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Monsanto

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DATE Jan. 23, 1976

SUBJECT :

REFERENCE :

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Mr. W. W. Withers - B2SA
Mr. David Wood - B2SD
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JAN 2 1976

F.Y.I., the attached background information on PCBs, updated to reflect our current position, is now available in quantities and may be useful in replying to industry questions and/or letters from concerned citizens.

Should you desire additional copies, please call Mary Strope at 4-2892.

Thank you.

JAN 29 1976

D. R. Bishop

/mks
attachment

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JAN 27 1976

POLYCHLORINATED BIPHENYLS

A RISK/BENEFIT DILEMMA

MONSANTO COMPANY

ST. LOUIS, MO.

JANUARY, 1976

HISTORY AND BACKGROUND

The chemical structure of polychlorinated biphenyls (PCBs) 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 PCBs -- inertness, fire resistance and their ability as dielectric insulators to act as non-conductors 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.

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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.

PCBs, 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 1960s, some 40 years after PCBs 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 PCBs as a result of an unfortunate industrial accident which has come to be known as the "Yoshu Incident." PCBs 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 three months. It should be pointed out that the levels of PCB contamination in the "Yoshu Incident" were in the two-to-three 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. It is also important to note that a similar industrial accident today, at least in the U.S., is virtually impossible since PCBs 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 PCBs in its electrical applications. It should be pointed out that the major uses for PCBs in Japan were in "open applications," particularly for

carbonless paper. The Japanese power distribution industry, less advanced than the U.S. 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 U.S. 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 PCBs in the bodies of fish. Monsanto and others began immediately to study the Swedish work. But before these findings could be confirmed or duplicated in the U.S., analytical methods had to be refined in order to separate PCBs 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.

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MONSANTO'S RESTRICTED SALES PROGRAM

When these scientific investigations first confirmed the presence of PCBs in the environment in the U.S. in 1970, and long before information regarding the potential impact of this contamination was determined, Monsanto voluntarily began its program of terminating sales of PCBs 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 PCBs, 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 PCBs 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 PCBs 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 PCBs 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 one to two pounds per day, which equates to approximately one to two parts per trillion PCBs in the Mississippi River at average flow rates. (Two parts per trillion is the equivalent of two pennies out of 10 billion dollars). 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 PCBs in the environment by literally making the department a "concrete bathtub." Drainage is collected in an isolated PCB sewer system with settling basins to insure PCB containment in case of accidental spill or equipment failure with the capability of monitoring the effluent from the department.

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Storage tanks are blanketed with nitrogen to eliminate tanks "breathing," and mist eliminators have been installed in vapor lines to eliminate the possibility of PCBs leaving the manufacturing area. The key to our continued success in controlling PCBs 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 multi-lingual 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 lable 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

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from our own operations and from our customers. Firebox temperatures above 2000°F 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 incineration 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 Interdepartment 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,

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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 PCBs per year to literally thousands of customers worldwide. At the present time, PCBs 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 PCBs 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 per cent, 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 PCBs entering the environment. It is now known that certain of the PCB isomers 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 PCBs 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 of 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 PCBs that had been dumped into the river in past years. The report explained that these PCBs

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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, on-going, research programs to develop acceptable replacement dielectric fluids that would be, in themselves, more environmentally compatible. Significant progress is being made.

It's 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 PCBs, 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 PCBs: -- more biodegaradable, not subject to biomagnification and relatively non-toxic. Additional studies currently underway

include acute toxicity to wild life, mutagenicity and teratogenicity (which are scheduled to be completed in early 1976); and two-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 these on-going 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 two to three 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: 1) Transformers contain about 2,000 pounds of dielectric

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fluid compared to from two-to-four ounces in the typical ballast-type capacitor, and 2) 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, PCBs 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

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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

When 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

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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 PCBs 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 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 ensure that the restrictive measures and controls we implemented in the early 1970s remain in force and are diligently pursued.

For more information, contact: Public Relations Department, Monsanto Industrial Chemicals Co., 800 N. Lindbergh Blvd., St. Louis, Mo. 63166. (314) 694-2891.

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