regularly test water supplies, such as the Great Lakes, and fishing resource areas for the presence of poisonous chemicals, then this committee should seriously consider establishing such a program.

Mr. Chairman, the committee could also be of great service to a large number of Americans who depend on their government for assistance in protecting them against threats to public health.

I am specifically suggesting that the committee ask the expert witnesses who come before it to look at ways of flushing PCB and other similar chemicals, like polybrominated biphenyl, from the human system.

Now that Americans know the problem of PCB ingestion by large numbers of citizens exists, our people will want to know what their government is doing to effectively advise them on its harmful effects.

Are there special diets which should be followed?

Are there special periods during human growth which are especially critical for PCB activity?

And, what can the Federal Government do to stop the spread of PCB and other toxic materials?

In my view, the people of this country will not treat us lightly, nor should they, if we fail to exhaust every avenue that could lead to a lessening of this and other chemical health threats.

Mr. Chairman, it is the paramount responsibility of government at every level—in Congress, in the executive branch and in the States, to protect the public health.

Finally, I would caution the members of the subcommittee that we ought not get involved in a highly technical and scientific debate over various aspects related to such chemicals.

It must be our purpose to examine the degree of adverse impact, assess the role of the responsible Federal agency involved, and thereby, insure that appropriate action is or will be taken to halt the buildup of these toxic compounds in the marine environment.

Mr. Train, I understand from your previous comments that you feel that EPA could not ban PCB's at the present time.

Do you have the authority, and if you do, have you chosen to implement your authority to either prohibit or control the discharge of PCB's in the environment or into waterways and the like?

Mr. TRAIN. To recapitulate some of what I have said and then to add to it, of the 35 million or 40 million pounds of PCB's that are introduced into use annually, we suspect that around a quarter of that, probably 10 million pounds or so escapes annually into the environment and of that about 10,000 pounds or one-tenth of 1 percent ends up in the form of a pipe discharge, a controllable pipe discharge.

Mr. RUPPE. Like perhaps the GE dischargers?

Mr. TRAIN. That is right.

We estimate on an annual basis their discharges at that plant at present time are probably around 1,000 pounds.

That, Mr. Ruppe, is a ball park figure. They are, of course, one of the largest manufacturers in the country.

We estimate on a national basis about 10,000 pounds is discharge of that sort. We are getting at that through our permit program at the present time and I directed our regional headquarters last December to send their surveillance and analysis teams out to all manufacturing and producing locations of PCB's which we identified, close to 50, and to make onsite inspections which they are to complete by the end of February and revise all permits as a result of those inspections, with the goal of achieving zero discharge.

Mr. RUPPE. How frequently can you revise the permits when they become due?

How often is that?

What about a permit that might be 5, 10, or indefinite?

What do you do in a situation like that?

Mr. TRAIN. I am informed that we can revise it at any time.

Mr. RUPPE. You can, no matter what the period of the permit?

Mr. TRAIN. Yes.

Mr. RUPPE. You intend to do that?

Mr. TRAIN. We certainly do.

Mr. RUPPE. Well, now, that takes care of part of this discharge. Perhaps I am duplicating.

How about the bulk of the 10 million discharged into the environment?

Are there any ways of pinpointing where it does so the discharges can be identified and controlled in that sequence?

Mr. LEGGETT. So that our record is straight, is it established it is 10 million pounds discharged into the environment?

Mr. TRAIN. I do not think I could prove that.

I believe that is our best estimate at the present time.

Mr. LEGGETT. That is by direct discharge?

Mr. RUPPE. That is all discharge, is it not?

Mr. LEGGETT. By all dischargers?

Mr. TRAIN. I am informed that that estimate of 10 million pounds represents our best estimate of the annual losses to the aquatic environment from leaching from landfill, direct discharges, air transport, and then getting into the water from the air.

But that is from all sources, Mr. Ruppe, and that is our best estimate.

Mr. RUPPE. Of that 10 million pounds of discharge, what percentage of that can you reach toward in any kind of a controlled program?

Can you stop General Electric from dumping in a river?

How much of the air and water dischargers can you really define?

How much can you really in a realistic fashion reach toward in terms of a controlled or a regulatory program?

Mr. TRAIN. The largest, I believe, single source would probably be landfills.

Mr. RUPPE. Existing landfills?

Mr. TRAIN. Yes, existing landfills, in the vicinity of manufacturing plants and also simply municipal landfills.

Now, we could, I think, over a period of time identify the highest concentrations of PCB's per landfill and develop a program of insulating them in a sense from the environment so they would not leach.

It would be an enormous task, but it is possible.

Mr. RUPPE. What about the PCB's that are currently discharged either, you know, not from a landfill, but are currently as the result of a chemical or other industrial processor?

How much of that is coming into the environment and are there any ways of controlling the new inputs of PCB's?

Mr. TRAIN. My impression is that this is a relatively small part of the problem.

They should be controlled as best they can.

There is no question about that, Mr. Ruppe, and I do not want to minimize any element of the problem, but I suspect that the normal industrial usages do not represent a large problem, other than the waste disposal aspects and landfills which are a significant part of the PCB's problem.

Mr. RUPPE. Can we control the new discharges that go into landfills, into the sewage systems?

Mr. TRAIN. PCB's apparently do get picked up by the air and I do not think we have a fix on amounts or control measures.

I have talked to a manufacturer who told me he had a completely closed cycle system of manufacturing.

He had PCB's on one side of the room with absolutely no connection to the other side of the room and PCB's were appearing in materials in the other side of the very large room.

MDNS 216639

Obviously, it was transported by air.

Mr. RUPPE. Then we really have a problem.

If we do not prohibit the use of PCB's we can talk about eliminating a few of the point sources like the oft repeated General Electric situation, but basically we are not going to be able to do a great deal about the 10 million pounds going into the environment as long as we keep producing for better or worse the PCB's, and I have a feeling a discharge in the environment of the PCB product is virtually beyond our control.

Mr. TRAIN. That is correct.

That is why we believe we should eliminate all uses of PCB's.

Mr. RUPPE. One or two more questions.

Mr. TRAIN. Now, total elimination is going to give you the answer, ultimately, but it is so ultimate that I do not think any of us feel very happy with it.

I mean, it may be 100 or 200 years from now before you really eliminate PCB's from the environment even if you stop using them today.

Mr. RUPPE. I believe, Mr. Train, that you mentioned that the FDA had an interagency study on the effects of PCB's on humans and I believe the study also included PCB's, is that correct?

Has there been a study on the effect of PBB's on humans and has it included PCB's as well?

Mr. TRAIN. Whether one of the charges of this interagency group on human exposure was to include PBB's as well as the PCB's and any existing data, I do not know.

Mr. RUPPE. When we refer to a 5-year study, is that 5-year study ongoing for a period of time, or is this a 5-year study the initiation period?

Mr. TRAIN. I am not aware of the 5-year aspect.

Mr. RUPPE. There is a study on the effect of PCB, on the effect of human beings ongoing, is there not?

Mr. TRAIN. Yes, there is the Food and Drug Administration.

Mr. RUPPE. I would assume you would strongly support the proper level of funding for a study that would go into the effects of PBB's and PCB's on humans, the attempt to definitively find at what level PCB's and PBB's are of interest to individuals.

Mr. TRAIN. Absolutely.

Mr. RUPPE. Are we doing anything beyond that or do you support a research program beyond that, to find out if there is a way of flushing PCB's and PBB's out of humans?

As I understand at the present time, there is no way of eliminating from the human system through other than the 100-year period that you referred to, and what frightens me is as far as PBB's are concerned, three-tenths parts per million in cattle causes usually the death of the animal or nonproductivity, and we have seen humans with PBB's reach a level of 200 to 300 parts per million and we do not know what the effect of that is nor do we know if it does have a bad effect, and how to flush it out of the human system.

I have a feeling we have the same danger here as far as PCB's are concerned.

We do not know the effect, and if it is deleterious we do not know what to do.

Mr. TRAIN. I do not know of any work underway on the flushing aspect.

I do not know whether that has any scientific probability.

Mr. RUPPE. Does it have any merit?

Can your people register a comment on the meritorious promise?

Dr. BRIDENBACH. It would take a person skilled in medical research to comment on the appropriateness of a flushing action on the fatty tissues of the body.

We do not have such a person with us today.

Mr. TRAIN. You have some EPA scientific witnesses on tomorrow, Dr. Del-Wayne Nimmo, from our Gulf Breeze Laboratory in Florida.

I am not sure he would be an expert on this.

Mr. RUPPE. What I am referring to is three-tenths parts per million in animals and humans has turned out individuals that come up with 200 or 300 parts.

If you start out with five parts per million in fish and other products that humans eat and five parts of PCB's that might translate to the end of the Japanese experience, do you take the same mathematical correlation of 2,000 to 3,000 parts per million and then we could really have something on our hands.

Mr. TRAIN. Speaking as a layman, Mr. Ruppe, I have never heard of any kind of research or information on this flushing process.

You know, certainly, as I said earlier, we all have DDT and Dieldrin and hexachlorobenzene in our system and they are going to be there for a long time and if we could get rid of them, it would surely be a desirable thing.

Mr. RUPPE. But as a first step, you certainly highly endorse the concept of finding out what are the effects at various levels of PCB's and PBB's on the human system?

Mr. TRAIN. Yes, sir, but would emphasize we should not wait on the results of that kind of research before we try to take action.

It takes a long time to get good human health data but we do have mammal studies, such feeding of PCB's to primates.

These may not be fully adequate, but I do not know.

We do have this kind of data and I think we should make judgments on the basis of that.

PCB's are very adverse to human health. What we do not know is dose level relationships and we surely should try to develop that as rapidly as we can.

Mr. RUPPE. Thank you. Mr. Chairman.

Mr. LEGGETT. I just noticed on January 1 of this year there was an article in McGraw-Hill and they indicated the title of it was Substitute Found for PCB's in Capacitors and they called it the CDO, chlorophemal dioxide.

This has some toxic effect only infinitisemal to that of PCB's. They indicate this is not good for transformers and on the other hand they indicate the Japanese have had a transformer lubricant available in utilizations there for the past 5 years.

Do you know anything about that, Mr. Train?

Mr. TRAIN. Very little.

Dr. BRIEDENBACH. The industry we met with were aware of this article. They were hoping for a substitute but they were not really as optimistic as the article says.

Mr. LEGGETT. Apparently, the article was prepared to provide industry requirements for capacitors by July of this year.

Mr. TRAIN. McGraw-Edison, as I recall, was present at our meeting with all of the manufacturers and this statement was made by their representative to the industry.

I think we have to do some more looking at that aspect of the problem before I would say we are ready to move in that direction.

That certainly was the reaction, I would say, of the rest of the industry.

Certainly, as Dr. Briedenbach said, hopefully, this substitute would prove to be as good as McGraw-Edison was claiming, but we are cautious because we have gotten into these binds before of jumping to use another substance and finding it also has a range of environmental problems.

I did want to make this point, Mr. Chairman. The key to the problem is adequate substitutes. As I said earlier, there is a very serious flammability problem with respect to transformers and I presume capacitors.

This is a problem that has to be dealt with in our society and unless we are ready to do away with an awful lot of electrical uses—and I suspect we are not at that point yet—we must find safe, effective substitutes.

We likewise, I think, have to be awfully sure that we are not buying other kinds of environmental problems simply by substituting another chemical.

In other words, thorough technological assessment of substitutes is a lesson we are learning pretty rapidly, that we better be sure before promoting the use of a substitute for PCB's.

Now, that is not in any way to say we should drag our feet or anything of this sort.

Mr. Chairman, I am saying this is a very important element in the problem and we should be very thorough in the way we get at it.

Having said that, I think it is exceedingly important that we get after the substitutes as rapidly as we can.

Mr. LEGGETT. Mr. Spensley has a question.

Mr. SPENSLEY. I hope to ask a policy-type question.

Without wishing to make this a forum for the toxic substance legislation, I would note that none of the versions of the toxic substance bills which I have seen place the burden of showing the substance is safe on the industry who wishes to propose the introduction of a new substance.

I think there are a large number of people who feel that the production of chemicals is not a right but a privilege and thereby at least in terms of protecting the public's welfare, that stronger burdens of proof should be shifted perhaps to the proponents of toxic chemicals.

As Administrator of EPA, would it be your position to support such a proposal of that kind?

MONS 216642

Perhaps you might want to comment on the present adequacy of the toxic bills.

Mr. TRAIN. I believe you are correct.

I think you would want to be careful before you require a proof of safety prior to the introduction of any chemical into commercial use.

Proving a negative is exceedingly difficult, for one thing. It can be exceedingly long and I would think that putting the burden on the introducer to establish reasonable safety—and I think there has always been that kind of qualification—that it should only be with respect to classes of chemicals that had been determined to be inherently questionable.

Now, we have that authority under the pesticide legislation, the Federal Insecticide, Rodenticide Act.

We are in the process of reregistering all pesticides, 35,000 or 40,000 of them.

Mr. SPENSLEY. That is for pesticides.

That would not apply, however, to many of the chemicals that you have been referring to today.

Mr. TRAIN. No, it does not involve what we have been talking about today.

I am saying this is not an unusual thing that you are talking about. In our reregistration process, we are adopting a rebuttable presumption that for certain classes of pesticides the risk outweigh the benefits.

It is going to be incumbent upon the registrant, the manufacturer, to produce reasonable evidence that the benefits outweigh the risks in those cases, so the burden is placed upon the manufacturer in those cases.

This is not an unheard of procedure and it does exist at the present time.

I would not think you would want to expand that generally.

It could be a very inhibiting requirement in terms of innovation in industry.

Mr. SPENSLEY. So you are saying, in short, you would not support such a concept generally although you would support it in the pesticides area.

Mr. TRAIN. No.

You must have misunderstood me.

I would not support a requirement that all chemicals must be proved safe or relatively safe by the introducer prior to their being permitted to enter into the environment.

I do not think I want to have some unknown chemical coming into commercial use without some knowledge of its effects. I do not think it is practical for us to try to handle all chemicals but where we can determine that a new chemical falls into a high risk category because of its molecular structure or past experience with similar chemicals, something of that sort, I do not think that premarket testing would be an unreasonable requirement.

Mr. LEGGETT. Thank you very much, Mr. Spensley.

Mr. de la Garza, do you have questions of this witness?

MONS 216643

Mr. DE LA GARZA. Thank you very much, Mr. Chairman.

I apologize, Mr. Train, for my absence but I had another very important matter and therefore, not having gone through your statement in detail, I would forego any question.

Mr. LEGGETT. I appreciate that and I thank you very much, Mr. Train.

We will be in further touch with you.

Mr. TRAIN. At the risk of being repetitive, let me make one more comment following up counsel's question.

I think that a very important element in the toxic substances legislation is notification of the commercial introduction of a chemcal so that even though we may not be requiring proof of no risk in advance of marketing, we at least know that something is going into the market; we know its general chemical characteristics.

We will know what testing has been done with respect to it, and are on notice and have an opportunity to blow a whistle if it is indicated before it gets into widespread use in the economy.

To illustrate the importance of such notice, PCB's are built so deeply into the economy now that no matter what you do it is a very wrenching process.

Mr. SPENSLEY. At least it is one small step for some men.

Mr. LEGGETT. Very good.

Thank you very much, Mr. Train.

Mr. Oberstar?

Mr. OBERSTAR. No questions.

Mr. LEGGETT. Mr. de la Garza.

Mr. DE LA GARZA. May I come back just for a question?

Mr. Train, when Secretary Reed testified he was asked about a plan and he alluded to the fact that he would leave that to your agency.

Could you go over that in your testimony?

Mr. LEGGETT. I think we have pretty thoroughly covered that.

Mr. DE LA GARZA. Then I would appreciate it, and I would redirect it.

Mr. TRAIN. If you have any further questions about it, do not hesitate to contact me.

Mr. LEGGETT. We will undoubtedly have you back here again.

Thank you again, Mr. Train.

Now, we have two industry members.

One is Mr. William B. Papageorge, Monsanto Industrial Chemicals and Mr. Clifford H. Tuttle, Jr., of Aerovox Industries.

Mr. Papageorge, how long would your testimony take?

STATEMENT OF WILLIAM B. PAPAGEORGE, MONSANTO INDUSTRIAL CHEMICALS CO., ST. LOUIS, MO.

Mr. PAPAGEORGE. I would say about 13 minutes, Mr. Chairman.

Mr. LEGGETT. How about you, Mr. Tuttle?

Mr. TUTTLE. I would say about the same or perhaps a little less, Mr. Chairman.

Mr. LEGGETT. Which of you has to leave the earliest?

Mr. PAPAGEORGE. I can stay overnight if it will help the committee any.

Mr. LEGGETT. Well, I would like to finish with both of you today. Do you have to go back tonight, Mr. Tuttle?

Mr. TUTTLE. I can stay or I can go at the pleasure of the committee.

Mr. LEGGETT. If you are both in the same situation, Mr. Papageorge, you are on first.

Mr. PAPAGEORGE. Thank you very much, Mr. Chairman.

My name is William Papageorge, and I am manager of product acceptability for the Montanto Industrial Chemicals Co., which is an operating unit of Monsanto Co.

Mr. LEGGETT. Very good.

And you are the very distinguished organization that has a cartel on the manufacture of PCB's.

Well, you do not have to answer that.

Mr. PAPAGEORGE. I like the distinguished part but I do not know about the cartel, Mr. Chairman.

Mr. LEGGETT. Your statement will be included in our record as though you read every bit of it.

Now you can highlight it or argue with the committee or suggest solutions or you can read it.

My staff has read the order of your analysis and you can do whatever you like at this point.

Mr. PAPAGEORGE. Well, that puts the burden on me, does it not?

Mr. LEGGETT. Yes; it does.

Mr. PAPAGEORGE. Then I would like to read it, sir, at your pleasure.

Mr. Chairman, the chemical structure of polychlorinated biphenyls—PCB's—has been known for nearly 100 years. Commercial production of the material was initiated in 1929 in response to the electrical industry's need for an improved dielectric insulating fluid which would also provide increased fire-resistant benefits when used in transformers and capacitors.

Mineral oil, the only known alternate material for these applications, had stability and flammability problems that made it potentially hazardous. Power surges in electrical equipment can cause arcs. A sustained, high-energy arc can vaporize mineral oil to the point where the material will ignite. The unique properties of PCB's—inertness, fire resistance, and their ability as dielectric insulators to act as nonconductors of direct electric current—made them ideally suited for those applications where high-voltage arcing could occur, and result in fires and/or explosions, damage to equipment and create hazards to people.

As the unique properties of this material became more fully understood, many additional uses were found. Their fire resistant nature made them an excellent choice for use in hydraulic and heat-transfer fluids. Their inertness imparted long-lasting qualities to lubricants. They also improved the waterproofing characteristics of surface coatings and offered similar and other benefits to the manufacturers of carbonless copy paper, printing inks, plasticizers and special adhesives.

PCB's, therefore, evolved as a truly unique class of chemicals which met important needs for both industry and society. It was within this framework that Monsanto and other producers developed a growing, worldwide business for these versatile products.

First signs of environmental concern:

In the late 1960's, some 40 years after PCB's were introduced, the first signs of potential environmental problems turned up in two separate events—one in Japan, the other in Sweden.

In 1968, about 1,000 people in Japan became ill from eating rice oil heavily contaminated with Japanese-produced PCB's as a result of an unfortunate industrial accident which has come to be known as the "Yoshu Incident." PCB's were being used as a heat-transfer fluid in equipment used to heat the rice oil. A leak developed in the equipment and went undetected, allowing the PCB to spill into the oil. Some news accounts have erroneously linked this incident with deaths, stillbirths, and miscarriages. While, in fact, no such cases were actually attributed to the incident, those exposed to PCB-contaminated rice oil did experience dizzyness, nausea, loss of appetite, weakness, and dermatological side effects. Infants, born to mothers who had been exposed during pregnancy, exhibited darkened skin at birth; however, in every case, this condition cleared within 3 months.

It should be pointed out that the levels of PCB contamination in the "Yoshu Incident" were in the 2-to-3 parts-per-thousand range—extremely high concentrations—while the levels being reported in fish and wildlife today are in the low parts-per-million and billion.

Mr. LEGGETT. That comes out to 2 or 3 parts per million?

Mr. PARAGEORGE. Yes, sir.

It is also important to note that a similar industrial accident today, at least in the United States, is virtually impossible since PCB's are not used in heat-transfer applications.

The Japanese ban:

Primarily as a result of Yoshu, the Japanese Government announced, in 1971, a total ban on all PCB usage to become fully implemented by September of 1973. Monsanto and the U.S. electrical industry are often asked how Japan has been able to get along without PCB's in its electrical applications.

It should be pointed out that the major uses for PCB's in Japan were in "open applications," particularly for carbonless paper. The Japanese power distribution industry, less advanced than the United States technically, had never actually gotten around to taking advantage of fire resistant transformers to the extent they have been used in this country. Most of their transformers were either using mineral oil or were dry-type units. The Japanese capacitor industry on the other hand was only in the beginning stage of converting its equipment to the more reliable PCB dielectrics when the ban was announced.

Reliability standards for capacitors in the United States are much more stringent than they are in Japan or anywhere else in the world. So, the Japanese ban really did not materially impact that country's electrical power distribution industry.

THE SWEDISH FINDINGS

The other early sign of trouble was reported by a Swedish biologist, who, while using a new and totally unique technique, for the first time, identified PCB's in the bodies of fish. Montanto and others began immediately to study the Swedish work. But before these findings could be confirmed or duplicated in the United States, analytical methods had to be refined in order to separate PCB's from the other chlorinated hydrocarbons—like DDT—that were known to be present in the environment. Techniques also had to be developed to enable researchers to identify the chemicals in a very small parts-per-billion range.

MONSANTO'S RESTRICTED SALES PROGRAM

When these scientific investigations first confirmed the presence of PCB's in the environment in the United States in 1970, and long before information regarding the potential impact of this contamination was determined, Monsanto voluntarily began its program of terminating sales of PCB's to open applications—those which could likely result in losses to the environment.

Major applications affected by the company's unilateral withdrawal were in carbonless paper, fire resistant hydraulic fluids, heat transfer fluids and plasticizers. These restrictions resulted in a reduction in uses of PCB's, in applications where their loss to the environment was less controllable, of some 45 million pounds per year—cutting production in half.

At the same time, Monsanto made the conscious decision to continue supplying PCB's only to the electrical power distribution industry where they were marketed as dielectric fluids in closed or sealed systems such as transformers and capacitors.

In making this decision, Monsanto felt, (1) that entry of PCB's to the environment would be effectively limited and controllable as a result of this restricted sales program—which became fully implemented by late 1972, (2) that a more biodegradable, lower chlorinated homolog had been developed for use by the capacitor industry, and (3) that withdrawal from electrical applications would have brought to a halt production of equipment, essential to the safe and efficient distribution and use of electrical energy—there being no known, satisfactory replacement for PCB dielectrics available.

MONSANTO'S MANUFACTURING FACILITY

In the manufacturing area we took a number of significant steps to prevent loss of PCB's to the environment. Control, unique in the industrial chemicals industry, has been achieved. Measurable losses from the Sauget Village treatment plant to the environment are approximately 1 to 2 pounds per day, which equates to approximately 1 to 2 parts per trillion PCB's in the Mississippi River at average flow rates. [Two parts per trillion is the equivalent of two pennies out of $10 billion]. While there presently are no formal PCB discharge limits, proposals under consideration call for ambient water concentrations at levels not to exceed one part per trillion.

In our manufacturing area we have acted to prevent loss of PCB's in the environment by literally making the department a "concrete bathtub." Drainage is collected in an isolated PCB sewer system with setting basins to insure PCB containment in case of accidental spill or equipment failure with the capability of monitoring the effluent from the department.

Storage tanks are blanketed with nitrogen to eliminate tanks "breathing," and mist eliminators have been installed in vapor lines to eliminate the possibility of PCB's leaving the manufacturing area. The key to our continued success in controlling PCB's is in our maintaining a high housekeeping level.

A Monsanto chemical waste treatment facility, to be completed in late 1976, will be a further step in reducing PCB effluents.

STEPS TAKEN IN LABELING AND TRANSPORT PRACTICES

Monsanto ships PCB fluids in both bulk carriers and in drums. Bulk shipments are made in a Monsanto-owned fleet of tank cars which is used exclusively for that service, or in customer-owned tank trucks.

Drum shipments are made in special reinforced drums which we believe to be the best available.

A multilingual warning label is affixed to each package giving a brief description of the nature of the material and appropriate actions to be taken in the event of a spill or leak. We also supply a label to be used on return shipments for incineration, which gives similar information.

THE MONSANTO INCINERATION SERVICE

An incinerator was built at our Sauget, Ill., plant for the specific purpose of destroying waste PCB-containing liquids, both from our own operations and from our customers.

Firebox temperatures above 2,000 degrees Fahrenheit are maintained to completely destroy the PCB compounds, and combustion products are removed in scrubbers. Routine sampling of both the stack and the scrubber effluent has confirmed the effectiveness of the system.

A fee for handling is charged for the information service, which does not fully cover the costs we have incurred to date in developing and operating the incineration system.

INDUSTRY GUIDELINES

In addition, representatives of the transformer and capacitor industries, utilities, and governmental agencies formed the American National Standards Institute Committee C-107 and promulgated guidelines for handling and disposing of dielectric fluids. The actions of this committee reflect the industry's understanding of the need for proper control.

FEDERAL TASK FORCE

In 1972, Monsanto's voluntary program was reviewed by a Federal interdepartmental task force—consisting of representatives

from the Office of Science and Technology, Council on Environmental Quality, Department of Agriculture, Department of Commerce, the EPA, HEW, and the Department of the Interior. The Federal Task Force Report, which is a matter of public record, supported and endorsed Monsanto's program.

CURRENT SITUATION—MONSANTO'S POSITION

Thus, the situation today is quite different from conditions which existed only a few years ago. Prior to 1971, Monsanto sold some 85 million pounds of PCB's per year to literally thousands of customers worldwide. At the present time, PCB's produced for U.S. consumption—about 27 million pounds per year—are used by fewer than 40 domestic customers and only in the manufacture of sealed electrical equipment.

All this notwithstanding, Monsanto is obviously aware of the mounting reports carried in the news media that would seem to suggest that the entry of PCB's into the environment has not been effectively curbed.

Monsanto simply cannot accept this hypothesis, given the following basic facts: (1) Production—reduced by over 50 percent; (2) open-system applications—totally eliminated; (3) manufacturing controls, unique in the industry—implemented; and (4) stringent electrical industry guidelines, for handling and disposal—established.

On the contrary, Monsanto sincerely believes that its current program, together with an increased level of awareness and concern on the part of the electrical industry, has had to have drastically reduced the amount of PCB's entering the environment. It is now known that certain of the PCB insomers will persist in the environment for a considerable period of time.

Monsanto is convinced, therefore, that the mounting reports of widespread contamination are not evidence that the restrictions are not working but, rather, substantiation of our theory that old PCB's have remained in the environment and are now being increasingly identified by a growing number of researchers, equipped with improved, highly sophisticated analytical tools and armed with advance knowledge of what to look for.

And, indeed, the findings of a task force involving agencies from Minnesota, Wisconsin, and the Federal Government, organized in the spring of 1975, tend to support this theory. Their report, issued in November 1975, said that industrial plants and sewage treatment facilities are not major sources of PCB contamination in the Mississippi River and its tributaries. Rather, the report suggested that the present source is quantities of PCB's that had been dumped into the river in past years.

The report explained that these PCB's settled to the bottom and became lodged in the sediment—only to be periodically stirred up by dredging operations.

PROGRESS ON ALTERNATE PRODUCTS

Monsanto has invested millions of dollars to implement and maintain its restrictive measures and controls and, despite the

company's strong belief that they are effective, it has invested additional millions in major ongoing research programs to develop acceptable replacement dielectric fluids that would be, in themselves, more environmentally compatible. Significant progress is being made.

It is important to discriminate between fluids designed for transformer cooling and those designed for capacitor impregnation. Because each application has requirements not shared by the other, Monsanto knows of no candidate replacement products which would be applicable to both.

For capacitors, we have studied several alternative technical approaches and have settled on a product, code named MCS 1238, which duplicates the electrical behavior of PCB's, yet contains no chlorine. The environmental and toxicological test data we have developed thus far encourages us to believe that MCS 1238 is better than PCB's—more biodegradable, not subject to biomagnification and relatively non-toxic. Additional studies currently underway include acute toxicity to wildlife, mutagenicity and teratogenicity—which are scheduled to be completed in early 1976, and 2-year animal feeding tests for carcinogenicity—which will be available by mid 1978.

We are confident, based on the results of all testing done to date and the chemistry involved, that no major problems will surface with those ongoing studies.

Our performance testing program has included accelerated life tests on capacitors impregnated with this material. While our own results are favorable, the ultimate acceptance must come from our customers. Sample quantities of this replacement candidate are currently being evaluated by customers.

Should we receive an early favorable verdict from enough of the industry to support an investment, we could get into interim production, at a volume sufficient to supply the industry, in a relatively short period of time.

Initially, the replacement product would be more expensive since the electrical industry would have to be supplied from an interim production facility. A fully dedicated plant could be constructed within 2 to 3 years.

In transformer fluids, we are not as far along. The same basic problems face anyone attempting to develop a replacement dielectric for transformers as for capacitors, but fire resistance is even more essential in many transformer applications for two fundamental reasons:

One: Transformers contain about 2,000 pounds of dielectric fluid compared to from 2 to 4 ounces in the typical ballast-type capacitor, and

Two: Many of these 2,000-pound units are installed in high-rise buildings, hospitals, schools and urban commuter trains, where a fire could well be catastrophic.

It is because of this that, despite the normal commercial incentives to replace them, PCB's have endured as the standard dielectric fluid for over 45 years, consistently performing their designed functions better and safer than any other product as yet conceived.

It is axiomatic that the chemistry which imparts high fire resistance tends also to produce stable molecules—those that tend to persist in the environment.

Our research efforts here are focused on developing replacement fluids that will provide performance reliability, acceptable fire resistance and environmental compatibility, as well.

Unfortunately, there is no accepted, quantitative definition of the degree of fire resistance needed in a fire resistant transformer fluid.

Another major objective of this program centers around the need to develop replacement fluids that will not only work in newly designed transformers but also in the thousands of existing "Askarel" type transformers—which, by definition, contain fire resistant dielectric fluids—currently required in high density population applications. Electrical, zoning and building codes, and indeed insurance rates have been traditionally predicated on the use of these Askarel units which, without exception, get their fire resistance ratings from the use of PCB fluids.

We feel we have a responsibility and a commitment, to the extent it is technically possible, to develop a fluid that can be used, interchangeably, in these Askarel transformers—thus avoiding the obvious economic burdens and serious power disruptions that would otherwise result from having to replace or retrofit them.

We have one promising candidate which is currently being readied for testing by transformer manufacturers. Preliminary environmental and toxicological screening has been completed on this new candidate fluid, and the test protocol for a comprehensive biological evaluation program, similar to the one used for our capacitor fluid, is currently being developed.

Monsanto's future plans/intentions:

While Monsanto made the conscious decision back in 1970 to begin restricting sales to closed-system dielectric uses, the main reason we elected to continue supplying the electric industry was that they had no viable alternates to turn to.

EPA also recognizes this, even today. At his December 1975 press conference, EPA Administrator Russell Train said he would not ask Monsanto to stop production because that would shut down the electrical power industry and the railroads in short order. He said we must find a way to proceed without shutting down the country.

This is precisely the position to which Monsanto has been committed since 1970.

While the PCB issue is a difficult one to handle, the difficulty does not now, nor will it in the future, stem from any lack of effort or cooperation on the part of Monsanto.

The problems that we face, collectively, are rooted in the unique fire resistant and dielectric characteristics of PCB's and the irreplaceable role they have played in electrical and industrial applications for the past 45 years.

The challenge is to replace them in an orderly manner without creating another hazard of equal or potentially greater consequences while, at the same time, avoiding serious power and transportation disruptions.

Monsanto has no desire to remain in the PCB manufacturing business any longer than is necessary. By this we mean as soon as we are able satisfied that the electrical power supply industry's needs for usable, acceptable alternate dielectric fluids have been met by whomever, Monsanto will voluntarily shut down its PCB manufacturing unit.

In the interim, we will continue to work with industry and Government to insure that the restrictive measures and controls we implemented in the early 1970's remain in force and are diligently pursued.

Thank you, Mr. Chairman.

Mr. LEGGETT. Thank you very much, Mr. Papageorge.

Now, you are currently selling it to 40 companies, half of which you were manufacturing in 1971, is that right?

Mr. PAPAGEORGE. That is correct, approximately correct.

Mr. LEGGETT. How much are you exporting?

Mr. PAPAGEORGE. The latest figure I saw, sir, about 17 million——

Mr. LEGGETT. To how many companies?

Mr. PAPAGEORGE. Export, I do not know that number.

Mr. LEGGETT. Would that not be important, too?

Mr. PAPAGEORGE. I do not know. I do not know who could use that information. They go to Southeast Asia, South America, Africa, Mexico, Canada.

Mr. LEGGETT. The way we get the evidence is that we are all in one ecosystem.

Mr. PAPAGEORGE. That is right.

Our policy that we follow in the United States we follow throughout the world, which is slightly different than our competitors throughout the world.

Mr. LEGGETT. How many people do you employ to manufacture this?

Mr. PAPAGEORGE. The individuals directly involved for a full working day, number at best about 20—a couple dozen people.

There are others who are involved sporadically such as the maintenance men who do repairs and then leave the operation.

Mr. LEGGETT. Now, the Japanese apparently went out of this business 3 years ago. They apparently do not have a transformer standard requirement like we do, but the question is, so what?

Mr. PAPAGEORGE. I can only speak of my personal experience, sir.

Mr. LEGGETT. Are you particularly knowledgeable as to what deficiencies they really suffer in their system because they failed to meet our high standards which we meet through the utilization of PCB's?

Mr. PAPAGEORGE. No, I am not. I suspect someone in the electrical equipment industry would be better qualified.

Mr. LEGGETT. But if your company does have informaion like that, it would be helpful.

Now, we have evidence—I guess it is an application before the Environmental Protection Agency and/or others, I think by General Electric, who discharged directly something like 10,000 to 14,000 pounds of PCB's per year.

Are you aware of that?

Mr. PAPAGEORGE. Yes, sir.

68-700—76——6

Mr. LEGGETT. So that despite the fact we do have this closed system, it does open up in certain spots?

Mr. PAPAGEORGE. I do not know that anyone has ever tried to misinform anyone that this was totally a closed system to the point where not a molecule would ever escape.

Mr. LEGGETT. Let me ask you this then.

Do you have any estimate of the amount of PCB's that you sell is it on the order of 40 million to 45 million pounds per year?

Mr. PAPAGEORGE. Right.

Mr. LEGGETT. How much of that do you estimate escaped into the environment?

Mr. PAPAGEORGE. It is more in the order of 10,000 pounds per year, although I can understand from Mr. Train's testimony that we may have some differences of definition.

By escape, we are talking about the situation in which PCB's are made available to living creatures as distinguished from material buried in landfill.

Mr. LEGGETT. I understand. I would not counterattack that. If it is buried in a landfill and the landfill is a contained system, I would not count it as an escape.

Mr. PAPAGEORGE. That is the way we defined it; yes, sir.

Mr. LEGGETT. I think Mr. Train was talking about escapes from the landfill.

Mr. PAPAGEORGE. I have no measure of what is escaping from landfills. I am not aware of any programs that have monitored landfills.

So it has to be an estimate.

Mr. LEGGETT. OK.

You say 10,000 pounds out of the 45 million, that would be 1/45 hundredth, I guess, as escaping of what you are producing. OK.

Let me see. I have got to go.

Mr. de la Garza, can you Chair the committee for the balance of the questioning of this witness?

Would you like to proceed and answer questions tonight, or would you like to come back tomorrow?

Mr. PAPAGEORGE. It is up to the committee, sir.

I am available any time.

Mr. LEGGETT. Mr. Ruppe, do you have any preference?

Mr. RUPPE. I have to leave before noon tomorrow, so the chances with the witness' time would be appreciated.

Mr. LEGGETT. All right.

Because we are not coming back until 2 o'clock tomorrow, why do you not Chair the balance of the meeting, Mr. de la Garza, and—our last witness will be here tomorrow inasmuch he indicated it made no difference whether he stayed or went home. And we chose to have him testify tomorrow.

All right. The Chair would ask Mr. Tuttle if you would like to reconsider that. We frequently reconsider things, Mr. Tuttle.

Do you have any strong preference one way or the other?

Mr. TUTTLE. Well, I certainly would rather go back tonight, but, on the other hand, if it has to be postponed until tomorrow, I will make myself available.

Mr. LEGGETT. All right.

He has indicated he does not want to reconsider and you have got to make a stronger plea than that. Very good.

Proceed, Mr. de la Garza.

Mr. DE LA GARZA [presiding]. The question is you said your statement was 10 minutes or so, and if there is no great interest in questions afterwards and you would like to continue and make this statement, I think probably we can accommodate you here until about 6 o'clock or thereabouts.

Mr. TUTTLE. I would appreciate that.

Mr. DE LA GARZA. I do not think the chairman would have any preference unless you gentlemen are interested.

Mr. RUPPE. Can we have a few moments after the gentleman has testified to ask a few questions of both of them?

Mr. DE LA GARZA. We all have the time element problem, but I know being away from home and so on, if we can accommodate them, and all of you are agreeable, fine.

Mr. STUDDS. Fine.

Mr. DE LA GARZA. Any further questions of Mr. Papageorge?

Mr. RUPPE. I have three questions.

Do you make any sales for use in open systems today?

You have indicated in your testimony you cut back the sales and have a program for elimination.

Has that program been completed and have you stopped all sales for open system use today?

Mr. PAPAGEORGE. The open system sales were terminated in early 1971.

Mr. RUPPE. You mentioned some possibility of PCB's being released in some type of breathing process.

Is that possible to take place in either—during the shipment or during storage by your customers, or even when the material is actually in the transformer itself?

Is there any chance for a release later on?

Mr. PAPAGEORGE. I cannot speak——

Mr. RUPPE. In the breathing process or any other process?

Mr. PAPAGEORGE. I cannot speak for the application in the electrical equipment. I would suggest that hopefully you can speak with someone who knows how a transformer functions while in service.

In the transporting, there is, of course, no breathing that occurs in the steel drums and in the tank car or bulk movements. The material is shipped at low temperatures so there are no high vapor losses and, in many instances, the use of inert gas like nitrogen is used. This is what we use.

Mr. RUPPE. You are satisfied that it gets from your plant to the customer's doorstep without the release of PCB's?

Mr. PAPAGEORGE. Yes; I am.

Mr. RUPPE. On page 9, you refer to the fact that—following up on your statement, you do not sell for open systems.

Is it not true that there is a certain amount of PCB reprocessing that does go into open-system utilization?

Mr. PAPAGEORGE. I have heard rumors to that effect, but this is not something we recommend or get involved in.

Mr. RUPPE. Do you know for a fact that perhaps it does get reprocessed for use in open systems?

Mr. PAPAGEORGE. I have been told by some people in EPA that they have some information in this area, but I have not been told the details.

Mr. RUPPE. Last question.

Do you know if PCB's are imported, and again, if they are imported, are those uses of imported PCB's most likely to be in open systems since it appears that Monsanto has a pretty good lock on the electrical utilities industry?

Mr. PAPAGEORGE. Again, I have to mention that my information came from EPA representatives who, in turn, got this from the Customs people, and the uses appear to be open type uses, those uses which we abandoned.

Mr. RUPPE. You mentioned that, on page 3, that the Japanese Yoshu incident was erroneously linked to deaths and stillbirths, miscarriages, and the like. And I understood there is an EPA study that indicates there were links to that effect.

I am not sure if you have been so advised.

Mr. PAPAGEORGE. I can only speak again from my personal observation. I have talked to Professor Kuratsame when he was here, and I believe we understood each other, and at no time did he say these were attributed to the exposure.

I have also spoken with representatives of the Food and Drug Administration who also have that impression, and we have in our medical department in Monsanto a letter from a professor who categorically says that the deaths were not attributed to the exposure.

Mr. RUPPE. Thank you very much.

Thank you, Mr. Chairman.

Mr. DE LA GARZA. Mr. Studds?

Mr. STUDDS. I will be extremely brief in recognition of the rule that thou shall not delay thy constituent.

Mr. Papageorge, I did not catch—I am not sure of your position with the company.

Mr. PAPAGEORGE. My position is that of manager, product acceptability.

Mr. STUDDS. Product acceptability.

I just really have one question. In today's Boston Globe, which is northeast of St. Louis, there is the following statement:

> Monsanto Co. has announced it intends to phase out the production of PCB's. In making the announcement in St. Louis the company spokesman said the phase out would take place in a planned and orderly manner.

Now, is that simply a rephrasing of your last paragraph, or is that an announcement of a new policy?

Mr. PAPAGEORGE. No; the intent was to rephrase. I hope it was done properly.

Mr. STUDDS. So that is not saying anything more or less than what you have said?

Mr. PAPAGEORGE. You are right.

Mr. STUDDS. Thank you.

Thank you, Mr. Chairman.

Mr. DE LA GARZA. Mr. Papergeorge, could you tell me, in a layman's term—are you a chemical engineer, a petroleum engineer, but can you tell us in a layman's term—can you explain to me in layman's term what is PCB?

Mr. PAPAGEORGE. I can try, sir. I have tried some time, and I think I have succeeded, and sometimes I do not do so well.

Mr. STUDDS. He really wants to know whether it comes from oil or gas.

Mr. PAPAGEORGE. He should.

We start with a high-purity benzene, and benzene is described by the chemists on paper with a diagram which represents a hexagon.

If you can visualize two hexagons, point to point, we have what we call the biphenyl group. Each of the points of the hexagons represents the position of a carbon atom.

To each carbon there is a hydrogen atom associated, so that give us—if I have my numbers correct, 12 carbon atoms, and 10 hydrogen, making the biphenyl group.

The biphenyl is then exposed to chlorine gas in its molten form. The chlorine displaces the hydrogen. The amount of exposure determines how many chlorine atoms affix themselves to the biphenyl group.

So we can have from 1 to 10 chlorines attaching themselves randomly on this double ring.

This is why this is called a commercial mixture, and it is a mixture of about 50 to 70—maybe 80 of these random mixtures of from 1 to possibly 10 chlorines.

The longer the chlorine is exposed to the biphenyl, the more chlorine attaches itself. Therefore, you will have PCB mixtures with chlorine content of 21 percent up to 68 percent. This is an indication of the amount of chlorine present.

There are, as was previously mentioned, 209 different chemical involved. So when we speak of PCB's, I think we should be very careful that we all understand what we are talking about. I find not only for PCB's, but for the precedent that it establishes, that we have got to be very careful that we do not attribute any characteristic to the whole family of 209, because it may not be factual.

Mr. DE LA GARZA. Where does the original benzene come from?

Mr. PAPAGEORGE. Benzene comes from petroleum sources.

Mr. RUTTE. Is that identified to one State, or just——

Mr. PAPAGEORGE. Well, yes. It does come out of Texas. Does that help any?

Mr. DE LA GARZA. I thought we ought to have that for the record, the process, and using the terms. it is a catalytic effect rather than a cracking or extracting effect. You take the benezene and then——

Mr. PAPAGEORGE. The benezine is cracked.

Mr. DE LA GARZA. You crack the benzene from the crude, and then in the process of making other matters from crude, but you add the chlorine.

Mr. PAPAGEORGE. Right. It is a chemical addition, right.

Mr. DE LA GARZA. Thank you very much, sir.

Are there any other further questions?

Counsel?

We appreciate very much your contribution, and without any further questions, you are dismissed.

Now, our next witness is Mr. Clifford H. Tuttle, Jr., Aerovox Industries.

Before you start, I might tell Mr. Papageorge, if you are looking for sites or sources for your product, we welcome you in South Texas.

You already are near Corpus Christi, but we wish you would come further south.

Mr. PAPAGEORGE. All right, sir. I will carry the message back.

Mr. DE LA GARZA. The same way with Aerovox.

Mr. STUDDS. A bad precedent has already been established.

Mr. DE LA GARZA. We will be happy to hear from you at this time, Mr. Tuttle.

STATEMENT OF CLIFFORD H. TUTTLE, JR., AEROVOX INDUSTRIES, NEW BEDFORD, MASS.

Mr. TUTTLE. Mr. Chairman and gentlemen, my name is Clifford Tuttle; I am not going to read this. Instead, I will highlight it and cover a few of the points on which I think there may be some confusion from previous testimony.

Firstly, you are just beginning to appreciate the magnitude of the problem.

Mr. Studds read a press clipping about the drinking water in five cities. I venture to say it is in every city water in the United States of America.

In New Bedford we reported the PCB content of incoming water to EPA. We also reported to the EPA that Boston was considerably worse than New Bedford. For New Bedford, it is not difficult to identify the source, because if you go back 10 years, we were paid for our scrap PCB's by the city, which used them to oil the roads.

Obviously, this was before the time we knew we were dealing with this ecological problem. What the source would be for Boston City, I cannot say, but PCB's are there.

Today there are three uses of PCB's. We have talked about them in general, and I am sure you gentlemen do not have to be told how to distinguish between them.

My company, Aerovox, manufactures what is known as small capacitors. A small capacitor is the type you have in fluorescent lighting, in street lighting, in television sets, microwave ovens, air conditioners, and virtually every AC motor in any plant, elevator, and so on.

It is used for one reason. It reduces the amount of energy required, and today the demand for this application is now up, because I am sure you are aware of the President's mandate on energy consumption decrease to appliance manufacturers of refrieragtors, freezers, washing machines, and driers; none of these are now power factor corrected directly.

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If appliances do not have this type of capacitor, by adding it will cut the amount of energy used. This is going to mean more capacitors, not less needed.

So to some extent we are fighting ourselves—not that I am arguing—but we are trying to cut our energy consumption, which is a function of this capacitor, and yet it only operates well with a PCB in it.

The small capacitor constitutes about half of Monsanto's sales or 20 million pounds.

A second use is the large capacitor. This is the type that is used in very large buildings, on the side of the building, or inside it. It is also used by utilities. This constitutes about another 7 million pounds.

The chairman left, but he cited an article in Electric World, relative to McGraw saying it has a non PCB fluid for capacitors. That article specifically states the fluid is for large capacitors. It is not for small capacitors.

The manufacturer of that fluid is Dow Chemical, and the first time material was put in the hands of small capacitor manufacturers was in December. We have had it on order since last spring. We are just starting to test it. Whether it will be a good alternative fluid to PCB in small capacitors I do not think that anyone can state yet. Obviously I have to agree with Mr. Train—without the PCB capacitor—you would virtually stop the construction industry, and we would also probably double the amount of energy used. We could go back to incandescent lights. Incandescent lights are exactly one-quarter as efficient as fluorescent.

In the past we have used PCB's for four reasons. The first one was flammability, and I think that has been well documented. There is no fluid that we are going to get that is as good as PCB in flammability, because it will not burn as used in our application. We are going to have to make a compromise there.

Another factor was reliability. When we used mineral oil—that was before my time—users had to change fixtures every 2 or 3 years, which is as often as you change a bulb in a fluorescent. Obviously, we hope whatever we use instead of PCB will not require the changing of the fixture every 2 or 3 years, because it will be prohibitive in terms of today's service costs.

And the last—the cost is very attractive in a PCB unit, compared to anything else.

In my statement I cite very strongly the fact that we should talk about PCB's by their specific formulation rather than the generic term PCB.

I have been told that I took a remark by Dr. Risebrough out of context. I am very anxious to see the record of the Chicago Conference, because I am sure I quoted him correctly.

The fact is that there are only three fluids really in demand that Monsanto makes now. One is Aroclor 1016. This is used in capacitors and is exceptionally biodegradable.

We have talked about the number of chlorine atoms in a molecule. Pentas and above—molecules with five and six chlorine atoms in it—have a half life of maybe 50 years. Aroclor has only 0.1 percent of the pentas.

There is another formulation called 1212; this has 7 percent of the pentas and above.

Now, beyond this I am not going to get into an argument; EPA has not agreed on what is biodegradable, and how quickly even Monsanto cannot tell this specifically.

Everyone agrees the one chlorine degrades quickly and two or three pretty well, but we are a little hung up on the four.

I am going to touch briefly on some of the things that have been done by industry. In some cases this must be limited to our company. Still I know that everyone in the capacitor industry switched voluntarily 5 years ago when 1,016 became available, even though the cost went up about 40 percent. We were aware enough of the ecological problem to say, "Let us spend more money to get material that is more biodegradable."

There has been a lot done in the area of discharge. Everyone today in the industry is paying a cost of about 10 cents a pound for hundreds of thousands of pounds a year to be incinerated at a high temperature. This is the only way we can totally breakdown a PCB.

Because of this and other practices, I would take very strong issue with Mr. Train's statement that 10,000 pounds are going to the environment via direct discharge. I am part of an industry committee that has determined that right now we are discharging 7 pounds a day as an industry. That is the total direct discharge, and that includes both municipal and navigable water. My company has gone from 5 to 10 pounds in 1970, to about a half a pound to 2 ounces a day right now. On the fifth of January this year our discharge was six-tenths of an ounce.

Other companies have made similar efforts, and we are working very closely, subject to the antitrust restrictions, to share our knowledge of how we can help the environment.

Although Bill Papageorge covered the Yoshu incident very well, I would like to add some comments. The fact is this is the only documented evidence we have of the effect on man of PCB's. There are some studies being done now. NIOSH has contacted four or five plants. They are going to spend considerable time at one of these plants, because each represents the only known populations that has been working with PCB for a long time; they will try to study the resulting effects. It looks like Aerovox is going to be one of the winners, if you can call it a winner, and GE may also have the lucky task of having all these people running around through our records and talking to our employees.

Two things that have not been pointed out to date, although you will get on them tomorrow.

First: In Chicago at least two panels reported on studies of the food chain that indicated that in the last 3 years the food chain has significantly improved with the exception of certain species of fish, which you are concerned with. They cited stripers, obviously, and a couple of species in the Great Lakes area.

Second: Other papers cited the fact that every body of water has improved, with one exception, and that was Lake Michigan. All other bodies of water have shown a drop in PCB, as we expected they would.

An alternative fluid is the solution to the problem. The lack of one presently is the reason that Mr. Train said he would not want to put a time schedule on a PCB phaseout. By now, he appreciates the need to have a viable alternative to which to go.

There are two potential fluids. We expect that the fluid that the McGraw-Hill article covered will probably raise the price of our product 100 percent, which would have a major economic impact on the Nation. We have a little more hope for the fluid that Monsanto is coming along with. Unfortunately, both were only available to us late in the fourth quarter. Tests are underway at our plant on these, and I am sure they have started at every other plant that could use them.

Whatever happens, we are going to definitely have to have some modification in our personnel safety requirements. Our industry is hoping to get Mr. Train or others in the Government to help us on this. UL is our specifier—they write the Bible—and right now they have not recognized the problem. Still we have told them there is no choice—changes in the requirements for flammability must be made.

We would estimate that testing these alternative fluids, if successful, could give us enough data under our belts by late in the spring of next year to say let us go. At present, I don't know if the successful candidate will be Monsanto or Dow Chemical or someone else. After the approval, it will probably take another year to gear up to produce 20 million pounds needed annually by our industry.

The switch from PCB probably cannot be made without a large gamble in product reliability, before July 1978, but I do think that this is a reasonable date to try to hit.

I would like to emphasize one section in my statement. I point out that our discharges go into Buzzards Bay, a body of water that I fish in, as do a lot of others. The tests we have had conducted by outside laboratories indicate that that body of water now meets the proposed water criteria which has been established by EPA for all waters; this is one part per trillion. Many testing labs say that they cannot measure and even EPA has admitted it has trouble measuring one part per trillion. Still that is the requirement.

I further point out that this is being achieved despite the fact that Aerovox and others in the area were not particularly mindful of the environment in the past—we did not know that what we were doing was wrong. Still the fact is we did not try to minimize our discharge into the environment. We used scrap material to oil the roads, and keep the dust down. Our practices were not good, and we used a much less biodegradable material at that time.

And last, one of the things that has not been previously mentioned is that one of the best uses of PCB was for bottom paint on boats. Practically every vessel in New Bedford, which has many boats, was painted with PCB up through 1971—a high chlorine content PCB, 10 to 15 percent and therefore nonbiodegradable. If you scrape those hulls you will find the PCB is still there, but Buzzards Bay has been cleared up.

I am sure there are other ways in which PCB have gotten into my local environment. As a matter of fact, EPA pointed out that

a recent bridge across the New Bedford Harbor, carrying I-95 across, was done with a lot of landfill and that PCB was found in the earth.

You are groping with a very big task. There is no doubt that we have got to stop using PCB as quickly as possible. I hope, and suspect that we can do that in the timespan I just suggested but that is still 2 years plus. The bigger problem is what we do to rectify the harm done to the environment over the past 45 years; I do not have that answer, and I have spent virtually half of my time over the last 6 months dealing with the PCB problem.

Thank you.

Mr. DE LA GARZA. Thank you very much.

Mr. Studds?

Mr. STUDDS. Thank you, Mr. Chairman.

Mr. Tuttle, I appreciate your patience with our time schedule, and hope you make the airplane.

Do not pay any attention to Mr. de la Garza when he is talking about luring you to Texas.

You said that at one point, I think, with reference to EPA, that they refused to talk with you. You said they hold the Bible, and would not talk with you, or something like that.

Did I misunderstand you?

Mr. TUTTLE. I do not know. No, I did not mean to say that, at all. EPA has been very cooperative, very cooperative.

Mr. STUDDS. Then I beg your pardon.

Mr. TUTTLE. That was Underwriters Laboratory.

Mr. STUDDS. There has been, in your experience, no instance of lack of cooperation from Federal agencies?

Mr. TUTTLE. Absolutely none. None, no.

Mr. STUDDS. Did I understand you correctly to say that you are most optimistic in your estimate of July 1978 in terms of complete cessation of use of PCB, and a transfer to some other——

Mr. TUTTLE. That would assume that one of these two, or some small modification, or something that pops up very quickly with a fluid that was acceptable.

Mr. STUDDS. I gather from listening to you that your own company, and the industry in general, is doing every thing they can to further this research to accelerate that process?

Mr. TUTTLE. They are. About a dozen of us have attorneys now determining whether we can do this on a developmental joint effort.

Mr. STUDDS. Are you aware of any way in which you think the Government might, or ought to be of assistance in this problem that it has not been so far, or you do not care to see the Government involved?

Mr. TUTTLE. Let me say I would not want the Government mandating the industry on what fluid to use, unless it wants to pick up the responsibility for the product.

I would say that there are two things; and perhaps NBS, or some other group, could assist in making a legal vehicle to assist in the evaluation of alternative materials, rather than having 15 companies going in 15 directions. That is the American way, but it does not bring the product necessarily to the market first. The Japanese

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are working through MITI via such means, and getting things done quickly.

The other thing—and I should have mentioned it earlier. We made a very passionate plea when we met with Mr. Train 2 weeks ago that perhaps some legislation could be passed giving some kind of assistance on fire insurance, this would be helpful.

There is going to be a big problem with the insurance underwriters, and in the end I am afraid of a lot of instances will come to pass in which a person will say, "let us try a lawsuit." All of us in the industry are going to be faced with product liability insurance bills that are going to be very, very substantial—very substantial.

I do not profess to really know how this could be worked out. Mr. Train was not too optimistic, either.

Mr. STUDDS. Thank you, sir.

Thank you for your time, and thank you, Mr. Chairman, for being accommodating.

Mr. DE LA GARZA. Thank you. Mr. Studds.

Let the record show that I am a friend of the New Bedford fleet. I just do not want to afford them any real protection that would injure the Texas fleet.

Mr. Ruppe?

Mr. RUPPE. Thank you very much. It may wipe out the Massachusetts fleet.

Thank you for a very, very interesting, very informative statement.

You mention the work your company has done, and the work that Monsanto has done to eliminate the sale of open system use of PCB.

Do you, in your own company, and from your own knowledge, and experience, know whether there is a great deal of import of this product, or reprocessing of the product for open systems use in the United States?

Mr. TUTTLE. I cannot imagine anybody in business being foolhardy enough to play with the liability we have.

Monsanto required 4 years ago that each of us, in order to be a customer, personally indemnify the Board of Directors of Monsanto.

Mr. RUPPE. How about the guy who reprocesses the waste?

Mr. TUTTLE. I pay a huge $10 million insurance policy on each director, and to sell a little scrap oil for a few dollars would not be too intelligent.

Mr. RUPPE. You have no knowledge of import through open system, or recycling or reprocessing?

Mr. TUTTLE. We process all fluid that comes into our plant from Monsanto. It is not clean enough to use; we filter it ourselves. We do our own filtering, but——

Mr. RUPPE. But yours is an open system use, the end product?

Mr. TUTTLE. The end product is closed, yes. The only place that I can think of it would not be in small capacitors, which you must remember are non-repairable items.

There are repair stations for your larger transformers and your capacitors.

Yes, these repair stations are generally a part of one of the big three or four who make that end product: Westinghouse, General Electric, McGraw, and so on. To the best of my knowledge, they are operating under the same care and practice that is dictated by management of the other plants.

They take a transformer in, and perhaps drain fluids; if it is deemed broken down, they barrel it and ship it back to the home plant which has an incineration process. The repair station then refills the transformer with new fluid.

I think generally all of the normal safeguards are being practiced there. Admittedly I have heard the rumor about recycling, and black market, and so on, but I just do not know that it exists. I really do not. I have no way of believing it, other than via imports, and it is very possible that the amount of imports may be unstated.

We have identified one user of imports of the type that are under investigation, also a constituent.

Mr. STUDDS. I hope that that is not the distinction that it sounds like.

Mr. TUTTLE. It is.

This is not a good use, but I have to say that it happens to turn out a beautiful gear, very inexpensively. Unfortunately, it requires that PCB wax being burned off and this gets into the environment. I am sure there are people who are still trying to buy PCB for hydraulic equipment and other things, because it is better.

I know of one guy who had a whole bunch of booster pumps. Without PCB as a cooling fluid, he had to wipe out about $200,000 worth of pumps. He queried me on the sale of PCB, I said, "no", although I could have made a buck on it. It just was not worth it.

Believe me, I really do not know of any black market selling, and I would be surprised if there is any, unless there is something insignificant which has not been identified, and that is very possible.

Mr. RUPPE. A number of people on this committee and in Congress have introduced a variety of toxic substance control pieces of legislation.

Do you think there is any merit to any type of pretesting, or preanalysis of the effects of such products in this area, and I must confess I do not know anything about it, to be more specific, but would there be any value in this kind of pretesting, which I think EPA referred to even earlier, as one of the things that would be within their realm of authority should the Toxic Substance Control Act pass in any form?

Mr. TUTTLE. I must say, that had you asked me this 2 years ago, I would have said a Toxic Substance Control Act was not necessary. But now I think it is a good idea, even though it is going to further control business.

I will be honest; at least two of the fluids that we are looking to as alternatives may not be ecologically and environmentally any better than PCB. I mean that. My people tell me they are not sure that alternatives will buy a thing, except a more costly product that is less reliable; the environment may be no better off than it is with 1016.

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We might as well face up to potential problems before we bring out a new product—such as the cure all for the PCB that we are now using.

It is not impossible that via such legislation, and we do hear such arguments, that 1016 could be judged a PCB formula which should be continued for a long time. In this example, unfortunately, because Monsanto has gotten so much negative publicity, that even at triple the price, they would not continue PCB production.

I think that what Mr. Train suggested was a responsible way of eliminating the possibility of introducing harmful chemicals. He did not necessarily advocate pretesting except on certain formulations of chemicals—certain combinations of chemicals, that past experience indicated posed problems. I know that environment studies are going on right now by Dow Chemical on their fluids, and Monsanto on their fluids, and Dow Corning on their fluids, because they are coming into an area—replacing PCB—in which we, their customers, are saying there is no point in jumping from one fire and ending up in another fire the next day. EPA will be right down our necks all over again on a different chemical if it is hazardous.

So I think really toxic substances legislation, although it may not be this committee's responsibility, is in order for consideration. I must state though that I have not read the proposed bill.

Mr. RUPPE. Are you suggesting pretesting or, I think perhaps you said more identifying the chemical composition, or chemical pieces of the product?

Mr. TUTTLE. I am suggesting that some pretesting is necessary on certain more potentially harmful chemicals. I am suggesting—well, I am suggesting what Mr. Train recommended—that the legislation call for prenotification of any new chemical on those that were improvements of prior materials or new applications of chemicals used without harm in the past, nothing further need be done. But on those of known risk, pretesting I think would be in order—and obviously pretesting is being done right now.

Mr. RUPPE. Thank you, Mr. Chairman.

Mr. DE LA GARZA. Thank you very much.

Counsel?

Mr. MANNINA. Mr. Tuttle, you seem to indicate Aroclor 1016 should be continued in use, and that the environmental impact may not be as severe as other PCB's. You indicate that Dr. Risebrough at the University of California stresses in his study that he has yet to find that particular component of PCB in environmental or animal life.

I would hope you and Dr. Risebrough could get together.

I took the liberty of talking with him yesterday, and it was his feeling that your statement did not reflect his position accurately, that 1016 had been found in the environment and in animal life.

He further contended that 1016 is toxic. Given your statement, could you explain the difference between 1016 and 1242, if 1016 has 41 percent chlorine and Aroclor.

Why is 1016 a better compound than 1242?

Mr. TUTTLE. I am not a chemist or a toxicologist. It is not so much the amount of chlorine, but how many chlorine atoms are in the benzine molecule. Therefore, how much will biodegrade instantaneously.

Those with two atoms will go very quickly. Three quite quickly. The biodegradability of molecules with four atoms, as I said, is up in the air. So it is really what is inside the structure, not the percent of chlorine by weight.

Now, 1242 has got 7 percent of its molecules that contain 5, 6 or 7 chlorine atoms and do not degrade. 1016 has got 0.5 percent. That is the difference really; it has less of the 5, 6 and 7 atom molecules, and 1016 has got more one's and two's.

Mr. MANNINA. Thank you.

Mr. TUTTLE. That is the difference. I do think when the Chicago record is published, and I wish it were out now, that that quote will be correct.

Mr. MANNINA. Perhaps you can get together and verify, amongst yourselves.

Mr. TUTTLE. One individual from EPA did indicate my quote was correct, but let's drop the subject.

Mr. DE LA GARZA. Thank you very much.

We appreciate your contribution. I am sure there will be more questions, and with that, the committee will stand in recess until 2 p.m. tomorrow.

[Whereupon, at 6:16 p.m., the subcommittee recessed, to reconvene at 2 p.m., Thursday, January 29, 1976.]

MONS 216665

POLYCHLORINATED BIPHENYLS (PCB)

THURSDAY, JANUARY 29, 1976

HOUSE OF REPRESENTATIVES,
COMMITTEE ON MERCHANT MARINE AND FISHERIES,
SUBCOMMITTEE ON FISHERIES AND WILDLIFE
CONSERVATION AND THE ENVIRONMENT,
Washington, D.C.

The subcommittee met at 2:50 p.m., pursuant to recess, in room 1334, Longworth House Office Building, Hon. Robert L. Leggett, chairman of the subcommittee, presiding.

Mr. LEGGETT. The meeting of the Subcommittee on Fisheries and Wildlife Conservation and the Environment will please come to order.

This is the time regularly scheduled for the second day of hearings on the oversight problem with respect to polychlorinated biphenyls, also known as PCB's, being introduced into the environment in spite of the fact that we have taken certain voluntary precautions.

In testimony that we have received yesterday, the committee was apprised of the overall national problem, particularly as respects fire in the high concentration of PCB's found in the fish environment in the Great Lakes area, such parts of the Atlantic Coast, to a lesser degree in other parts of the country, including the Yukon.

Today, we have a total of six witnesses, and counsel has suggested that we have all six witnesses testify as a panel, and the members be allowed to perhaps question them, not necessarily in rotation, but as the demand may require.

Today we have Mr. Tom Carver, National Marine Fisheries Service, U.S. Department of Commerce; Mr. Karim Ahmed, Natural Resources Defense Council: Mr. Lee Weddig, executive director, National Fisheries Institute; Dr. Del Wayne Nimmo, Environmental Reserch Lab, Environmental Protection Agency; Mr. Bob Pond, Stripers Unlimited: and Prof. Donald Parejko, Department of Biology, Northern Michigan University.

Very good, gentlemen.

Mr. Carver, your job with the National Marine Fisheries Service is what?

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STATEMENT OF TOM CARVER, NATIONAL MARINE FISHERIES SERVICE, U.S. DEPARTMENT OF COMMERCE

Mr. CARVER. Pesticide Specialist in Environmental Investigations.

Mr. LEGGETT. Very well.

Counsel, at this point, wants to complete our record in that he wants to present some documents to the committee and they include what, Mr. Spensley?

Mr. SPENSLEY. Mr. Chairman, on January 22, the letter was sent to you from Dr. McKelvey at the U.S. Geological Survey, requesting certain information with respect to PCB's in the environment.

Similarly, a letter was also sent to Hon. Alexander Schmidt, Commissioner of the Food and Drug Administration, on the same date, asking confirmation as to their research on PCB's, and we have submitted for the record responses from both of those gentlemen as well.

Mr. LEGGETT. Do they confirm, in fact, they do have PCB's in the environment?

Mr. SPENSLEY. Yes, they do confirm that and outline the research they are doing with PCB's.

In addition to that, the McGraw-Edison Co. has presented a study.

Mr. LEGGETT. A study of alternatives for PCB's and capacitors, and they point up some utilization of foods by the Japanese.

Let me ask this, counsel.

What are the conclusions that we draw from throughout the presentation?

Mr. SPENSLEY. I have not had a chance to digest the entire documents.

Mr. LEGGETT. Very good.

We will not ask you then to present a preliminary perusal.

Have you digested what Interior said?

Mr. SPENSLEY. This is from the U.S. Geological Survey.

Mr. LEGGETT. The Department of Interior has not responded.

All right. We find that PCB's are mobile. It is difficult to assess.

All right. All those documents will be inserted in the record at this point.

[The documents referred to follow:]

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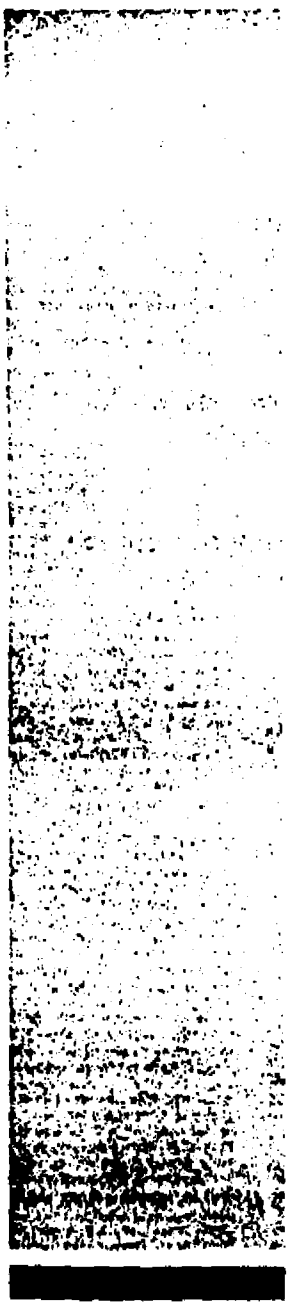


McGRAW-EDISON COMPANY
Power Systems Division

Canonsburg, Pennsylvania 15317

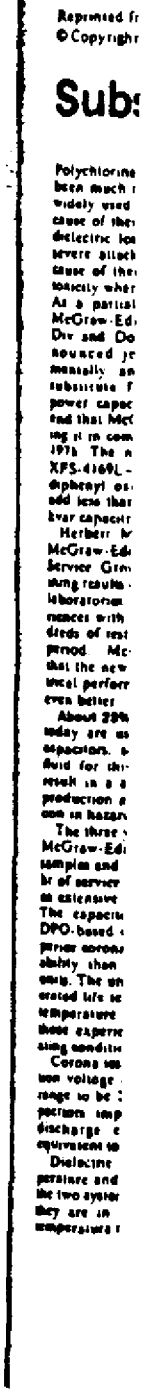
A Replacement for
PCB's in High Voltage
Power Capacitors

MONS 216668

Section A: Reprint of article from January 1, 1976 issue of Electrical World.

Section B: Text of bulletin now being prepared for publication.

Section C: Technical paper prepared jointly by McGraw-Edison Company and Dow Chemical Company.



MONS 216669

Section C

Reprinted from January 1, 1976 issue of Electrical World
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Substitute found for PCBs in capacitors

Polychlorinated biphenyls (PCBs) have been much in the news of late. Though widely used in electrical apparatus because of their nonflammability and low dielectric loss, PCBs have been under severe attack by environmentalists because of their extreme persistence and toxicity when they enter the food chain. As a partial answer to this problem, McGraw-Edison Co's Power Systems Div and Dow Chemical Co have announced jointly that an environmentally and electrically acceptable substitute for PCB in high-voltage power capacitors has been developed, and that McGraw-Edison will begin using it in commercial quantities by mid-1976. The new fluid—designated Dow XFS-4169L—has an alkylated chlorodiphenyl oxide (DPO) base, and will add less than $20 to the cost of a 200-kvar capacitor.

Herbert M. Appleton, president of McGraw-Edison's Electrical Systems & Service Group, says that, after examining results of tests performed at Dow's laboratories as well as evaluating experiences with its own equipment in hundreds of test samples over a three-year period, McGraw-Edison determined that the new fluid offers the same electrical performance as PCBs, or perhaps even better.

About 25% of all PCBs manufactured today are used in high-voltage power capacitors, so acceptance of the new fluid for this application alone would result in a significant cutback of PCB production and a corresponding reduction in hazard to the environment.

The three years of electrical testing by McGraw-Edison involved hundreds of samples and more than 10-million kvar-h of service for full-sized units, as well as extensive testing of miniature units. The capacitors impregnated with the DPO-based dielectric demonstrated superior corona behavior and greater reliability than similar PCB-impregnated units. The units were subjected to accelerated life tests, with voltage stress and temperature ranges greatly in excess of those experienced under normal operating conditions.

Corona tests showed discharge inception voltage over the normal operating range to be 20-25% higher than for capacitors impregnated with PCB, and discharge extinction voltages were equivalent to those of PCB systems.

Dielectric loss as a function of temperature and stress also is equivalent in the two systems. The losses are as low as they are in PCB systems, from room temperature to about 90C.

The new dielectric fluid introduced by McGraw-Edison and Dow is technically a flammable liquid, using a standard flammability test. However, a comparison of flash and fire points shows that the new fluid has substantial advantages over mineral oil (see table).

Unlike distribution transformers in which the flash and fire points are often approached, capacitors are hermetically sealed, and the dielectric fluid normally

Flammability of insulants

	Flash deg. C	Fire deg. C
Mineral oil	154	167
PCB	166	216
XFS-4169L	174	199

attains maximum temperatures that are well below both the flash and fire points. Therefore, substantial energy is required from an arc to produce a fire.

The National Electrical Code allows installation of electrical devices in or on buildings without a vault if they contain less than 5 gal of a flammable liquid. The commonest-sized power capacitor—a 200-kvar unit—contains less than 5 gal of fluid—and is usually installed out-of-doors. Therefore, the flammability classification does not pose a serious drawback to use of the fluid in capacitors.

As a flammable liquid, the DPO-based dielectric offers at least one major advantage over the PCB it replaces. PCBs require incineration at temperatures in excess of 2,000F and under highly controlled conditions for environmentally acceptable disposal (EW, Sept 15, 1970, p 76). The new insulating fluid requires no special incineration, and no toxic residue is emitted or deposited to the stack.

The problem of disposal of PCB was called to the world's attention in 1966 when its residues were detected during studies of the retention of DDT in animal tissues. Pressure against use of PCBs built up so rapidly that, in 1971, Monsanto Industrial Chemicals Co, principal producer of the chemical in the US, announced that it would, thereafter, restrict sales to use in so-called "closed-cycle" systems, such as capacitors and transformers.

The US Food & Drug Administration allows up to 5 ppm of PCBs in fish, but the US Fish & Wildlife Service considers anything over 0.5 ppm in a fish egg an unacceptable. Despite current tight control of PCBs in aquatic life, readings of these values have been found in fish in extensive sections of waterways throughout the country.

The low toxicity of DPO has been demonstrated in a test on fathead minnows. Comparatively, the DPO-based fluid proved to be 20 times less toxic to fish after 96 hr than were PCBs. A concentration of only 0.7 mg/liter of a capacitor-grade PCB was lethal to 50% of the minnows, compared to 13.4 mg/liter of the DPO-based fluid. Further tests in the same series indicated an even greater difference in toxicity for longer exposures.

In tests for toxicity to mammals the highest practical dosage of the DPO-based fluid did not kill rats. During a 90-day dietary feeding study, no significant differences resulted in control rats and rats fed up to 15 mg/kg/day. In a 110-lb person, this dose would be equivalent to 750 mg/day or 1,500 ppm if consumed in a daily portion of meat or fish.

Relative biodegradability of chemicals in the DPO-based fluid and in capacitor-grade PCB also shows a marked difference, according to the developers of the new fluid. Generally, DPO-based fluid chemicals biodegrade significantly faster than the chemicals in capacitor-grade PCB, at a rate comparable to many compensatory industrial chemicals.

Chlorodiphenyl oxide, the most-water-soluble component in the new dielectric fluid, biodegrades fast enough to be classified as "biodegradable" in wastewater-treatment plants, although the developers caution against using this kind of disposal as a recommended practice. Disposal of the DPO-based fluid should be performed as with any other low-hazard chemical.

The new fluid is intended for use in capacitors, and is not directly applicable to transformers. Dow, however, has a polydimethyl siloxane liquid under test for this purpose. The Japanese National Railway System has used it for almost five years and ongoing field evaluation is under way in France, Scandinavia, and Great Britain.

Dow has assured the electrical industry that it will have the manufacturing capability to produce XFS-4169L at a 1-million-lb/yr rate during the first quarter of 1976. Should the fluid prove acceptable to the industry, Dow is willing to make a commitment to produce it in multimillion-lb/yr quantities by the end of 1976. ●

MONS 216670

Section A

(Text of bulletin now being prepared for publication.)

AN ENVIRONMENTALLY ACCEPTABLE LIQUID DIELECTRIC FOR POWER CAPACITORS

By

McGraw-Edison Company
Power Systems Division
Greenwood, South Carolina

MONS 216671

ıblication.)

ıIELECTRIC

United States Department of the Interior

GEOLOGICAL SURVEY
RESTON, VIRGINIA 22092

JAN 28 1976

Honorable Robert L. Leggett, Chairman
Subcommittee on Fisheries and Wildlife
Conservation and the Environment
Committee on Merchant Marine and Fisheries
U.S. House of Representatives
Room 1334, Longworth House Office Bldg.
Washington, D.C. 20515

Dear Mr. Leggett:

In response to your request of January 22, 1976, for a letter detailing several aspects of the Geological Survey's water resources investigations, I submit the enclosed information. The enclosure was prepared by Dr. R. J. Pickering, Chief of the Quality of Water Branch in our Water Resources Division, after consultation with Ms. Nancy Matthews of Congressman Ottinger's staff. Dr. Pickering's replies are numbered according to the questions enumerated in your January 22 letter. I hope this will be of some help to you in the hearings that you will be holding later this week.

In addition to the replies to your specific questions, I also have enclosed literature describing the Geological Survey's Water Data Storage and Retrieval System (WATSTORE), our fledgling National Water Data Exchange (NAWDEX), and the program of our Office of Water Data Coordination (OWDC) which is a function assigned to the Department of the Interior by OMB Circular A-67.

Because of the time required to make retrievals and statistical summaries of the many thousands of water-quality analyses in our data storage system, we are able to provide at this time only a computer printout of individual determinations for six selected constituents on a station-by-station basis, but we will be pleased to provide a stetistical summary of the data for insertion into the Congressional Record as Dr. Pickering has arranged with Ms. Matthews.

Sincerely yours,

V. E. McKelvey

Director

MONS 216672

Enclosures:
- Computor printout of analyses for 6 toxic substances
- WATSTORE Phamphlet
- USGS Circular 460-E
- USGS Circular 643
- NAWDEX design pamphlet (OWDC)
- Brochure on OWDC functions (OWDC)
- Digest of 1972 Catalog of Info on Water Data (OWDC)

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ATTACHMENT
R. J. Pickering
1/27/76

1. The bulk of the Geological Survey's information on PCBs in the biological environment is with reference to fresh-water aquatic environments--that is, streams and lakes. Data obtained to date make it clear that PCBs are very widespread in their occurrence, that they travel largely in solids suspended in the water, and that they reside in significant concentrations in bottom sediments of rivers and lakes.

The Geological Survey has no systematic continuing program for sampling and analyzing PCBs in biological materials. Our data consist of the results of studies of known problem areas, and are not representative of the fresh-water aquatic biological community as a whole. The data do show, however, that PCBs are readily taken up by aquatic organisms when they are introduced into the aquatic environment.

2. The Geological Survey's program of water resources investigations is nationwide in geographic extent and addresses a broad range of physical, chemical, and biological characteristics of water quality. It can be divided into three types of programs: (1) the Federal program, which is designed to develop information about large geographic areas and an understanding of general hydrologic principles, and which is funded wholly through our annual appropriation from Congress; (2) the programs with other Federal agencies, which are usually funded by the agency requesting the work and are in response to specific needs of those agencies; (3) and the Federal-State cooperative program, which responds to the needs of State and local agencies for water data in which the Federal government also has an interest, and which usually is funded on a 50-50 basis with the cooperating agency providing half the funds and the Geological Survey providing the other half.

Our water-quality program has grown so rapidly in the past few years that we have found it necessary to centralize and automate our water-quality laboratories. Our three large laboratories now perform an average of 7,000 individual determinations per day, and the demand continues to rise. The variety of determinations has changed in recent years, also. We are making many more determinations of toxic metals, pesticides and other toxic organic chemicals, and biological characteristics than in previous years. The mix of water and sediment fractions and chemical characteristics to be measured results in a very large number of measurements that can be made. Our Central Laboratories System offers a total of about 400 standard determinations at the present time, and provides many more on a custom-analysis basis.

One or more water-quality characteristics were measured at more than 5,600 sites on surface streams and at about 350 sites on lakes or reservoirs in 1975, and water-quality data are available for about 80,000 ground-water wells. Sites selected for sampling range from ground-water wells and remote surface water sites unaffected by man to highly polluted locations such as streams draining urban-industrial complexes or wells sampling ground water below surface waste-disposal sites.

3. The accompanying data printout lists the sites at which PCBs in the several water fractions have been measured. Many of these are in known problem areas, so the range of concentrations cannot be considered to represent a balanced assessment of conditions nationwide. However, we hope that such a balanced assessment for the Nation's major rivers will be provided eventually through the National Pesticide Water Monitoring Program, which we have recently initiated in cooperation with the Environmental Protection Agency.

Some feeling for the mobile nature of PCBs can be obtained from the fact that they have been detected in water and bottom sediments at stations in our Hydrologic Bench Mark Network. Stations selected for this network are believed to be essentially free of man's influence in terms of known flow regulation and waste inputs. It is suspected that a significant part of the PCBs found at these sites was transported by air.

The National Interim Primary Drinking Water Regulations, published in the Federal Register for December 24, 1975, lists no maximum contaminant levels for PCBs because of insufficient information on their occurrence, their health effects, and methods for their analysis. However, the National Academy of Sciences' "Water Quality Criteria, 1972" recommends a maximum concentration of PCBs of 0.002 micrograms per liter (ug/l) in water-suspended sediment mixtures for fresh water aquatic life and wildlife. Because this concentration is below the sensitivity of the Geological Survey's analytical method, any positive numbers in the data printout can be considered as representing excessive levels of concentration of PCBs.

4 and 5. As noted under 2 above, our central laboratories are capable of providing a very large number of determinations on request. These include essentially all the toxic and nontoxic inorganic substances of current interest, many of the persistent pesticides, and selected organic compounds of special interest, such as PCBs, PCNs, TNT, RDX, and Kepone.

The accompanying data printout shows the levels of concentration in our Nation's waters of PCBs and five other toxic substances that you have indicated are of interest to your subcommittee. A statistical summary of these data will be provided within the next few days. As

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a basis for comparison with sites relatively unaffected by man, the summary will include a separate listing of the ranges of concentrations observed at our Benchmark Network sites during a three-year period. For your further information, a copy of USGS Circular 460-E, which describes the quality of water at our Hydrologic Benchmark sites, is enclosed. Also enclosed is a copy of USGS Circular 643, which describes the results of a 1970 reconnaissance of seven minor elements in surface waters of the United States.

6. The Geological Survey disseminates the information gained through its water-resources investigations widely in order to make it of benefit to the maximum number of potential users. The availability of water-quality data for stations or water wells sampled on a continuing basis is announced in the Catalog of Information on Water Data (digest enclosed) that is issued regularly by the Office of Water Data Coordination. Basic data are stored in our computerized data bank (WATSTORE) from which the enclosed printout was obtained, and are also published in a series of annual basic data reports organized on a state-boundary basis. Large masses of one-time-only data that are not stored in our data bank or published in our basic data reports are published as raw data and/or in summary form in our several series of interpretive reports, or in reports issued by cooperating agencies.

The availability of Geological Survey reports is announced in our monthly List of Publications of the Geological Survey, in the catalogs of the Department of the Interior's Water Resources Scientific Information Center, and in lists of publications available from several other organizations such as the National Technical Information Service and the Government Printing Office. In addition, copies of basic data and completed reports are provided to organizations and individuals whom we may know have a particular interest in them, either through their direct involvement in the data-collection program or their expressed interest.

Our field offices have instructions to inform appropriate state and Federal officials of potentially dangerous situations such as observed concentrations of toxic substances exceeding public health standards in raw sources of public water supplies. All basic water-quality data stored in our WATSTORE system are transferred to EPA's STORET system on a weekly basis, and streamflow data are provided on request.

For the past several years we have provided the Council on Environmental Quality with input to their annual report, and we are now discussing with them ways in which we can provide CEQ with basic data on an even more timely basis. The Geological Survey endeavors to apprise other Federal agencies of the availability of our data

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through regular meetings of a number of Federal interagency coordinating committees. Close contact is maintained with all appropriate Federal agencies on such matters as standardization of methods for field and laboratory measurements, and future plans for water-data acquisition.

7. The type of cooperative arrangements that the Survey makes with Federal, State, and local agencies vary considerably. As noted above, cooperative programs with State and local agencies usually are funded on a 50-50 basis. Occasionally, a State or local cooperator may provide all the project funds. Formal documentation normally consists of a simple cooperative agreement between the two agencies.

Cooperative programs with other Federal agencies also are normally by interagency agreement, with transfer of funds either at the field office level or at the Washington level. The programs may be long-term, such as our water-data gathering agreements with the Corps of Engineers or the National Weather Service, or one-year-only projects, such as our agreement with EPA in 1970 to mount a major effort to analyze surface-water samples for mercury.

8. It is difficult to assess the extent to which our water data are put to use by agencies receiving the information. We do know that many of the states have used our data as a basis for setting state water-quality standards and identifying water-quality limited reaches of state streams in accordance with the provisions of PL 92-500. The Corps of Engineers and National Weather Service use our streamflow data in managing the flows of some of the Nation's larger streams. Our salinity data for the Colorado River constitutes an important part of the information used by the Bureau of Reclamation in selecting salinity control measures to assure U.S. compliance with our treaty with Mexico. The Council on Environmental Quality intends to use data from our National Stream Quality Accounting Network (NASQAN) as input to its monthly report to the President on environmental conditions in the United States. Our own Conservation Division has used our advice and the data we are gathering in the oil shale and coal-mining areas of the West as a basis for writing monitoring requirements for lessees of Federal lands for production of energy raw materials. These are just a few examples of known uses to which our water data have been put by agencies receiving the data.

MONS 216677

INTRODUCTION

The history of developments in the power capacitor industry has been quite dramatic over the last 30 years. Through material and design improvements, power capacitors have had size reductions from 80 to 10 cubic inches per KVAR and prices have dropped from $5.00 per KVAR to the current low of $1.50 per KVAR, which has made capacitors one of the best buys in the electrical industry.

A major contributor to this dramatic product improvement has been the liquid dielectric Aroclor,* a capacitor-grade askarel containing polychlorinated biphenyl (PCB). But today, capacitor users and manufacturers are now faced with a major problem.

Table I is a brief account of industry and governmental activities regarding PCB liquid over the past 10 years.

TABLE I

Industry and Government Activities on PCB's

1966	- PCB detected in the environment
1971	- Federal Government establishes task force to coordinate government efforts investigating PCB liquids; FDA sets temporary PCB tolerance levels
1972	- Monsanto voluntarily restricts use of PCB liquid to electrical applications
1972-3	- EPA initiates new approach to toxic pollutant effluent standards
1974	- EPA develops criteria document (Clean water standard ... 1 part per trillion maximum)
1975	- Government task force reconvenes to consider EPA document

It is quite apparent from these actions that there is a real possibility that there will be a total ban on the use of PCB's in the United States in the very near future and it is of major concern to us as a manufacturer of power capacitors and to you as a major user of these electrical devices. It is for this reason that we have come to you to discuss alternative actions and present our recommendation.

PCB ALTERNATIVES

Mineral oil was used in capacitors 30 to 40 years ago and, therefore is a qualified capacitor dielectric. However, use of mineral oil would have detrimental effects on the power capacitor market.

*Monsanto trade name

First of all, the physical size of capacitor units would more than triple. This means that the 100-KVAR capacitor unit that we know today would be at least 3 times larger physically if made with mineral oil.

Second, material requirements would be triple that being used for equivalent KVAR sizes today. Serious raw material shortages would limit output - - especially paper dielectric and mineral oil. This would lead to inadequate supply to satisfy the KVAR needs of the industry.

Third, a 100-KVAR capacitor unit would be the largest size unit that could effectively be manufactured. This is opposed to the major usage today of 150-, 200- and 300-KVAR size units.

Fourth, with the tripling of unit physical sizes, capacitor equipments would increase in size to a point where they would be incompatible with existing facilities.

Last, but not least, cost per KVAR would increase by at least three times.

Obviously, mineral oil is an unacceptable alternate.

McGRAW-EDISON RECOMMENDATION

Over the past several years, McGraw-Edison has been engaged in a number of testing activities with various liquids aimed at the development of a replacement dielectric fluid for power capacitors. One of these fluids, a diphenyl oxide (DPO) based fluid developed by Dow Chemical Company, has been found to possess the required electrical, physical and environmental properties as specified in the testing program goals. The remainder of this presentation discusses the major aspects and results of this testing program.

Health and Environmental Evaluation

Dow Chemical Company has conducted an extensive and comprehensive evaluation of the DPO based fluid's impact on the environment. Their evaluation was based on:

- Persistence in the environment (biodegradability).
- Toxicity in mammals.
- Toxicity in fish.
- Bioconcentration in fish.

Persistence in the Environment (Biodegradability)

The biodegradability of the DPO based fluid has been observed to be much faster than capacitor grade PCB's. Figure 1 shows that the rate of biodegradability for the lower chlorinated fractions of PCB is known. The extremely slow or nondetectable rate is attributed to the higher degree of chlorination of PCB. The rates of biodegradability of the DPO based fluid are comparable to those of common industrial chemicals. Examples of these would be napthalene moth balls and dichlorobenzene used to deodorize lavatories. Neither of these industrial chemicals is known to present significant environmental problems.

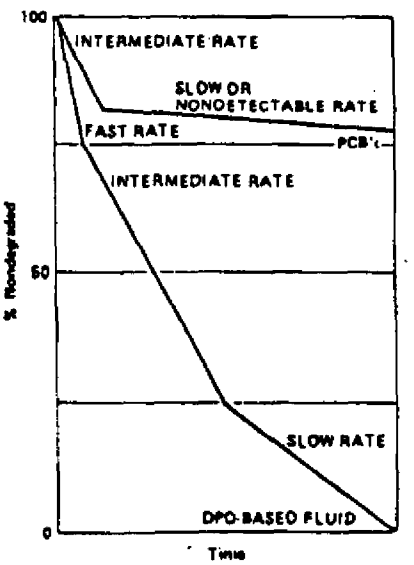

Figure 1.

There was a time when disposal of waste chemicals or capacitors was treated as standard refuse. Today, it is unlawful to dispose of materials in ways that will adversely affect man or his environment. Guidelines available from the EPA recommend that more hazardous types of waste require more extensive types of disposal. For PCB's this means special high temperature incinerators designed for chlorinated hydrocarbons - the most costly type of disposal. It is Dow Chemical Company's opinion that a supervised dry landfill is acceptable for the disposal of capacitors and adsorbents that contain the DPO based fluid.

Toxicity in Mammals

An evaluation of tests performed on animals shows that the DPO based fluid is less toxic than capacitor grade PCB's. These tests included toxicity from oral feeding, skin adsorption and vapor inhalation, plus irritation to eyes and skin. Based on this information, minimal protection measures for workers handling chemicals are recommended in accordance with the Occupational Safety and Health Act of 1970. This recommendation applies to chemicals with the least potential handling hazards. Oral administration tests were performed on rats to determine the maximum doses of the DPO based fluid and capacitor grade PCB which could be tolerated and yet sustain a 100% survival rate. These test results are shown in Table II. The DPO based fluid produced no fatalities among the rats after oral administrations of up to 10 grams/kilogram, the maximum practical dose level in this test, whereas the maximum dose of capacitor grade PCB was only 1 gram/kilogram. Preliminary results of a dietary study in rats has shown that the DPO based fluid has much less toxicity than PCB's after prolonged feedings. Also the accumulation factor (concentration of chemical in fat per concentration in diet) for the DPO based fluid was 0.1 as compared to 2.2 for capacitor grade PCB's.

TABLE II

TOXICITY IN MAMMALS

	Dosage (gm/kg)	
Acute oral, rats	DPO Based Fluid	Capacitor Grade PCB
100% survival	greater than 10	1.0

Toxicity in Fish

The toxicity of the DPO based fluid to fish is significantly less than the toxicity of capacitor grade PCB's. Table III shows the concentration of several common samples that is lethal to 50 percent of the fish (LC_{50}).

TABLE III

TOXICITY CLASSIFICATION FOR FISH

Toxicity	Example	LC_{50} ppm
Low	ethyl alcohol	100
Moderate	dry cleaning solvent	10-100
Toxic	naphthalene (moth balls)	1-10
Extreme	DDT	1

Table IV shows the results of the conventional static water test on fathead minnows used to compare the toxicity of DPO based fluid with capacitor grade PCB. It can be seen that the DPO based fluid is moderately toxic to the fish while PCB is extremely toxic.

TABLE IV

TOXICITY IN FATHEAD MINNOWS

Test	LC_{50} (ml/liter; ppm)	
	DPO based Fluid	PCB
96-hour static water [EPA recommended procedure	15	0.76

To give you a volumetric perspective of this contamination, the 0.76 milligrams/liter is equivalent to approximately 45 drops of PCB (from an eye dropper) in 1,000 gallons of water. Recognize that this is the amount that will kill 50 percent of the fish in 96 hours. In order to kill no fish in this period of time, the contaminated water would have to be diluted to 10,000 gallons. Water quality criteria of PCB is one part per trillion.

Bioconcentration in Fish

Tests to evaluate chemical bioconcentration in rainbow trout have shown that the DPO based fluid has a low bioconcentration potential as opposed to a very high potential for capacitor grade PCB's. It was this bioconcentration of PCB's in fish that was one of the most detrimental environmental properties and gave rise to the FDA limit of 5 parts per million in fish. For example, comparison of the environmentally significant components of DPO and PCB capacitor grade fluids shows that the PCB bioconcentration potential is 30 times greater than that of the DPO based fluid. Organic chemicals that have low water solubility are easily picked up and stored by fish, especially in the fat. This happens whether the chemicals are present in their food or the water.

Environmental Evaluation Summary

To summarize the four environmental evaluation points, refer to Table V. Capacitor grade PCB, mineral oil and the DPO based fluid are listed in a forced ranking based in their degree of environmental hazardousness.

TABLE V

RELATIVE ENVIRONMENTAL HAZARDS

Forced Ranking (1 to 5)

Chemical	Biodegradability	Toxicity: Mammal	Toxicity: Fish	Bioconcentration	Total
PCB	5	3	5	5	18
Mineral Oil	4	1	1	4	10
DPO based Fluid	3	1	2	2	8

Note: A total of 20 is the most hazardous ranking possible and 5 is least hazardous ranking.

Electrical Test Program

Since 1971 McGraw-Edison has been conducting an active research program on various liquids to replace capacitor grade PCB's. Over 1000 small capacitor units have been tested and over 400 of these were impregnated with the new DPO based fluid.

Results of the extensive test program on small capacitors are outlined in Table VI.

TABLE VI

McGRAW-EDISON TEST PROGRAM

Type of Test	Conditions	Failures
Voltage Stress	Stress: 150% Time: 2 years Stress: 200% Time: 1000 hours	None
Low Temperature	Stress: 150% Temp. : -30°C Time : Over 200 hours	None
High Temperature	Stress: 175% Temp. : 75°C Time : Over 1000 hours	None
Switching Surge	Stress: 125% Time : 7000 hours 65,000 switching operations at 250% rated stress	None

Full size 100- and 200-kvar capacitor units were used during the reliability tests. These units were tested at stresses ranging from rated voltage to 160% of rated voltage and temperatures ranging from from -30 C. to +40 C. To date, over 18 million kvar-hours of operation have been logged during which time no failures have been experienced.

The DPO based fluid works satisfactorily in both paper-film and all-film capacitors. However, since it was developed primarily for use with an all-film dielectric as opposed to a paper-film dielectric, it is necessary to review the major electrical features of McGraw-Edison's all-film capacitor which are directly affected by the use of this new fluid.

*Average dielectric losses under operating conditions were reduced from 0.5 (paper-film) to 0.2 (all-film) watts per KVAR.

*Low temperature rises during operation provide for greater kilovar stability.

*Operating costs are reduced since less total system capacity is required plus a savings of kilowatt hours during operation.

*Higher level of reliability due to the greater ratio of discharge inception voltage (DIV) to operating voltage, thereby reducing the possibility of corona damage to the dielectric.

*Greatly reduced tank rupture hazard due to the absence of paper in the dielectric.

Therefore, the DPO based fluid will allow the capacitor industry to maintain or improve on present capacitor designs using PCB's.

In the following several paragraphs, a comparison is made between specific tests of identical all-film dielectric capacitors impregnated with PCB and the DPO based fluid.

FIGURE 3

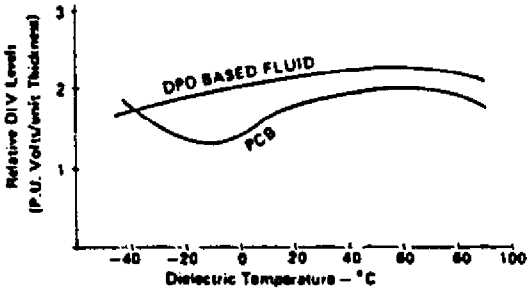

Figure 3 presents a comparison of discharge inception voltage (DIV) versus temperature. Capacitor units impregnated with the DPO based fluid shows an appreciable advantage over those impregnated with PCB.

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Note that with DPO based fluid, only slight changes in DIV occur over the normal temperature operating range. This means that the capacitor units with the DPO based fluid would have a greater margin of safety between their operating stress and the DIV and have better low-temperature over-voltage characteristics.

The results of this data show that through the use of the DPO based fluid as a dielectric, users can be assured of having capacitor units that will maintain or improve on the present available electrical ratings and physical sizes.

Up to now, capacitors impregnated with PCB's have been very desirable because of the non-flammable characteristic of PCB. Table VII shows a comparison of the DPO based fluid as compared to PCB and mineral oil.

Note that the DPO based fluid is definitely less flammable than mineral oil even though it is classified as a flammable liquid, whereas PCB is a non-flammable liquid. By definition (Underwriter's Laboratories) a non-flammable liquid has a fire point which exceeds its boiling point.

TABLE VII

FLAMMABILITY CHARACTERISTICS

Dielectric Liquid	Flash Point (°C)	Fire Point (°C)
PCB	165	None to 315*
DPO-based fluid	175	200
Mineral oil	155	170

*Boiled at 300°C.

Although the flammability rating of the DPO based fluid is a disadvantage, it is offset by the improved tank rupture characteristics of all-film capacitor designs. This important feature allows users to more safely protect capacitor equipments and prevent the possibility of tank rupture which could result in a fire hazard and environmental damage.

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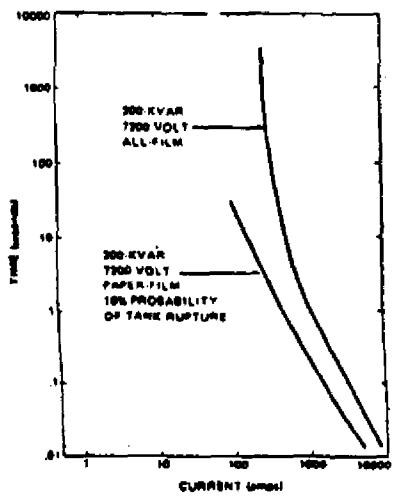
FIGURE C



Comparison of all-film vs. paper-film capacitor tank-rupture curves

Figure C shows the comparison of the all-film Type S capacitor tank rupture characteristic with that of the Type R paper-film design. There is a definite improvement in the safe zone of fusing that can be obtained by using all-film capacitors and also allows application of capacitors in higher fault current areas. McGraw-Edison has found through extensive testing that no internal gases are generated during an all-film capacitor failure mode. This is because of the absence of paper in the active all-film dielectric, and is in contrast to the gases which are generated during a paper-film capacitor failure mode - gases which would in turn rupture the tank.

CONCLUSION

Upon completion of careful cost studies, it has been concluded that the cost of a capacitor unit impregnated with the DPO based fluid will be approximately 25 percent higher than a comparable PCB unit.

But consider:

*The cost in terms of the alternative, mineral oil, and what its use will cost in terms of compatability, dollars, space and beautility.

*The dollars involved in cleaning up after a PCB accident or disposal of PCB capacitors.

With the DPO based fluid, McGraw-Edison can offer all capacitor users:

1. An adequate KVAR supply in the near future.

2. Compatible physical sizes with present equipments.

3. The superior electrical characteristics of today's capacitors.

4. Capacitors at a reasonable cost.

We have now reached the point where field trial experience is necessary to fully qualify the DPO based fluid as a dielectric liquid for power capacitors. May we count on your participation in this field trial program?

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Section B

AN ENVIRONMENTALLY ACCEPTABLE FLUID FOR POWER CAPACITORS

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Dean Brunson
Dow Chemical Company
Midland, Michigan

ABSTRACT

A new and environmentally acceptable dielectric fluid has been developed for power-factor-correction capacitors. The fluid is based on alkyl chlorobiphenyl oxide and has excellent dielectric properties when used in an all-film capacitor. The dielectric losses are very low, the partial discharge inception voltages are high, and the system is reliable.

The health and environmental properties of new fluid compared to capacitor-grade polychlorinated biphenyl show low toxicity to fish and mammals, less accumulation in fish and mammals, and faster rates of biodegradability.

INTRODUCTION

Power-factor-correction capacitors have for many years used polychlorinated biphenyl (PCB) as the liquid impregnant. Capacitor-grade PCB is a very good dielectric fluid which has contributed significantly to the improvements in performance of power-factor-correction capacitors. In the last 30 years or so, the volume per kVAR has been reduced by a factor of about 8, the dielectric losses have been reduced by a factor of over 10, and the cost per kvar has been reduced by a factor of about 5. In short, capacitors have become more economical which is due, in part, to the use of PCB.

In the past few years, the use of PCB has been questioned on the grounds of its potential hazard to health and the environment. A suitable alternative to capacitor-grade PCB is necessary because of the significant role played by capacitors.

CRITERIA OF A NEW CAPACITOR FLUID

The suitability of candidate fluids in all-film capacitors was judged using the following criteria:

1. The dielectric losses were to remain as low as with PCB.
2. The partial discharge inception voltage of the new system was to be equivalent to that with PCB.
3. The new capacitive system was to exhibit equivalent reliability to a PCB capacitor system.
4. There should be no increase in volume per kvar.
5. The new capacitive system should not present any greater explosion and fire hazards than is realized with the PCB system.
6. The new fluid had to be environmentally acceptable.

It was also desired that candidate fluids be available in large quantities, at a reasonable price, and have themselves no capacitor manufacturing.

FLUID EVALUATION APPROACH

The project started with a literature search resulting in a list of hundreds of possible candidates. Over 50 fluids with desired physical and dielectric properties were obtained and evaluated.

The evaluations began by determining material compatibility. Fluids which would have dissolved polypropylene film or reacted with aluminum foil would obviously be rejected. The main evaluation, however, involved the performances of the liquid in miniature capacitors.[1]

The miniature capacitors were constructed and processed with the fluids and were subjected to various tests. The following performance was expected of the replacement fluid in the miniature capacitors:

1. The samples using the test fluid were to last as long as similar samples processed with capacitor PCB.
2. The samples had to exhibit reasonably high partial discharge inception voltages (PDIV's) in particular the PDIV had to be well above the operating stress over the entire operating temperature range (from about -40°C to +90°C).
3. The dissipation factor of the replacement liquid had to have reasonably low values over the ordinary operating temperature range of the dielectric. In particular, from about 20°C up to about 90°C, very low values were required, thereby resulting in low losses per kvar and ensuring against thermal overheating, and failure of the capacitor.
4. The dissipation factor was required not to increase with time of operation under electrical stress. At the same time, the PDIV was not permitted to decrease with time. If either of the above two requirements were not met, the system was considered unreliable and was rejected.
5. The samples using the new fluid had to last under conditions of switching surges.
6. The new fluid samples had to perform properly on life tests conducted under a wide range of temperature changes.

Most of the fluids evaluated using the above criteria were rejected. With additional work involving processing, additives, etc., some fluids did perform reasonably well.

THE NEW DIELECTRIC FLUID

In the latter half of the 1960's, it became increasingly apparent that there were health and environmental problems associated with PCB's. In 1971, a joint research program was established. During the course of the program, the family of alkyl chlorobiphenyl oxides was identified as the type of materials that has the best overall electrical, physical, and environmental properties.[2] For example,

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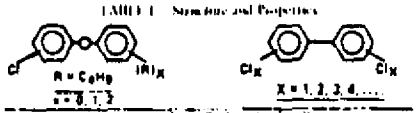
TABLE 1. Structure and Properties



Property	(DPO-Based) Fluid	Polychlorinated Biphenyl (PCB)
Dielectric constant (25°C)	4.5 – 4.5	5.3 – 5.9
Dielectric strength	33	25
Dissipation factor	0.01	0.01 – 0.04
Volume resistivity (ohm-cm)	8.2×10^{10}	5.0×10^{11}
Solubility in water (a) (25°C, mg/liter)	0.14 – 3.3	0.05 – 2.9
Viscosity (30°C, centistokes)	10.5	35.4
Vapor pressure (mm Hg, 25°C)	1.4×10^{-6}	2.0×10^{-4}
Pour point, C	< -45	< -14

a. Range of values for components in dielectric fluids.

b. Values listed for a capacitor grade PCB with the following weight percent composition, 1.5% C_3H_7, 21% C_3H_7, 56% C_3H_7, 21% C_4H_9, and 0.5% C_5H_9.

Intelated chlorodiphenyl oxide optimizes the good electrical properties while minimizing the adverse health and environmental characteristics. Table 1 shows the chemical structure of alkyl chlorodiphenyl oxide (DPO-based fluid) and PCB's.

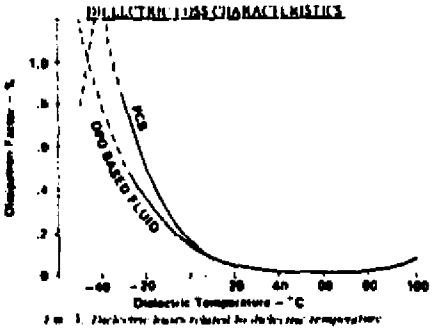


Fig. 1. Dielectric losses related to dielectric temperature.

Figure 1 compares the dielectric losses of capacitors impregnated with capacitor PCB and the diphenyl oxide (DPO-based fluid). Both of the systems used an epoxide additive in the liquid impregnant. The losses as a function of temperature are virtually identical on the two systems from 20°C to about 100°C. At very low temperatures, the two systems exhibit a difference. The PCB system peaks out at about -40°C because of the physical change in the fluid. The replacement system continues to have increases in dissipation factor and, at -60°C, the lowest temperature at which a reading was taken, the dissipation factor was about 2.0%.

Figure 2 exhibits the dielectric losses of the two systems as a function of the dielectric stress. The readings for Figure 2 were obtained at room temperature. The shapes of the two curves are quite similar with somewhat lower losses having been obtained on the new system. Additional data of dielectric loss as a function of

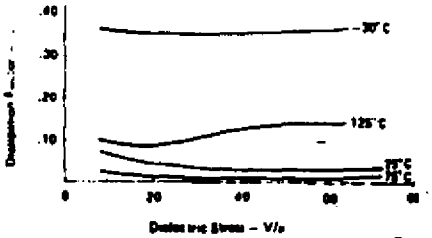


Fig. 2. Dielectric losses as a function of electrical stress.

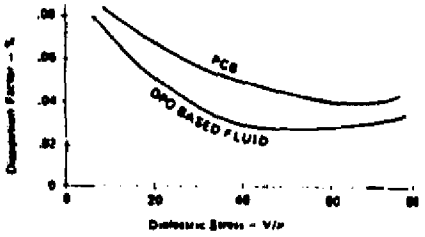


Fig. 3. Dielectric losses related to electrical stress at room temperatures.

dielectric stress for insulation capacitors impregnated with the DPO-based fluid is presented in Figure 3. Thus, depending on the stress chosen, the dielectric losses tend to be low from about 20% to well above 75%. The losses are somewhat higher at very high temperatures and considerably higher at very low temperatures. Thus, one of the requirements of the new liquid is met. It exhibits low losses from room temperature to about 90°C. The high losses at very low temperatures are generally felt to be desirable. The reliability of many dielectric systems have been found to be poor at very cold temperatures. The high losses at low temperatures force rapid heating of the dielectric and ensure operation in temperature regions where reliability is known to be very good.

PARTIAL DISCHARGE INCEPTION VOLTAGE

The discharge inception voltage (DIV) was required to be reasonably high above the design stress over the entire temperature range. Figure 4 is a presentation of the DIV as a function of temperature for PCB and the new liquid all-film systems. The solid dielectric was the same thickness in both cases. Except at very low temperatures

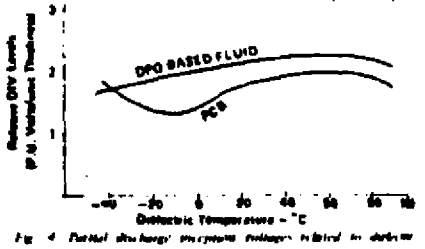


Fig. 4. Partial discharge inception voltages related to dielectric temperatures.

...ture. The film system has higher DIV values than does the PCB system. Particularly significant is the fact that the characteristic dip in the PCB systems at about 0° to -30°C is not present for the DPE-based fluid system. In this respect, the new dielectric system is more ideal in that the DIV changes only slightly over the normal operating temperature range.

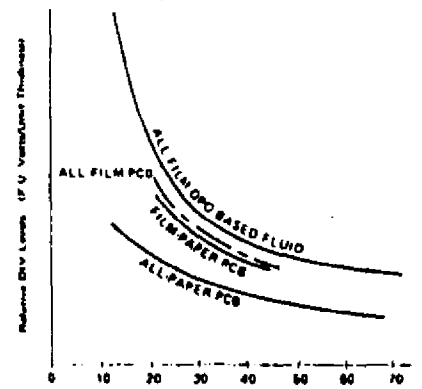


Fig. 5. Partial discharge inception voltage related to dielectric thickness.

Figure 5 shows the DIV as a function of the dielectric thickness for several capacitor systems. With the improvement in materials, the DIV has also improved.

The all-paper PCB system was an improvement over the all-paper mineral oil system. The use of polypropylene film led to substantial improvements. The introduction of the new fluid has raised the DIV still higher.

LIFE TESTING OF THE SYSTEM

Long-term testing under electrical stress had to be conducted on the systems for the purpose of determining changes in DIV and dielectric losses as a function of time. The miniature capacitors impregnated with the new fluid were life tested at both high and low temperatures and under conditions of extra-long stress. Although the tests are not complete, the preliminary results appear to be very reliable. As an example of one of the tests, consider Figure 6. The

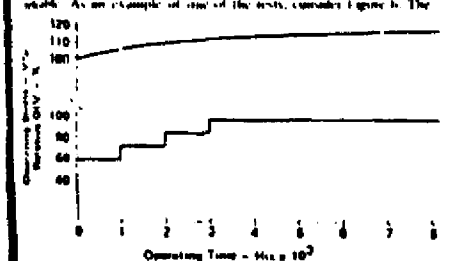


Fig. 6. Partial discharge inception voltage related to capacitor model operating stress.

...discharge-free life test capacitor samples under accelerated conditions. Initially, the electrical stress was raised every 1000 hours; however, at what was felt to be a sufficiently high stress, the stress was maintained at constant and optimal at that stress. The DIV required during the time that the units were on test. Additionally, the dielectric losses also decreased with time of operation.

These results life test conditions the all-film new fluid system met or exceeded all of the dielectric characteristics considered desirable.

TESTS INVOLVING FULL-SIZE CAPACITORS

An in-depth evaluation of the all-film DPE-based fluid system was performed utilizing miniature capacitor samples. The results had to be duplicated and verified on full-size capacitors. Numerous prototype capacitors were constructed and tested. The results as described above on the miniature samples have been verified in particular, the dielectric losses are, in fact, as described in Figure 7. Additionally, the capacitors were operated at stresses well above rated voltage for thousands of hours with excellent results. Some prototype capacitors were on test for over two years at stresses above the rated design stress.

RELATIVE DIELECTRIC CONSTANT

The relative dielectric constant of capacitor grade PCB is about 5.0 which compares to about 2.2 for the DPE-based fluid. Consequently, PCB has a 127% higher relative dielectric constant. It would be anticipated that this would influence capacitor design. In particular, it would be expected that the use of the new fluid in a capacitor would require substantially less area and therefore a larger volume/foot of the electrical stress is kept the same. This is probably true for all-paper capacitors where the fluid is a substantial constituent of the overall relative dielectric constant and therefore the capacitance. However, in the case of polypropylene, where the bulk of the dielectric is polypropylene, which impregnated with either impregnant PCB or the new fluid, exhibits an increase in the relative dielectric constant. As nearly as can be determined, the relative dielectric constant of polypropylene alone is actually slightly better when the new fluid is used as the impregnated instead of impregnant PCB. Thus, only the ordinary reduction in capacitance due to the lower dielectric constant of the fluid. The results to date have indicated a reduction in capacitance of about 10% for otherwise identical capacitors PCB to the DPE-based fluid. Because of the change in capacitance, the electrical stress and the volume will have to be changed to keep the kvar per unit volume the same.

FLAMMABILITY

It is desirable that capacitors, even when they fail, will not present a fire hazard to the surroundings. With the use of PCB many fire hazards are reduced. The liquid is relatively non-flammable and will not support a flame. However, when it is present in electrical equipment as a vapor with air, it can be ignited. The replacement fluid is declared as a flammable liquid using a standard flammability test. This is due to the presence of the substituted ethylene, which is present as a protective agent in PCB.

TABLE II — Electrical Fire Point of Dielectric Liquids

Dielectric Liquid	Flash Point (°C)	Fire Point (°C)
PCB	165	None to 315*
DPE-based fluid	175	200
Mineral oil	155	170

* Tested at 315°C

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Table II lists the flammability of three dielectric fluids. Here, the new dielectric fluid is flammable, but not as great a fire hazard as flammable oil is normally.

Prior to the use of PCB as capacitors, mineral oil was the commonly used dielectric liquid. The change to PCB was made because of superior dielectric properties, primarily a higher relative dielectric constant, the non-flammability was a desired by-product. Over the past 40 years, capacitors were developed into very efficient and safe machines. With the introduction of polypropylene film and the elimination of paper completely from the active dielectric, the risk of tank rupture and explosions were reduced substantially. The absence of the paper from the active dielectric has eliminated gassing almost entirely under conditions of ordinary failures. As a consequence, considerably longer times are required to cause bulging of tanks and tank ruptures. This means that fusing is much more effective in eliminating tank ruptures and explosions.

Capacitors operate with the dielectric fluid at temperatures well below either the flash or the fire point. In the case of distribution transformers, for example, the flash and fire points are very often approached. An arc of any kind will produce a fire if a flash is above the fire point. In contrast, a rather large amount of energy is required from an arc to produce a fire if the fluid is well below the flash or fire point as it is in a capacitor. As a result, with the use of the new fluid, a rather safe capacitor is produced. The fire hazard of the all-film DPO-based fluid is probably less than it is with the all-paper and paper-film PCB capacitor.

ENVIRONMENTAL CONSIDERATIONS

An environmentally acceptable alternative to a PCB fluid was delivered or a material that was significantly

Less toxic to fish and mammals.
Less accumulative in fish and mammals.
More biodegradable.

Table III summarizes the results of the toxicity and accumulation tests with fathead minnows and rats. Data from the Technical Manu-

TABLE III. Toxicity and Accumulation

Fathead Minnows	DPO-based Fluid	PCB	Ratio DPO-based Fluid Toxicity: PCB
Toxicity			
96-hour static water			
LC_{50}, ppm	15	0.75	20x
15-day flow-through LC_{50}, ppm	1.5	0.050	30x
Accumulation[a]			
Conc. in fish / conc. in water	0.23	2.2	10x[b]
Rat			
Toxicity, acute oral			
LD_{50}, g/kg	>20	1.0	
LD_{50}, mmol/kg	>50	1.0	>50x
90-day diet, no effect level, mg/kg/day		0.25 ppm	
Accumulation[c]			
% left in tissues after 60 days (5 mg/kg/day)	0.05	5.2	100x[d]

[a] Whole body concentration
[b] Less accumulative of PCB obtained by DPO-based fluid

water test[1] is important for regulating the discharge of chemicals into public water. The concentration of the DPO-based fluid that was lethal to 50% of the fathead minnows (LC_{50}), the most commonly accepted value, was 15.0 mg/liter[a] compared to 0.75 mg/liter[b] for a carbon-free PCB. The data shows the DPO-based fluid to be 20 times less toxic than PCB's to fathead minnows in 96 hours.

Data from the 15-day flow-thru water test[2] is important in determining the long-term exposure levels that are "safe" for fish. The test was stopped after 15 days because most of the animals from the DPO-based fluid screened earlier. The LC_{50} of the DPO-based fluid was 1.52 mg/liter[c] compared to 0.050 mg/liter[d] for the PCB. This means the DPO-based fluid was 30 times less toxic to fathead minnows after 15 days exposure. The trend of the data also indicated an even greater difference in toxicity for longer exposures.

The potential to accumulate in fathead minnows was determined by analyzing the concentration of chemicals in whole fish and exposure water. The samples were taken from the 15-day toxicity test[2] and extracts were analyzed by gas chromatography. The average concentration of butyltetrabiphenyl ranged in whole fathead minnows exposed to 1.65 ppm for 15 days was 180 ppm for tetrachlorobiphenyl, the concentrations in whole fathead minnows exposed to 0.051 ppm for 15 days was 490 ppm. The ratio of the concentrations in fish to the concentration in water was an index of the potential of these compounds to accumulate in fish. The ratio for butyltetrabiphenyl oxide was 530 compared to 9,700 for tetrachlorobiphenyl as shown on Table III. These data indicate that butyltetrabiphenyl oxide was about 20 times less accumulative than tetrachlorobiphenyl.

The data regarding acute oral toxicity to mammals, shown in Table III, indicate that the DPO-based fluid did not kill rats even at the highest practical dosage. This test was part of the acute toxicity studies which included an evaluation of rabbit skin irritation, rabbit eye irritation, toxicity from absorption through rabbit skin and toxicity to rats by inhalation of vapors. Based on the results of these tests, no significant pure and skin irritation will present hazards from inadvertent exposure during handling the DPO-based capacitor fluid. Accidental and accidental exposures of normal workers to other alkyltetrabiphenyl oxides[3] have not resulted in handling hazards.

Capacitor-grade PCB was also evaluated for acute toxicity by the same test methods in order to compare the DPO-based fluid and PCB tests. Both the PCB and DPO-based fluid were found to be relatively non-toxic to the skin of rabbits.

The DPO-based fluid was evaluated in a 90-day dietary feeding study on rats. The hematological parameters measured were body and organ weights, gross and microscopic pathology, clinical chemistry, hematology, and concentrations of the capacitor fluid in tissues. Data after 90 days showed that rats fed doses up to 15 mg/kg/day showed no weight gain differences in most parameters as control rats. The hematological parameters of an apparent decreased body weight have not been established at this time. The 15 mg/kg/day dose is equivalent to 750 mg/day for a 50-kg person or 1,500 ppm in the diet of 5-kg daily portions of meat or fish.

a The range of 95% confidence was 11.8-24.2 mg/liter
b The range of 95% confidence was 0.58-1.03 mg/liter
c The range of 95% confidence was 1.44-2.03 mg/liter
d The range of 95% confidence was 0.029-0.066 mg/liter
e Samples were taken from these aquaria with chemical concentrations around the LC_{50} concentration
f Intermediates in other products.

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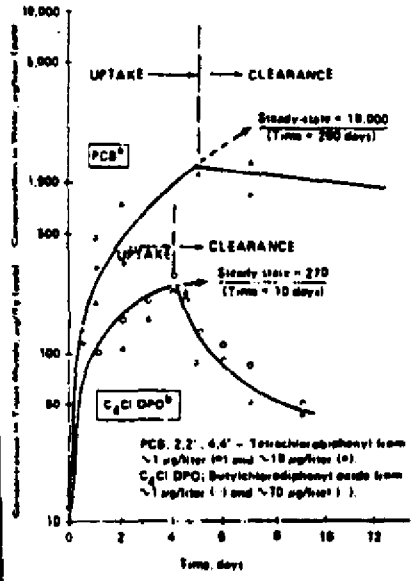

Fig. 2. Bioconcentration profile in trout muscle

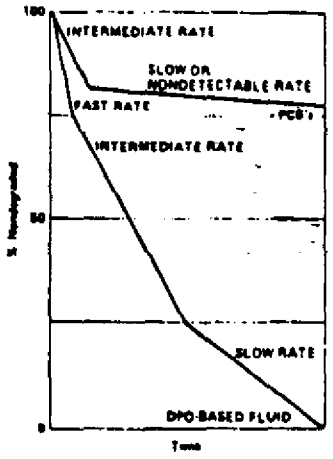

Fig. 3. Relative biodegradability

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accumulative in fish, less toxic and accumulative in mammals and more biodegradable.

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Mr. LEGGETT. Now, let me see. Some of you gentlemen have prepared statements and some of you do not.

As I understand it, Tom, you do not have a prepared statement at the outset.

Would you want to lead off, or some of you with the prepared statements would like to lead off?

Tom, you are No. 1 and you get the first option.

Mr. CARVER. Mr. Chairman, I do not have a prepared statement.

Mr. LEGGETT. Switch the microphone around, Tom.

Mr. CARVER. I do not have a prepared statement, but I do have some notes that outline the activities of our agency related to PCB's.

Mr. LEGGETT. All right.

Why not give us a brief overview of what you are doing?

Of course, we have had you here before. You are with Commerce, and I presume that you interrelate pretty well with your counterparts over in the Fish and Wildlife Service.

Mr. CARVER. Yes; with both the Fish and Wildlife Service and EPA.

Mr. LEGGETT. All right.

And we have had presentations yesterday by Nat Reed, who purported to speak for all of his associates, and gave us rather impressive assessment of what he considered his problem.

You can present your assessment.

Mr. CARVER. First, I would like to report some nonincriminating results from our Seattle laboratory.

We have recently completed a study in which we investigated the effects of PCB's via ingestion on juvenile coho salmon.

Some important results indicated that PCB's were not lethal when fed at levels considerably above concentrations in water that are lethal to fish.

No mortalities from PCB's occurred when levels up to 12 parts per million were fed for 5½ months.

The growth of salmon fed 1, 2, and 12 parts per million PCB's was statistically greater than the controlled fry.

This is contrary to the results reported by the Fish and Wildlife Service on lake trout, which is a freshwater species.

Mr. LEGGETT. That is a rather interesting statement you made.

Mr. CARVER. There is a species difference.

Mr. LEGGETT. I see.

And one species you can conclude responds negatively to PCB's rather dramatically.

Mr. CARVER. You have to bear in mind that this was a very carefully controlled experiment. They were subjected to PCB's only in the diet.

Mr. Chairman, this could not possibly be duplicated in nature because of the amount of PCB's that they would acquire through the normal process of respiration.

Mr. LEGGETT. Now, where did the PCB's in this test that you describe come from that they ingested and assimilated?

Mr. CARVER. The material was incorporated into a pellet.

Mr. LEGGETT. Well, all right.

Mr. CARVER. And is actually fed.

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Mr. LEGGETT. It was digested but was it actually assimilated into their system?

Mr. CARVER. The next point I was going to make is that the PCB's in the diet-induced activity of live enzymes that break down biphenyls, which implies that the compounds were metabolized and excreted.

Mr. LEGGETT. Was there any deleterious effect on the livers as discovered?

Mr. CARVER. You are one step ahead of me.

On the other side of the coin, work in progress as Seattle seems to indicate that environmental levels of PCB's in Puget Sound have a degenerative effect on fish livers.

Pathological examination of starry flounder in the Puget Sound showed almost all fish exhibited enlarged and abnormally colored livers.

These characteristics are similar to those described for livers of mammals exposed to high levels of PCB's.

In answer to your question, Mr. Chairman, yes.

We have also studies underway concerning the distribution and magnitude of PCB residues in marine species. Efforts have focused on specific fish, and the menhaden fisheries of the Atlantic and Gulf Coasts.

All samples from Alaska, Washington, and Oregon contain less than three-tenths of 1 part per million PCB's in the edible portion of the flesh.

The species include halibut, striped bass, sable fish, oysters, and mussels.

The largest fishery in the United States, based on the number of fish landed, is a nonfood species, the menhaden, which ranges from Maine to Texas.

The PCB levels in whole fish have decreased from 3.7 parts per million in 1971 to 1.0 parts per million in 1974. However, this still leaves a residue level in the oil of over 7 parts per million.

Of our samples, 70 percent exceeded the two parts per million level guideline that was established by the Food and Drug Administration.

Menhaden oil is also an export commodity for use in the manufacture of margarine. The PCB's in the oil do not represent a health hazard because they are removed by normal processing methods.

No menhaden meal from any area had as much as eight-tenths of 1 part per million PCB's.

Our ocean fish pesticide monitoring program is a joint venture with the EPA, and represents one element of the national pesticide monitoring program.

During 1973 and 1974, 175 samples of 20 fish each were analyzed, but the analyses were only of the liver.

The station locations ranged from Georges Bank—300 miles off the coast of New England—to South Carolina, the north central Gulf of Mexico, and from the Bering Sea in Alaska south to Los Angeles, Calif.

Bottom depths ranged down to near 1,000 feet. For the most part, residues were confined to DDT and PCB's in the low parts per million range.

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Notable exceptions were in the area west of Los Angeles, the mouth of the Columbia River area, and George's Bank.

In some samples from these areas, particularly sharks, the DDT complex and the PCB residues were in the 1 to 10 parts per million range.

Interpretation of these large residues was complicated by the absence of information on the age of the fish.

Repeat collections were made in the summer of 1975 in both inshore and offshore waters of the northwestern Atlantic. Only juvenile specimens were analyzed, Mr. Chairman. We subsequently analyfied shark embryos that were surgically removed. The results analyzed shark embryos that were surgically removed. The results are that the total body burden is a function of age.

That is the end of the summary of the work that we are doing.

If you have any additional questions, I will be happy to respond.

Mr. LEGGETT. Let me ask you this: Did you find any fish with 2 parts per million or above of PCB's that did not have liver damage or do you know?

Mr. CARVER. No; this would apply particularly to the menhaden. This is a nonfood resource.

Mr. LEGGETT. I did not understand that.

Mr. CARVER. We did not find that condition, no, sir.

Mr. LEGGETT. OK.

The areas that you indicated, the mouth of the Columbia River, Los Angeles, and George's Bank, that do have the PCB problem, what magnitude is that?

Mr. CARVER. Generally speaking it is less than 1 part per million, which does include liver damage.

We are discussing two different programs.

Mr. LEGGETT. What program are you discussing?

Mr. CARVER. Right now I am on the ocean fish monitoring program.

The environmental levels which are in the Sound are somewhere in the neighborhood of three-tenths to five-tenths part per million in adult fish, and you find liver damage.

Mr. LEGGETT. You find liver damage?

Mr. CARVER. Yes, sir.

Mr. LEGGETT. Now, have you found any evidence of deterioration in reproductive capacity?

Mr. CARVER. We have had no studies directed toward that. There is some information in the literature which would indicate this is the case.

Mr. LEGGETT. Now, you indicated that PCB's had gone down from 1972 to 1975.

Mr. CARVER. That was in the South Atlantic in one fishery.

Mr. LEGGETT. One fishery in the South Atlantic?

Mr. CARVER. Yes.

Mr. LEGGETT. Was that just one fish or a representative sample of fish?

Mr. CARVER. This was based on the analysee of hundreds of fish.

Mr. LEGGETT. Did you draw any reasons as to why that had occurred?

Mr. CARVER. No, sir.

Mr. LEGGETT. OK.

Mr. CARVER. This is an offshore fishery.

Mr. LEGGETT. How far offshore was the fishery?

Mr. CARVER. Up to 100, 150 miles.

Mr. LEGGETT. Normally do you find, let us say, at the mouth of the Columbia River, if you are 150 miles off the mouth of the Columbia River, would that affect——

Mr. CARVER. I do not think our ships went that far off the Columbia. We were sampling within 25, 30 miles of the mouth of the river system. I do not think they went out as far as you have mentioned.

Mr. LEGGETT. Well, Mr. Reed indicated yesterday that it is his position that considering the threat to fish and wildlife by PCB's that he would support a summary ban on all manufacture and import of PCB's for thrift.

Mr. Train indicated he would support that ban provided it were tied to a program to replace PCB's as soon as possible.

If I asked you do you have a position, would you be able to give it to me?

Mr. CARVER. I think we can support Mr. Train's position on that; to ban PCB's as soon as there is suitable replacement.

Mr. LEGGETT. Very good.

Our next witness is Dr. A. Karim Ahmed, Natural Resources Defense Council.

Your statement will be included in the record as though you completely read it. Your statement here is 4 pages.

You can go ahead.

You have some 15 conclusions.

STATEMENT OF DR. A. KARIM AHMED, NATURAL RESOURCES DEFENSE COUNCIL, INC.

Dr. AHMED. Mr. Chairman, what I have done here is try to summarize the information we have concerning the environmental contamination of PCB's.

Mr. LEGGETT. Why not go ahead and summarize each of those points for us.

Dr. AHMED. OK.

PCB residues are generally found in areas associated with high industrial and urban activity. Wildlife sampled in remote, non-populated areas generally show little or no detectable levels of PCB's.

High concentrations of PCB's have been observed in several predatory birds, including heron, white-tailed eagle, peregrine falcon, cormorants, et cetera. Tissue or whole body weight PCB values ranged in these species between 30 and several hundred parts per million.

Many fish species sampled in the Great Lakes region and in the Eastern seaboard have PCB concentration values well above the present FDA tolerance limit of 5 parts per million. In Lake Michigan this would include species such as chinook salmon, coho salmon, brown trout, tiger trout, lake trout, whitefish and carp.

Similar levels of PCB's have been shown to occur in walleye, white bass and carp in the northern reaches of the Mississippi River.

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particularly Minnesota. Certain varieties of lake trout in Lake Superior have PCB residues ranging up to 12.7 parts per million.

Nearly all the fish species sampled in Massachusetts rivers show PCB concentration values above 5 parts per million. Recent sampling by the federal EPA of fish caught in the Housatonic River at stations below Pittsfield, Mass., were the General Electric transformer manufacturing plant is located, show PCB concentration levels up to seven times above the present FDA standards.

Fish sampled in the Hudson River, north of Albany and in a region south of the two GE plants manufacturing electrical capacitors, show the highest PCB contamination thus far recorded in the United States. Recent monitoring data indicate extensive contamination of nearly all fish species in the upper reaches of the river, with values ranging upto 500 parts per million. Striped bass and shad caught in the lower Hudson River also show levels frequently above 5 parts per million.

The bottom sediments of the Hudson River appear to be a sink for the bulk of the non-degradable PCB's. Near the GE plants, sediment PCB levels ranged between 540 and 2,980 parts per million. Lower reaches of the Hudson River also contained PCB in the sediments, often in the order of 1 to 18 parts per million.

Dredging of river bottoms appears to be one of most certain routes by which the nonwater soluble PCB's can get resuspended into the river. It is clear that sufficient studies and careful abatement procedures will be required to minimize this potential problem. In the meantime, we strongly urge a complete mortatorium on all proposed river bottom dredging in the Hudson River.

PCB's, as a class of compounds, as you know, are extremely persistent and nonbiodegradable substances, and tend to bioaccumulate in the aquatic environment by factors of a few thousand to several hundred thousand fold. For example, fathead minnows may bioaccumulate as much as 200,000 fold.

PCB's have been shown to interfere with the reproductive process and hatchability of fish eggs, in concentration levels as low as 0.5 parts per million with certain species.

Similarly, PCB's have been demonstrated to effect the reproduction of several animal species, at dietary levels of 20 to 100 parts per million in experimental rats, and at less than 1 parts per million in minks. Several domestic bird species, such as pheasants and chickens, show marked thinning of eggshells and reduction of egg production when fed PCB as little as 10 parts per million.

Recent studies indicate that dietary levels as low as 2.5 parts per million show clear effect on the reproductive ability of female rhesus monkeys. It is important to note that many of the known human toxicity symptoms observed in acute ingestion of PCB's the so-called "Yusho" disease, were also seen with the primates studied in the above experiments.

Experimental rats fed PCB's at 100 parts per million for 21 months were recently shown to have an abnormally large number of malignant liver tumors. PCB's are also known to drastically increase the microsomal enzyme activity in mammalian species, indicating that its presence in the liver may help trigger the formation

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of potentially injurious or carcinogenic chemical metabolites in animals.

The effect of PCB contamination of commercial and sport fisheries in this country appears to be large. We estimate that about 22 million pounds of Hudson River striped bass are consumed each year, if we combine both commercial and sport catch figures. It has been estimated that between 50 and 90 percent of the North Atlantic striped bass are spawned in the Hudson River. Being a migratory fish, there is no way of distinguishing the origin of striped bass in the North Atlantic coastal areas, and thus it is possible that its entire stock may be contaminated.

A similar problem may also exist in the Great Lakes region. Commercially important fish in Lake Michigan, such as chubs, appear to be contaminated with PCB's. They accounted for 32 and 54 percent of the total commercial fisheries in Lake Michigan and Lake Superior, respectively.

I have also with me a copy of the paper I recently submitted at the National Conference on PCB's.

Mr. LEGGETT. You were in Chicago?

Dr. AHMED. In Chicago, right.

It has most of the points in my testimony expanded and fully documented.

Mr. LEGGETT. Your full statement will be received and if it is not too complicated or too long it will be incorporated in our record or else it will be digested by counsel.

[The statement follows:]

STATEMENT OF DR. A. KARIM AHMED, NATURAL RESOURCES DEFENSE COUNCIL, INC., NEW YORK, N.Y.

Polychlorinated biphenyl (PCB) residues were first detected in fish and wildlife samples accidentally by the Swedish scientist, S. Jensen, in 1966. This chemical substance, which is commercially available as a mixture of chlorinated compounds, has been used as a highly desirable fluid in a variety of industrial products and processes. Because of its abundant and widespread use, which reached a production peak of approximately 72 million pounds in 1970 in the U.S., PCB residues have now been detected in numerous aquatic and animal species, in river bottom sediments and in foods, such as poultry, fish and dairy products.

In this testimony, we wish to summarize briefly the extent of the environmental contamination of PCBs, its potential affect on animal and human health and its impact on fisheries in the United States:

(1) PCB residues and generally found in areas associated with high industrial and urban activity. Wildlife sampled in remote, non-populated areas generally show little or no detectable levels of PCBs.

(2) High concentrations of PCBs have been observed in several predatory birds, including heron, white-tailed eagle, peregrine falcon, cormorants, etc. Tissue or whole body weight PCB values ranged in these species between 30 and several hundred parts per million.

(3) Many fish species sampled in the Great Lakes region and in the Eastern seaboard have PCB concentration values well above the present FDA tolerance limit of 5 ppm. In Lake Michigan this would include species such as the chinook salmon, coho salmon, brown trout, tiger trout, lake trout, white fish and carp.

(4) Similar levels of PCBs have been shown to occur in walleye, white bass and carp in the northern reaches of the Mississippi River. Certain varieties of lake trout in Lake Superior have PCB residues ranging up to 12.7 ppm.

(5) Nearly all the fish species sampled in Massachusetts rivers show PCB concentration values above 5 ppm. Recent sampling by the federal EPA of

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fish caught in the Housatonic River at stations below Pittsfield, Mass., where the G. E. transformer manufacturing plant is located, show PCB concentration levels up to seven times above the present FDA standards.

(6) Fish sampled in the Hudson River, north of Albany and in a region south of the two G. E. Plants manufacturing electrical capacitors, show the highest PCB contamination thus far recorded in the United States. Recent monitoring data indicate extensive contamination of nearly all fish species in the upper reaches of the river, with values ranging up to 500 ppm. Striped bass and shad caught in the lower Hudson River also show levels frequently above 5 ppm.

(7) The bottom sediments of the Hudson River appear to be a sink for the bulk of the non-degradable PCBs. Near the G.E. plants, sediment PCB levels ranged between 540 and 2,980 ppm. Lower reaches of the Hudson River also contained PCB in the sediments, often in the order of 1 to 18 ppm.

(8) Dredging of river bottoms appears to be one of most certain routes by which the non-water soluble PCBs can get resuspended into the river. It is clear that sufficient studies and careful abatement procedures will be required to minimize this potential problem. In the meantime, we strongly urge a complete moratorium on all proposed river bottom dredging in the Hudson River.

(9) PCBs, as a class of compounds, are extremely persistent and non-biodegradable substances, and ten to bio-accumulate in the aquatic environment by factors of a few thousand to several hundred thousand fold. For example, fathead minnows may bioaccumulate as much as 200,000 fold.

(10) PCBs have been shown to interfere with the reproductive process and hatchability of fish eggs, in concentration levels as low as 0.5 ppb with certain species.

(11) Similarly, PCBs have been demonstrated to effect the reproduction of several animal species, at dietary levels of 20 to 100 ppm in experimental rats, and at less 1 ppm in minks. Several domestic bird species, such as pheasants and chickens, show marked thinning of eggshells and reduction of egg production when fed PCB as little as 10 ppm.

(12) Recent studies indicate that dietary levels as low as 2.5 ppm show clear effect on the reproductive ability of female rhesus monkeys. It is important to note that many of the known human toxicity symptoms observed in acute ingestion of PCBs ("Yusho" disease) were also seen with the primates studies in the above experiments.

(13) Experimental rats fed PCBs at 100 ppm for 21 months were recently shown to have an abnormally large number of malignant liver tumors. PCBs are also known to drastically increase the microsomal enzyme activity in mammalian species, indicating that its presence in the liver may help trigger the formation of potentially injurious or carcinogenic chemical metabolites in animals.

(14) The effect of PCB contamination of commercial and sport fisheries in this country appears to be large. We estimate that about 22,000,000 pounds of Hudson River striped bass are consumed each year, if we combine both commercial and sport catch figures. It has been estimated that between 50 and 90 percent of the North Atlantic striped bass are spawned in the Hudson River. Being a migratory fish, there is no way of distinguishing the origin of striped bass in the North Atlantic coastal areas, and thus it is possible that its entire stock may be contaminated.

(15) A similar problem may also exist in the Great Lakes region. Commercially important fish in Lake Michigan, such as chubs, appear to be contaminated with PCBs. They accounted for 32 and 54 percent of the total commercial fisheries in Lake Michigan and Lake Superior, respectively.

Dr. AHRENS. Thank you.

PCB residues are generally found in areas associated with high industrial and urban activity. Wildlife sampled in remote, non-populated areas generally show little or no detectable levels of PCB's.

High concentrations of PCB's have been observed in several predatory birds, including heron, white-tailed eagle, peregrine falcon, cormorants, et cetera. Tissue or whole body weight PCB values

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ranged in these species between 30 and several hundred parts per million.

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Similar levels of PCB's have been shown to occur in walleye, white bass and carp in the northern reaches of the Mississippi River, particularly in Minnesota. Certain varieties of lake trout in Lake Superior have PCB residues ranging up to 12.7 parts per million.

Nearly all the fish species sampled in Massachusetts rivers show PCB concentration values above 5 parts per million. Recent sampling by the Federal EPA of fish caught in the Housatonic River at received at hearings, for example, at the present administrative hearings in New York State. This is a summary of all that information. levels up to seven times above the present FDA standards.

Mr. LEGGETT. Let me ask you this: You have gone through a number of different places here and you have more particular testimony that is incorporated in our record. We would like to know if you have sampled these areas more than once in various time frames.

Dr. AHMED. I am stating the information we have received from various government documents and reports. Also, materials we have received at hearings, for example, at the present administrative hearings in New York State. This is a summary of all that information. We did not sample ourselves.

Mr. LEGGETT. I understand.

Then in your particular testimony do you site the documents and the time and place?

Dr. AHMED. Exactly. All the figures, tables, and the documents are cited.

Mr. LEGGETT. In any of these areas where you found these high concentrations, have you noticed any difference between 1970, as an example, or do the reports show any difference between 1970 and 1975?

Dr. AHMED. The best study comes from Lake Michigan. That was done by the Michigan Department of Natural Resources.

I have a figure in my paper here that shows that between 1969 and 1974 DDT levels in Lake Michigan of coho salmon and chubs have been systematically decreasing, in some cases below the FDA's allowed concentration.

On the other hand, PCB levels between 1972 and 1974 in Lake Michigan have been increasing.

Mr. LEGGETT. That report is from where?

Dr. AHMED. From the Michigan Department of Natural Resources.

Mr. LEGGETT. OK. Very good.

I did not mean to interrupt you.

Dr. AHMED. Fish sampled in the Hudson River, north of Albany and in a region south of the two G.E. plants manufacturing electrical capacitors, show the highest PCB contamination thus far recorded in the United States. Recent monitoring data indicate extensive con-

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tamination of nearly all fish species in the upper reaches of the river, with values ranging up to 500 parts per million. Striped bass and shad caught in the lower Hudson River also show levels frequently above 5 parts per million.

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A similar problem may also exist in the Great Lakest region. Commercially important fish in Lake Michigan, such as chubs,

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appear to be contaminated with PCB's. They accounted for 32 and 54 percent of the total commercial fisheries in Lake Michigan and Lake Superior, respectively.

In conclusion, I would like to mention briefly that recently our organization, along with the environmental defense fund, petitioned the Food and Drug Administration to revise the present 5 parts per million limit to a lower level in view of recent studies that show PCB's affect animal species at far lower levels than had been originally assumed. If this tolerance level were to be lowered, you can imagine the impact it might have on the fisheries, particularly on those fish below or at 5 parts per million.

Mr. LEGGETT. It is your position that all dredging ought to be stopped in the Hudson River?

Dr. AHMED. Well, I think it should be stopped until they can find the proper measure by which they can properly contain PCB in the shipping channels.

It turns out the PCB's tend to accumulate most on very fine silt particles. These silt particles tend to be settle in the very shipping channels where dredging has ben proposd.

We have asked the Corps of Engineers to hold a public hearing to consider the possibility of a temporary moratorium on dredging until they have decided how best to deal with the problem of dredging.

Mr. LEGGETT. Of course, you mentioned the Hudson River, but I would suspect that you would include all rivers where dredging occurs where noticeable or substantial PCB levels exist.

Dr. AHMED. This would obviously be the case.

Right now we are faced with a very eminent proposal by the Corps of Engineers in the Hudson River.

Mr. LEGGETT. Now, considering what you have said about the Great Lakes and the problems they are having there and the high concentrations, the inability to differentiate, would you also recommend that all fishing stop in the Great Lakes?

Dr. AHMED. Do you mean in terms of PCB concentration found in some of the species mentioned?

Mr. LEGGETT. Yes.

Dr. AHMED. Well, it seems to me that you could do it two ways. Some of the States have done it by warning the public not to consume more than a certain number of sports fish over a given period of time. In cases wehere large amounts of PCB contamination are found, well above 5 parts per million, and these are commercially important fish, then I think the FDA should seize shipments of these fish. They have in many instances done so already.

Mr. LEGGETT. Are there shipments from the Great Lakes today in excess of 5 parts?

Dr. AHMED. Last fall when we were in contact with the FDA, there were shipments of fish in both the Great Lakes area and in the Mississippi River that were above 5 parts per million and where shipments of fish had been seized.

Mr. LEGGETT. Considering Canada has adopted the 2 parts or 2½ parts, should we also adopt that standard?

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Dr. AHMED. Well, our position with the FDA is we have not suggested a level, but I think 2 parts per million is hardly the level that we should have. I think it should be at least one-tenth lower.

Mr. LEGGETT. You think it should be one-tenth lower?

Dr. AHMED. At least tenfold lower or less.

Mr. LEGGETT. Tenfold?

Dr. AHMED. Or lower.

Mr. LEGGETT. Instead of 5 parts, five-tenths parts per million, or 5 parts per million?

Dr. AHMED. Well, we have made the point that since PCB has now been shown to cause cancer in experiment animals, one cannot really establish a threshold or safe level for it. It is a difficult question of how you go about setting an acceptable level or reasonably acceptable level of a carcinogen in food. This issue has to be resolved, I think.

Mr. LEGGETT. Now, is this covered by the Delaney amendment?

Dr. AHMED. It is not very clear whether PCB comes under the Delaney amendment. If it were a pesticide, it may have come under the Delaney clause, being, in fact, an indirect food additive.

We do not really have a clear interpretation of whether PCB would be interpreted as the indirect food additive. But, the same concept of the Delaney clause should still apply here.

Mr. LEGGETT. Have you found any proof of malignancy at levels at less than 100 parts?

Dr. AHMED. In experimental animals?

Mr. LEGGETT. Yes.

Dr. AHMED. No.

The only experiment we have is Dr. Kimbrough's experiments from the Center for Disease Control where the experimental animals, female rats, had been given a diet of 100 parts per million of PCB's.

Mr. LEGGETT. Do you question any of the evidence presented by the previous witness?

Dr. AHMED. I have not examined his data. I only listened to his testimony. I do not have any basis to either accept or disagree.

Mr. STENSLEY. Mr. Chairman, I would want to raise for the record that evidently the testimony of Dr. Albert Colby, Associate Director of Sciences, Bureau of Food and Drug Administration, part of the testimony referred to earlier that was submitted for the record indicated that temporary tolerances have been set for PCB's and they range anywhere from two-tenths of a part per million to 5 parts per million.

Mr. LEGGETT. That is set by FDA.

Dr. AHMED. That is the limit I mentioned earlier. The FDA has a series of different tolerance levels.

Mr. LEGGETT. Do you agree with that?

Dr. AHMED. I obviously do not because we petitioned the Food and Drug Administration to lower the tolerance levels in fish and other foods.

Mr. LEGGETT. OK.

Mr. Oberstar.

Mr. OBERSTAR. Thank you, Mr. Chairman.

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Reviewing your testimony, your comments on dredging, is it possible to have dredging where the dredge spoil is pumped directly from the lake or river bottom rather than mechanically moved up through the water and would that avoid the problem of reinfecting the water with PCB?

Dr. AHMED. I do not really know the answer to that question.

There have been a lot of ingenious proposals being made now on how to contain the dredging operation itself so that you do not churn up all the fine silt material.

I do not think there is an easy answer. Perhaps your suggestion may be something to examine. But, obviously it is a difficult thing to figure out mechanically, how to maintain PCB in river bottoms, and once you do contain it, how you plan to store it.

The same problem arises with disposal. That is a whole different issue. Will you be willing to take it to some kind of a sewage treatment facility or do you take it to the ocean? That is the next question that arises.

So, you really have a whole host of problems here.

Mr. OBERSTAR. You are not going to take dredge spoils from the Great Lakes interconnecting channels 2,000 miles to the ocean.

Mr. LEGGETT. If the gentleman will yield, we also have determined that many times you get 1,000 times as much debris circulating in the water due to turbulence than you do from a normal annual dredge operation.

Dr. AHMED. That is possible, too.

Mr. OBERSTAR. So, there are those problems as well.

Dr. AHMED. But, the PCB concentration, if you look, is not only on the surface of the bottom sediment, but also resides at the lower depths in the bottom of the river.

Mr. OBERSTAR. In response to the chairman's question about banning fish in all the Great Lakes, do you not differentiate or would you not differentiate between the various Great Lakes?

The levels of PCB are different in Lake Superior than in Lake Michigan.

Dr. AHMED. Different species have different levels, that is correct.

Mr. OBERSTAR. There are varying levels of PCB.

Dr. AHMED. I thought that is what I said when I said they were above the present limitation.

The Government obviously has the legal power to seize shipments of fish and the States may have their own powers.

Mr. LEGGETT. If the gentleman will yield. Wait a second.

We have to be consistent.

You are petitioning the lowering of the standards.

Dr. AHMED. To lower it, yes.

Mr. LEGGETT. What standard do you support for fish?

Dr. AHMED. My personal point of view, in terms of what——

Mr. LEGGETT. No.

In the petition that you filed to have the FDA reduce their standards, your organization files, reduce it to what level?

Dr. AHMED. We have not suggested a level. We have asked the FDA to examine that whole question scientifically and arrive at a standard.

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Mr. LEGGETT. How about 4.99?

Dr. AHMED. Obviously not, no.

Mr. OBERSTAR. I cannot understand how you can ask the FDA to reexamine the question. It is under a continuing review.

Why would you ask them to reexamine it unless you would have some good scientific evidence to come in and ask for a lower standard?

Dr. AHMED. Because, as I mentioned earlier, it is a very difficult thing to set a standard for a carcinogenic substance.

It is not scientifically correct to talk about a threshold for a carcinogen. You have to make a judgment, in effect, of how much substance you are going to tolerate in a food supply, or what you consider to be a risk level.

These are not easy answers to arrive at.

Mr. OBERSTAR. Do you have any quarrel with what the FDA has done in their procedural work in arriving at 5 parts per million?

Dr. AHMED. This level was arrived at from experiments and data that go back at least 5 years. We are talking about some new data that have been just published.

Mr. OBERSTAR. Are you asserting that FDA has not updated their information?

Dr. AHMED. No, I would not be stating that.

I think the FDA, within its own agency, has been looking at this question themselves. We have merely petitioned them to take the legal steps to gather the information, and based on new evidence to establish a lower tolerance limit.

Mr. LEGGETT. If I may, I will interrupt again.

As I understand the letter you put in from FDA, they are reviewing the tolerance of 5 parts per million for fish in light of the data that has been presented, and they indicate that the Environmental Defense Fund, your group, has petitioned FDA to gradually reduce all the temporary tolerances for PCB's, including zero, and that they will continuously be reviewing this matter.

Dr. AHMED. That is right.

The zero level is the concept of the Delaney clause.

Mr. LEGGETT. That is the concept?

Dr. AHMED. That is the concept.

Mr. LEGGETT. It is your time.

Mr. OBERSTAR. Well, the purpose of my questioning is to determine whether you have some solid scientific data to go on or whether you are just ringing alarm bells.

Dr. AHMED. No, we have recent experimental data.

Mr. OBERSTAR. Just a minute.

People want to have solid information on which to make judgments, you know. Concerns about levels of foreign substances and the food we eat are matters that affect the daily lives of people.

If we are going to have people ringing alarm bells, well, they had better be well informed. It is not only a matter of public responsibility, but it is also a matter of economics.

Some years ago, the FDA rang the alarm bell on fish from the Great Lakes that had botulism. They clamped the lid on all fish and

particularly smoked fish from the Great Lakes. We found out later that the seven deaths that occurred from botulism were traced to fish that were taken from Lake Michigan, and the botulism entered the food chain several days after the fish had been processed, shipped, and not properly refrigerated.

So when you make a blanket, sweeping statement that would stop all economic activity in the Great Lakes, you are scaring some people. You are not making a statement that is based on scientific fact and your statement will have an economic effect s well.

Dr. AHMED. Let me try to respond to that.

The evidence we have presented in our petition could also be gone into in some detail with Dr. Joe Highland, who will be here tomorrow, a witness from the Environmental Defense Fund.

Let me mention the basis on which the FDA usually sets these tolerance standards which are based on experimental data, both in humans and animls.

They try to establish a "no effect" level. They extrapolate that by dividing by a factor of 100, when experimental animal data is used.

In the present petition, we have to examine the experimental data of Dr. James Allen of the University of Wisconsin Medical School, who still finds an effect on reproductibility at levels as low as 2.5 parts per million.

If you were to accept that data, and I have no reason to believe too many people would challenge that particulr experiment, you then have to extrapolate that information down to a lower level of PCB's that should be tolerated by human beings who may ingest PCB's.

Thus, we still have not established a "no effect" level as low as 2.5 parts per million.

Mr. OBERSTAR. Now, you provided some scientific information.

Dr. AHMED. I have details of this experiment in my paper which I submitted for the committee's record. I did not have time to go into detail in my presentation.

Mr. OBERSTAR. Have you looked at the Canadian basis for setting a level of 2 parts per million?

What scientific measurement did the Canadian Government use in arriving at the levels it established for PCB's in fish?

Dr. AHMED. I have not examined the Canadian Government's standard.

Mr. OBERSTAR. Thank you, Mr. Chairman.

Mr. LEGGETT. Thank you, Mr. Oberstar.

Mr. Forsythe.

Mr. FORSYTHE. I have no questions.

Mr. LEGGETT. Very good.

You are still part of the panel, Doctor.

We will now move on to the next witness, who is Mr. Lee Weddig, executive director, National Fisheries Institute.

Your statement will be incorporated in our record.

[The statement referred to follows:]

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STATEMENT OF LEE WEDDIG, EXECUTIVE DIRECTOR, NATIONAL FISHERIES INSTITUTE

There is no need to review background information on the use of polychlorinated biphenyls in our economy or how they found their way into our environment. I am sure the various theories on potential health hazards of PCBs are also known to the committee.

As of this time, the effect of this environmental problem on the commercial fish industry is relatively modest. To our knowledge, the industry has lost usage of rough fish in some parts of Lake Michigan, the resource of the Hudson River, and several other modest sized resources. Certain other Great Lakes resources are in a borderline state under the present FDA 5 ppm tolerance.

The FDA is considering the need to lower the present tolerance. If this tolerance is reduced, it will cause much more severe effects on the commercial industry, most specifically eliminating the remaining activity in Lake Michigan and severely hampering other Great Lakes production. Depending on the exact level and details of a new tolerance, we would expect negative impact on some of our coastal resources as well.

We are not in a position to scientifically comment on the various theories regarding ill effects of long term exposure to PCBs. We can only indicate to the committee that exposure to PCBs through normal fish consumption patterns is exceedingly low.

Commercial product from the rivers and lakes in industrial areas makes up but 2 percent of the total mix.

None of the products can be considered to be daily, or even weekly dietary items.

The only possibility of consistent exposure that we can see would be to the sports fisherman who may fish one body of water and load his freezer with the same species.

While we have severe misgivings over the theories of potential harm through commercially marketed fish, we must come to the conclusion that if the Government determines that presence of PCBs in fish is a health hazard, then the Government must also take whatever steps are necessary to prevent that presence.

We believe then the following measures must be adopted to react to the present situation, and to prevent further problems:

The Government should immediately ban further sale, production, importation, or recycling of PCBs in any form whereby the chemical can be expected to enter the environment. Efforts should be made to achieve international agreement to the same goal.

A national system should be established to provide for safe disposal of PCBs already in use.

The Toxic Substances Control Act should be passed to help avoid future problems with other chemicals.

The present FDA tolerance of 5 PPM in fish should be retained pending further research on the toxic effects on humans of PCBs. Any reduction in the tolerance should be selective, based on the role of the specific affected food in the diet.

Compensation should be made to commercial fishermen whose livelihood is destroyed by prohibition of sale of the species of fish in which presence of PCB exceeds the FDA tolerance.

Effluent standards for PCBs, and other toxic substances, should be implemented immediately by the EPA.

We wish to elaborate on several of these points.

First, regarding a ban on further usage. It may seem to be unreasonable to ask for an immediate ban, and, perhaps it is. Yet, our fishermen are put out of business immediately. We would have to be convinced that a long term phase out is proper for the polluter, but improper for the victim.

Second, on the matter of the FDA tolerance, we believe that modification of the Food, Drug and Cosmetic Act is in order.

In our mind, the present law is confusing in that toxic substances in the environment at times are considered to be unauthorized additives. Some may be considered pesticides for which a tolerance in fish is not registered; or they may be considered a toxic substance whose presence cannot be avoided.

In our opinion, all such substances that are present in the waters should be considered as unavoidable microconstituents. Tolerances should be promulgated

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to protect the public health under ordinary circumstances. We do not believe the presence of such environmental microconstituents can be considered to be food additives nor unregistered pesticides.

Further, we believe the development of tolerances for these unavoidable substances should take into account consumption patterns of the product involved. Fish consumption is low. Very often, it's seasonal. The product from a given source is distributed to a widespread market. The likelihood of consistent exposure to any individual is extremely rare.

Further, we propose such tolerances should be applied only to specific stocks of fish from specific bodies of water. If the trout, over a certain size in Lake Michigan generally contain more PCB than the tolerance, then remove that entire stock from the market. If on the other hand, the fish generally contain less than the tolerance, then allow all of them to be marketed.

There is no way the commercial industry can test fish on an individual, or even lot sampling basis, for contaminant presence. The tests are too expensive and too slow. In addition, such procedures are meaningless in protecting public health, in that any potential health hazard is not the result of an occasional exposure, but rather the result of long term continuous exposure.

We realize that these basic concepts in relating the FDC Act, and its enforcement to environmental contaminant problems, are not in this committee's jurisdiction. However, this is a most important concern we have with PCBs and similar substances.

Finally, we would like to comment on the matter of compensation.

We mentioned earlier that the effect to date of PCBs on the entire fish industry has been minimal. But to those fishermen involved, it's been catastrophic. There is no mechanism to compensate these people who are entirely blameless for this problem of our society.

We have noted before to this committee that beekeepers and dairy farmers are compensated if their product is contaminated by pesticides. I believe the proposed fiscal 1977 budget includes almost $4 million for this purpose.

The need is present for a rapid response system to aid commercial fishermen and dealers during times when their products are declared unfit. The system should provide assistance to recover losses from condemned product and income lost through inability to fish. It should provide a means to refit vessels if movement to a new fishery is required.

Mr. Chairman, we thank you for this opportunity to comment, and would be pleased to respond to questions.

STATEMENT OF LEE WEDDIG, EXECUTIVE DIRECTOR, NATIONAL FISHERIES INSTITUTE

Mr. WEDDIG. I will just summarize what we pointed out in our statement.

Mr. LEGGETT. Your statement will appear in the record. You may summarize.

Mr. WEDDIG. I would like to talk just about the effects of PCB on the commercial side of the industry as we see it as of this point as opposed to the effects on the reproductive capabilities of fish and the basic resource.

As of now, we have lost not too many fish from the commercial viewpoint. As Dr. Ahmed has mentioned, we have had some seizures. Those were rough fish out of Lake Michigan, mainly carp, which is a tremendously large resource for the individual fishermen involved with it. It represents the only resource for them.

So the PCB problem has become rather catastrophic and has put them out of business entirely.

However, if the byline of tolerance is lowered to something in the order of 2 parts per million, or beyond that, we would expect to have significant problems with other resources around the country;

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namely, in the coastal resources, and some of the other river and lake resources.

Many of the fish that have been cited with the higher levels of PCB are mainly sports fish and, as a result, they have not affected commercial industry quite as much as they would have otherwise.

In terms of the ill effects of long-term exposure to PCB's, we are not toxicologists or scientists but we can report that at the Chicago conference, which we attended also, at the time Dr. Kimbrough presented her paper about the possible carcinogenic effects of PCB after the exposure of 100 parts per million for quite a few months, the following paper that was presented disputed the carcinogenic finding stated by Dr. Kimbrough.

So I think we are running into another situation similar to what occurred, say, in cyclamates, where there is a concern if something is carcinogenic or not.

Another scientist said he looked at the same slides as Dr. Kimbrough, and they did not look carcinogenic to him.

To call PCB's carcinogenic at this time, I think, is a little advanced. I would like to say potentially they may be carcinogenic as opposed to saying they are.

Mr. LEGGETT. Now, that is a contradiction from what the doctor just stated.

The doctor was talking about hearsay that he had read rather than the experiments.

Dr. AHMED. Dr. Kimbrough's experiments.

Mr. LEGGETT. It was Dr. Kimbrough's experiments?

Dr. AHMED. Yes.

Mr. LEGGET. That was 100 parts?

Dr. AHMED. On rats.

Mr. WEDDIG. So you have two opinions on the scientific part.

Mr. LEGGETT. You say another doctor saw the same slides of Dr. Kimbrough?

Mr. WEDDIG. That is what he reported.

I guess you would have to say my statement here is hearsay, but it is what I heard at the Chicago conference on PCB.

One doctor reported that his experiments were unable to produce any carcinogenic effects in rats also.

Mr. LEGGETT. Did anybody else here at the table hear anything at the Chicago conference?

Mr. WEDDIG. I will send you the paper if you would like.

Nonetheless, I do not want to minimize the potential problem that exists because we do recognize that it is a very serious problem and it will be very bad on our Great Lakes fishermen if the guideline is lowered any extent whatsoever.

We feel that the only real problem that exists right now from our point of view is with the person who might load up his freezer with a lot of sports fish. In terms of exposure over a continued period of time, the fish-eating habits of this country usually do not concentrate on a given fish from a given body of water unless they are sports-caught fish. This is a possibility where someone could go and catch a mess of fish and put them in his freezer. They would be eating them week after week after week, especially if they are using them for subsistence or because they like them so well.

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From a commercial viewpoint, you would not find our product on the market in a continuing fashion. Just the purchase habits would provide a measure of protection against the continued exposure that is really the heart of the problem with these contaminants.

In terms of steps to be taken, we have outlined a number of them here.

We agree that further sale production, et cetera, of PCB's really should be halted. In one respect to say immediate is not very reasonable, but for our fishermen who are put out of business, the effect is immediate. They think what is good for the goose is good for the gander in this case, and that if the polluters are able to go on for an indefinite basis, then those fishermen catching fish may be should not be put out of business either.

It has to work both ways.

Second: We are concerned with the safe disposal of PCB's. This is a problem that will take us a long time. I am especially concerned about the disposal of things like capacitors, which are going to end up in landfill eventually, and over a period of time those metal cases are going to rust and the material eventually is going to get into the environment.

So that is a long-term problem that we see.

We think the Toxic Substance Control Act should be passed because prior testing of chemicals has to take place if we are going to avoid similar situations over the next generations.

We would like to see the tolerance remain as it is. We do not think that the evidence presented warrants a lowering of the tolerance, even though this is in the hands of the Food and Drug Administration, and I am sure they will come up with an answer as they analyze the present data.

We would think any reduction should be selective based on the role of the specific food in the diet. When you look at the different fish species, the total available is very small and spread over a large market, so you are not talking about extended exposure which is really the key to any potential harm.

There is no level of PCB in fish that is on the market that has any kind of immediate toxic effects. It just is not high enough. The concern is over a long-term exposure, and for that you really have to look at dietary habits and the amount of fish that is available to be spread out over many people.

We think any reduction in the tolerance should be based on the role of the particular fish in the diet.

Then we have a matter of compensation. This is a long-term problem with us and we have gone through this with DDT, with dieldrin, with mercury, and now with PCB, and who knows what is coming up next.

Commercial fishermen are really the ones that get it in the neck on this thing, and there is no form of helping them out other than going on welfare, as somebody told them they should do down in Virginia with Kepone. It just does not seem to be right that there is not a system to provide some means for them to either relocate their fishing vessel or to tide them over until the hazard disappears.

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We noted that in the agricultural sector, for example, beekeepers and dairy farmers have a regular program. They re compensated if their production is contaminated by pesticides.

So we do not see any reason why something like that could not be established for fishery producers who get into the same bind through no fault of the fishermen.

Mr. LEGGETT. On the other hand, when the wool growers came to Congress and wanted compensation, the bill passed the committee but bombed on the floor.

The cyclamate bill bombed. The eucalyptus compensation bill bombed.

Of course, the Florida fishermen recently asked for special compensation and that has not received action by this committee.

Mr. WEDDIG. That is correct.

At one time there was a problem in the Department of Interior where commercial fisheries had a disaster aid program. The unfortunate part of it was while, in theory, it was good, it was never financed properly, and also there was a real discussion over what constituted a disaster. It usually took more paperwork and time to try to get any results from it than would actually happen.

I think the whole program is gone right now.

Nevertheless, it is a problem for us.

We think also the effluent standards for PCB must be implemented immediately by the EPA. The Water Quality Act of 1972 or 1973, as I recall, called for implementation of effluent standards for toxic substances. The law called for these standards to be implemented within a period, as I remember, of 1½ years.

Now, we are somewhat beyond that, and we still do not have toxic substance effluent standards in practice, so that plants that use PCB's can continue to let them go into the waterways.

I believe the EPA has just published these proposals in the last month.

Finally, I would just like to comment on one other item, and Dr. Ahmed mentioned this. It concerns the Food and Drug Cosmetic Act and its definitions as to toxic substances, adulteration and so forth.

Dr. Ahmed said there is some confusion over just what part of the act applies.

Mr. LEGGETT. Your position is this should not be considered as an additive?

Mr. WEDDIG. That is correct.

It should be looked on as an unavoidable contaminant. Tolerance should be based on the need to protect public health.

Right now we could have our product seized by the mere presence of some of these things. It is part of our nature now.

I think anyone who looks at it as being something foreign from the present nature of 1975 is just wrong. It is part of the natural environment that we have in this country.

It may be that the Food, Drug and Cosmetic Act should be modified to recognize this type of a contaminant and to set up a very special way of handling tolerances and the means of protecting public health.

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Mr. LEGGETT. Very good.

Thank you very much.

Maybe before further questions, unless there is a reasonable objection, we will hear from Dr. Nimmo now, Research Ecologist, Environmental Research Laboratory, Sabine Island, Gulf Breeze, Fla., Office of Research and Development, U.S. Environmental Protection Agency.

Your statement of January 29, 1976, will be included in our record in total at this ponit, including the charts and graphs which you have appended to the end of your statement.

You may proceed to highlight your statement, if you will.

[The statement referred to follows:]

STATEMENT OF DR. DELWAYNE R. NIMMO, RESEARCH ECOLOGIST, ENVIRONMENTAL RESEARCH LABORATORY, SABINE ISLAND, GULF BREEZE, FLA., OFFICE OF RESEARCH AND DEVELOPMENT, U.S. ENVIRONMENTAL PROTECTION AGENCY

My name is Dr. DelWayne R. Nimmo. I am a Research Ecologist at the Environmental Protection Agency's Gulf Breeze Environmental Research Laboratory at Gulf Breeze, Florida. I have conducted research on the effects of pollution on marine organisms at this laboratory since 1968. The mission of the Gulf Breeze Laboratory is to study the effects of toxic materials on marine organisms and ecosystems.

My education background is as follows: I received my B.S. degree in Biology from Evangel College, Springfield, Missouri in 1959; my M.S. degree in Zoology from Wichita State University in 1964, and my Ph.D. in Limnology from Colorado State University in 1968.

Data produced at our laboratory are used by officials in EPA to establish criteria and in enforcement activities. I have not personally been involved in policy decisions concerning PCB's, but I would like to present research findings developed at the Gulf Breeze Laboratory on the effects of these chemicals on marine organisms. With your permission, I submit a collection of scientific papers from which my testimony is taken.

Our laboratory has conducted field experiments to determine the routes and reservoirs of PCB's and has completed many experiments in the laboratory to determine effects of these chemicals on marine organisms.

FIELD STUDY

We detected the polychlorinated biphenyl, Aroclor® 1254, in the water, sediment and biota of Escambia Bay, Florida in 1969 and we are continuing to study some aspects of the movement and accumulation of this chemical within the bay system. Only one source of the chemical, the Monsanto Chemical plant on the Escambia River, was located at that time. To date, we have not documented other sources. In our studies on various components of Escambia Bay and contiguous waters we have come to the following conclusions:

(1) Much of the chemical in Escambia River and upper reaches of the Bay is associated with the particulate or suspended matter in water.

(2) Of the components (sediment, water, plants and animals) sampled, the greatest concentrations of the PCB are contained in the sediments and biota of the Bay.

(3) Although quantities of the PCB have been reduced in the sediments and biota, two beds (reefs) of oysters located approximately 8 miles from the original source of the chemical still have detectable PCB in their tissues, and I would like for you to refer to Attachment 1 and notice that we have sampled for seven years.

(4) It has been documented that this PCB can be accumulated by estuarine and marine crustaceans directly from contaminated sediments, and

(5) Although the specific routes are unknown, we have evidence that the chemical is dispersed or transported to adjacent waters by physical or biological transport.

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Now as far as the laboratory studies, following the discovery of PCB's in Escambia Bay, Florida in 1969, our Laboratory at Gulf Breeze, Florida began studies with PCB's to determine their effects on and bioaccumulation by estuarine organisms. Estuarine organisms studied included bacteria, protozoans, oysters, shrimp, fishes and communities of benthic organisms. The following discussion is confined to research on Aroclor 1016, 1242 and 1254 because these PCB's are presently produced in the greatest quantities.

Aroclors 1016, 1242 and 1254 are acutely toxic to certain estuarine organisms. The 48- or 96-hour concentrations that kill 50% of the test organisms (LC_{50}) are in parts-per-billion range from 9 to 32 for penaeid shrimp, 12 to 16 for grass shrimp, over 100 for pinfish. From 10 to 32 parts-per-billion of the chemical reduces shell growth in oysters.

Laboratory bioassays lasting longer than two weeks demonstrate that acute bioassays underestimate the toxicities of Aroclors 1016 and 1254. Aroclor 1254 is toxic to commercially valuable shrimps, and I will dispense with the reading of the scientific terms, and grass shrimp at concentrations of 1 parts-per-billion. Exposed shrimp are particularly sensitive to salinity stress and possibly to viral disease. Aroclor 1254 decreases growth rates of oysters at 4 parts-per-billion. At concentrations of about 5 parts-per-billion, Aroclor 1254 is lethal to juvenile fishes: spot pinfish and sheepshead minnow. At Aroclor 1254 concentrations of 0.1 parts-per-billion, some sheepshead minnow fry die. Aroclor 1016, at 15 parts-per-billion was lethal to pinfish and sheepshead minnows; susceptibilities of fry, juvenile and adult sheepshead minnows were similar.

Aroclor 1254 affects reproduction of the sheepshead minnow, an estuarine fish. Adult fish exposed for four weeks to 0.1 parts-per-billion appeared to be unaffected, but when eggs from these fish were fertilized and placed in PCB-free water, the survival of fry was diminished. Mortality was observed also in fry from eggs that contained greater than 5 parts-per-million per gram of the PCB and increased as PCB content of the eggs increased. Reproductive success of Atlantic salmon and striped bass may also be affected by PCB's in their eggs. Adult sheepshead minnows that had been exposed for four weeks to from 0.8 to 8 parts-per-billion of Aroclor 1016 produced eggs that contained from 8 to 77 parts-per-million of this PCB, yet fry that hatched from these eggs were apparently unaffected.

Estuarine organisms accumulate PCB's from water. Maximum concentration factors (concentration in animals divided by concentration in water) in laboratory exposures of various species to Aroclor 1254 were: oysters, 101,000 to 165,000; shrimp, 20,000; and fishes, 87,000. The maximum concentration factor determined from exposures of fishes to Aroclor 1016 was 34,000. Fishes exposed continuously to Aroclors 1016 and 1254 accumulated both Aroclors in increasing concentrations for about four weeks; thereafter, the quantity stabilized. Maximum concentrations were found in the liver, gills and skin of the fish, but the lowest concentration found in fishes and shrimps was in the muscle. Bioconcentration factors calculated from data from Escambia Bay were greater than 230,000 for shrimp, 670,000 for fishes and greater than 100,000 for oysters, indicating that laboratory data underestimate bioconcentration potentials of Aroclor 1254.

At this point in the testimony, I would like to introduce some comparisons of toxic effects of Aroclors 1016, 1242 and 1254 to various marine species. This data is summarized in Attachment 2a. Included are data illustrating rates of accumulation and loss of these PCB's from fishes, summarized in Attachment 2b, and a comparison of bioaccumulation of Aroclor 1254 in animals held in the laboratory with those from Escambia Bay, Florida (Attachment 2c).

In summary, our research in the field has shown that polychlorinated biphenyls: (1) occur in the marine environment, (2) are readily dispersed from point sources, (3) are relatively persistent, and (4) are concentrated in animals, plants and sediments. Controlled experiments conducted in the laboratory indicate: (1) various PCB's are toxic (at the parts-per-billion level in water) to shrimp, fish and other organisms, (2) animals can obtain PCB's from water, sediment or food organisms, and (3) these chemicals are bioaccumulated.

Mr. Chairman, that concludes my prepared remarks. I will answer any questions you may have.

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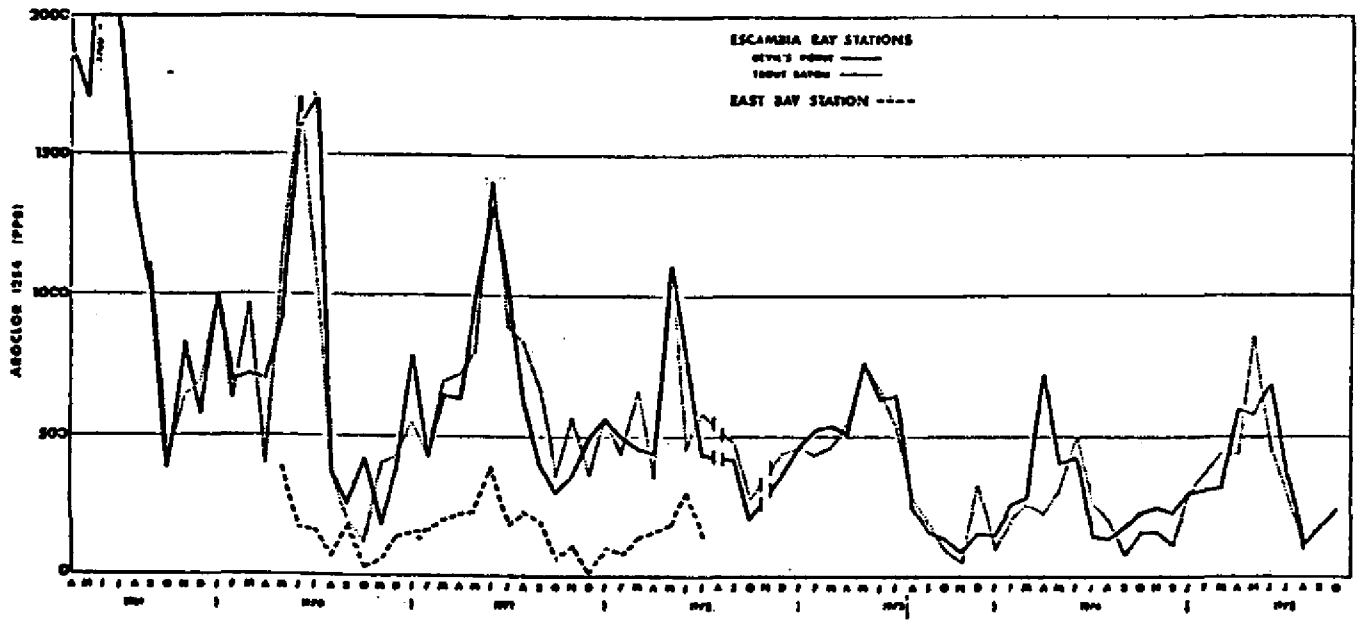
RESIDUES OF AROCLOR 1254 IN OYSTERS



Attachment 1

Attachment 1

140

CONCENTRATION IN WHOLE FISH, µg/g wet weight

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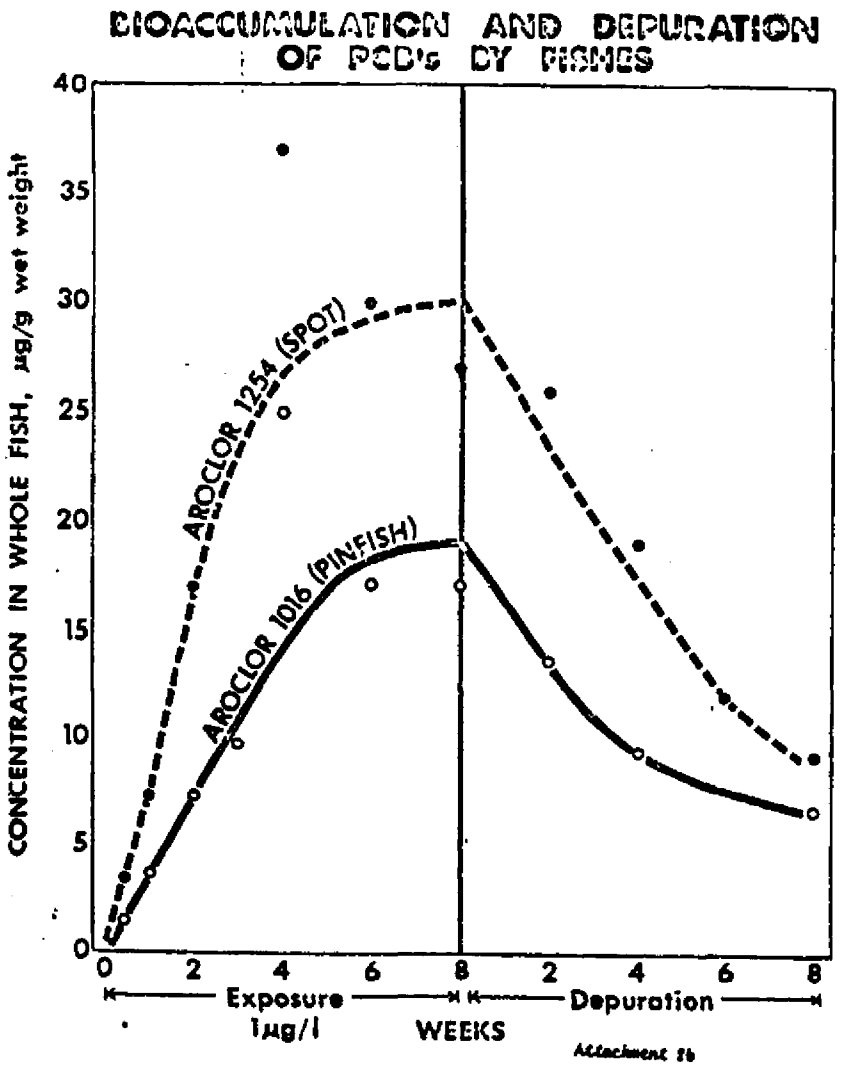
ACUTE TOXICITY OF AROCLORS 1016, 1242, AND 1254 TO SELECTED ESTUARINE ORGANISMS IN FLOW-THROUGH BIOASSAYS

Organism	96-hour LC50 or EC50, microgram per liter		
	1016	1242	1254
Penaeid shrimp	18	9	< 32
Grass shrimp	12	16	> 12
Oysters	18	32	< 14
Pinfish	> 100	> 100	> 100

1 48-hr tests.



Attachment 5b

Attachment 1

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