MEETING WITH MONSANTO ON INERTEEN

December 16, 1971 at St. Louis

Monsanto People

| | |
|---|---|
| Bill Richards | Bill Papageorge |
| Ralph Munch | Scott Tucker |
| Paul Benignus | E. P. Wheeler |

Westinghouse People

| | |
|---|---|
| Don Sauter - Bloomington | Ed Boquist - Headquarters Mfg. |
| Don McClain - Bloomington | Dave Kaiser - South Boston |
| Tom Dakin - R & D Center | T. O. Munson - Annapolis |
| Gordon Gainer - R & D Center | Jack Kelley - Annapolis |
| Lyon Mandelkorn - R & D Center | T. K. Sloat - Sharon Works |

Paul Benignus opened the meeting and discussed the production and sales of askarels from 1960 thru 1971 pointing out that thru the elimination of askarels for all uses other than transformers and capacitors their business was cut from 85 million pounds in 1970 to 40.4 million pounds for 1971 (see attached chart). The sales are about equivalent to the 1960 production. Much of the decrease in the fluid for use in electrical equipment in 1971 has been due to the low capacitor activity.

Ralph Munch presented information on the chemistry of the askarels and their advantages to the electrical industry such as thermal stability, oxidation resistance, non-flammable properties, high dielectric constant and corona resistance.

The problem of environmental pollution from the polychlorinated biphenyls (PCB's) was first shown in Sweden in the study of DDT. The methods for the detection of DDT became so sensitive that they found other interfering materials which were shown by gas chromatograph and mass spectrograph to be PCB's. Both DDT and the PCB's are chlorinated aromatic compounds and are concentrated by extraction from suspect materials.

A short review was made of the problems associated with birds and marine life and the vast amount of studies that have been made by various groups to date. Scott Tucker presented information on the analytical procedures used in the analysis of the PCB's and showed a group of spectrograms to illustrate how the various isomers are identified. He spent some time then to show the types of tests made by Monsanto to indicate that the lower PCB isomers, the mono-di-and tri- will degrade more rapidly than the higher isomers. The procedure used for test is called the semi-continuous activated sludge method and uses waste disposal sludge as the source of cultures. It requires an elaborate preconditioning

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of the sludge before it is inoculated with the various PCB isomers. They then measure the amount of Aroclor left and calculate the average percent disappearance rate after 48 hour exposure.

Such values were shown:

| Pure Diphenyl Isomer | Average Percent Disappearance Rate |
|---|---|
| Aroclor 1242 (tri) | 42% |
| Aroclor 1016 (tri) | 41% |
| Aroclor 1043 (di) | 30% |
| Aroclor 1221 (mono) | 21% |
| Aroclor 1254 (penta) | 54% |

It was at this point that I questioned the statement of whether or not Aroclor 1016 is more biodegradeable than Aroclor 1242. The only answer given was that since the higher isomers have been removed from the Aroclor 1242 to make Aroclor 1016 it must be more biodegradeable. This test is far from conclusive.

Tests have been made using two different pure cultures and the general data is similar to the semi-continous activated sludge method.

Data was presented on dogs and rats which were fed one, ten, and one hundred ppm. of Aroclor 1242 with only slight effects at the highest level after 100 days showing that the PCB's are not toxic.

Dr. Munch showed the following composition data on three Aroclors:

| Percent Diphenyl Isomer | Aroclor 1242 | Aroclor 1016 | Aroclor 1043 |
|---|---|---|---|
| Pure Diphenyl | .02 | .02 | .04 |
| Monochlorodiphenyl | .72 | .93 | 22.2 |
| Dichlorodiphenyl | 15.6 | 19.4 | 74.4 |
| Trichlorodiphenyl | 54.5 | 64.5 | 3.3 |
| Tetrachlorodiphenyl | 22.5 | 15.0 | |
| Pentachlorodiphenyl | 6.7 | .16 (.4max)* | |

* Production Limit

The Aroclor 1043 was suggested as a new material for use in capacitors. It has a dielectric constant of 4.65 at 100°C and a pour point of -45°F. It has been shown that some 4,4' dichlorobiphenyl may crystalize at -25°F. It was felt that the Underwriters Laboratories would not classify this in the flammability range of 2-3 as is the case of the other askarels in use.



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The fact that the capacitor industry will change to Aroclor 1016 in 1972 the decrease in the higher chlorinated biphenyls is shown in the following data.

Capacitor Askarels

| | 1970 | 1970 Penta Chlorobiphenyl & Higher | 1972 Penta Chlorobiphenyl & Higher |
|---|---|---|---|
| Aroclor 1242 | 26.1 m * | 1.83 m | .07 m |
| Aroclor 1254 | .5 m | .5 m | 0 |
| Total | 26.6 m | 2.33 m | .07 m |

* m = million lbs.

This table shows that by changing to the Aroclor 1016 the capacitor manufacture will eliminate nearly all the higher chlorinated biphenyl's, that is the pentachlor and higher.

Transformer Askarels

| | 1970 | 1970 Penta Chlorobiphenyl & Higher | 1972 Penta Chlorobiphenyl & Higher |
|---|---|---|---|
| Aroclor 1242 | 6.3 m | .4 m | .4 m |
| Aroclor 1254 | 3.5 m | 3.5 m | 7.3 m |
| Aroclor 1260 | 4.1 m | 4.1 m | 0 m |
| | 13.9 m | 8.0 m | 7.7 m |

If Westinghouse had continued to use PDS 54201KA there would have been an additional 7.0 m of the Aroclor 1254 used or 4.9 m of the higher chlorinated biphenyls. This would also apply to 1972. The General Electric Co. is expected to continue the use of Aroclor 1254 but eliminate any usage of Aroclor 1260.

Paul Benignus

In summary Mr. Benignus made the following statements.

1. Monsanto intends to continue the manufacture of the Aroclors for electrical applications.

2. A further study should be made of the 1.8 million lbs. of the Aroclors that are direct sales to utilities, repair shops, and other users for makeup and repair purposes.

3. Monsanto would like Westinghouse to help with the effort to keep government agencies, customers and other groups aware of the facts concerning the PCB's.

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PRODUCTION AND SALES
POLYCHLORINATED BIPHENYLS (PCB)
MONSANTO INDUSTRIAL CHEMICALS COMPANY
(SHORT TONS)

| YEAR | U.S. PRODUCTION | DOMESTIC SALES | | U.S. EXPORT SALES |
|---|---|---|---|---|
| | | Electrical* Insulating Liquids Uses | All** Other Uses | All Uses |
| 1971 (Est) | 20236 | 14417 | 4401 | 4938 |
| 1970 | 42527 | 20268 | 16263 | 6826 |
| 1969 | 38194 | 18564 | 15034 | 5312 |
| 1968 | 41427 | 20568 | 11990 | 5616 |
| 1967 | 37655 | 20387 | 10846 | 4062 |
| 1966 | 32925 | 18897 | 10642 | 3426 |
| 1965 | 30240 | 16203 | 9695 | 2117 |
| 1964 | 25417 | 13769 | 8666 | 2048 |
| 1963 | 22367 | 11448 | 7618 | 1824 |
| 1962 | 20986 | 11683 | 7339 | 1809 |
| 1961 | 20333 | 11108 | 7661 | 2076 |
| 1960 | 20786 | 12444 | 5163 | 1827 |

* Closed Systems - Transformers and Capacitors

** Including Heat-transfer Systems, Hydraulics/Lubricants, Plasticizers

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