ENVIRONMENTAL PROTECTION AGENCY

BEFORE THE ADMINISTRATOR

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ENVIRONMENTAL PROTECTION AGENCY HEARING CLERK

In re	)	
	)	
Chapman Chemical Company, et al.,	)	FIFRA Docket No. 246, et al.
	)	
Registrants	)	

INITIAL DECISION

OF

BERNARD D. LEVINSON

ADMINISTRATIVE LAW JUDGE

DECEMBER 12, 1975

ENVIRONMENTAL PROTECTION AGENCY

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In re	)	
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Chapman Chemical Company, et al.,	)	FIFRA Docket No. 246, et al.
	)	
Registrants	)	Initial Decision

Preliminary Statement

These are consolidated proceedings to cancel the registrations of all pesticides containing mercury. The proceedings were initiated under section 4 of the Federal Insecticide, Fungicide, and Rodenticide Act as it existed prior to the amendments of October 21, 1972 (FIFRA 1947, 7 U.S.C. 136b(c)). The proceedings continued under section 6 of the Act as amended (FIFRA), P.L. 92-516, 92nd Cong., 7 U.S.C. 136d(b) and (d).[1/]

The proceedings were initiated on March 22, 1972 when the Administrator of Environmental Protection Agency issued PR Notice 72-5 cancelling the registrations of all pesticides containing mercury because they created "a substantial question of safety as to whether or not their use, even in accordance with label directions, is not injurious to man and other living animals." This notice also contained the following order. "In addition, registrations for alkyl compounds and

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1/ A motion to dismiss by some of the registrants based, in part, on the ground that certain procedures set forth in FIFRA 1947 had not been complied with, was denied by the Administrative Law Judge and the denial was sustained by the Judicial Officer on April 1, 1974.

nonalkyl uses on rice seed, in laundry, and marine antifouling paint create an imminent hazard and these registrations are hereby suspended." [2/] These suspensions are not here in issue.

Section 6(b) of FIFRA, 7 U.S.C. 136d(b) provides in pertinent part as follows:

> If it appears to the Administrator that a pesticide or its labeling or other material required to be submitted does not comply with the provisions of this Act or, when used in accordance with widespread and commonly recognized practice, generally causes unreasonable adverse effects on the environment, the Administrator may issue a notice of his intent . . . to cancel its registration . . . together with the reasons (including the factual basis) for his action . . . The proposed action shall become final and effective at the end of 30 days from receipt by the registrant of [the] notice . . . unless within that time . . . a request for hearing is made by a person adversely affected by the notice.

Section 2(bb) of FIFRA (7 U.S.C. 136(bb)) defines "unreasonable adverse effects on the environment" to mean:

> Any unreasonable risk to man or the environment, taking into account the economic, social, and environmental costs and benefits of the use of any pesticide.

Section 6(d), 7 U.S.C. 136(d) sets forth the basic procedural requirements for hearing and decision.

A number of registrants did request a hearing and by order of the Chief Administrative Law Judge the cases were consolidated for hearing. Two parties were admitted into the case as intervenors and one individual a physician, was permitted to participate in the case as amicus curiae.

2/ The suspensions for "imminent hazard" were issued under section 4(c) of FIFRA 1947, 7 U.S.C. 135b(c). Section 6(c) of FIFRA as amended, 7 U.S.C. 136d(c) contains a similar provision.

For various reasons the proceeding was dismissed as to some of the registrants, thereby canceling their registrations. As to certain registrants some were designated as inactive parties and others as limited parties. The attached list (Attachment A) indicates the status of the various participants who remain in the case. 3/

The hearing was conducted pursuant to the Rules of Practice governing hearings of this type, 40 CFR Part 164.

Following the conclusion of preliminary matters, including filing of prehearing briefs and replies, and prehearing conferences, the formal hearing commenced on October 1, 1974. There were several recesses, occasioned primarily because of multiple parties and uses involved and availability of witnesses. The taking of evidence was completed on September 10, 1975 after 89 witnesses had testified during 41 hearing days resulting in 4466 pages of transcript. The exhibits in the case, numbering more than 750, are voluminous and include many technical and scientific papers and studies relating to various aspects of mercury -- its occurrence -- natural and man-made, its toxicity, its effects on the environment and its uses. There is also considerable evidence relating to products which may be used as substitutes for mercurials.

Following conclusion of the evidence, pursuant to section 164.90 of the Rules of Practice, the respondent and some of the registrants filed proposed orders, proposed findings of fact, conclusions and briefs in support thereof. The hearing was deemed closed on November 17, 1975.

3/ One of the intervenors, National Paint and Coatings Association (NPCA) took an active part in the proceeding and will at times be included in the term "registrant."

We are concerned here with the use of mercury compounds as a pesticide when used as a bactericide for in-can preservation of paint and as a fungicide in paint and other coatings; as a fungicide in the treatment of turf, seed, textiles, wood, and the Dutch elm disease. Such uses bring mercury compounds within the purview of FIFRA which, in pertinent part, defines pesticide and pest as follows (sections 136(u) and (t)):

> Pesticide. -- The term 'pesticide' means (1) any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating any pest.
>
> Pest. -- The term 'pest' means (1) any insect, rodent, nematode, fungus, weed, or (2) any other form of terrestrial or aquatic plant or animal life or virus, bacteria, or other micro-organism . . .

The most extensive use of mercury as a pesticide is in paint where phenylmercuric acetate (PMA) is the principal compound that is used. Other phenylmercurials are used, as pesticides in paint and also as fungicides for other purposes above mentioned. Mercuric chloride is used in the treatment of Dutch elm disease, and a combination of mercuric and mercurous chloride is used as a fungicide for turf treatment.

The respondent's case is not directed primarily at the harmfulness of phenylmercurials or mercury salts that are used as pesticides in accordance with the labeling, but rather at the conversion product of such compounds, principally the alkylmercury, methylmercury. The notice of cancellation contained the following findings:

1. Mercury, in many forms and degrees of volatility, can circulate in the environment: Water, soil, and the atmosphere.

2. Aryl mercury and mercury salts in river and lake bottoms can be converted into highly toxic methyl or alkyl mercury.

3. Mercury levels accumulate in the aquatic biota with the results that potentially dangerous residue levels are reached in aquatic foods consumed by man and animals.

* * *

6. Alkylmercury has a particularly high degree of toxicity and it has a propensity for accumulation in the brain.

7. Alkylmercury may be stored in the body and build up to critical levels leading to the central nervous system. It may be stored in fish.

8. Since alkylmercury is readily transported, it poses a threat to the entire public.

The use of methylmercury, an alkyl compound, was prohibited under the Order of March 22, 1972, which initiated these proceedings. We must therefore direct our attention to the compounds presently used, and whether, when used in accordance with widespread and commonly recognized practices, they generally cause unreasonable adverse effects on the environment.

* * *

It is a most difficult task that is given to an Administrative Law Judge in a complex and important case such as this, where on many important facets there are conflicting views and opinions in many areas from highly qualified and respected experts and where there is much conflicting evidence from other witnesses. The respondent has acknowledged the difficulty in the following statement (in its reply brief) in which I substitute "individual" for "witness":

> In order for any single [individual] to reach the ultimate finding of whether or not mercurial pesticides pose an unreasonable adverse effect on the environment, that [individual] would require expertise in a broad range of scientific specialties: chemistry, microbiology, wildlife, biology, toxicology, and experience in evaluating biocides to name a few.

To these I might add an additional few disciplines and these do not complete the list: medicine, agronomy, genetics, statistics, paint technology and ecology. I profess no expertise in any of these specialties. My decision is based on my best judgment in evaluating the evidence and applying the applicable law.

I begin with the understanding that the burden is on the registrants to prove that the use of their pesticides when used in accordance with widespread and commonly recognized practice will not generally cause "unreasonable adverse effects on the environment." This latter phrase means "any unreasonable risk to man or the environment taking into account the economic, social, and environmental costs and benefits . . ."

As will hereinafter appear, I have decided that registrations for certain uses of mercurial pesticides should be canceled and that others should not. In reaching these decisions, I have considered, as the statute requires, whether the particular pesticide, when used in accordance with widespread and commonly accepted practice, generally causes unreasonable adverse effects on the environment. Again, in accordance with the statute, in considering whether a particular use causes unreasonable adverse effects on the environment, I have taken into account the economic, social, and environmental costs and benefits of the particular use. With respect to the uses which are being permitted, I am finding that the risks are minimal and that the benefits outweigh the risks. With respect to the uses which I find should be canceled, although the risks may be minimal, there are no benefits or they are minimal from such continued uses since there are effective and adequate substitutes for the particular uses.

General and Physical Properties

Mercury is a silver-white metal and is one of the elements found naturally in the earth. Some form of mercury has been found in all parts of the world and it is generally considered to be ubiquitous throughout nature. The greatest amount of naturally occurring mercury is found as mercuric sulfide in a red rock called cinnabar. It is also found in measurable amounts in combination with a number of other minerals. The richest sources of mercury are in Spain. In the United States the principal mines are in California, but deposits have been worked in ten additional states. Mercury is obtained by heating cinnabar to liberate the metal as vapor followed by cooling and collection of the condensed vapor.

Mercury is an extremely heavy element with specific gravity of 13.59. It is the only metallic element that is liquid at ordinary temperatures. It also forms vapors at ordinary temperatures, the rate of vaporization increasing with increases in temperature.

Mercury readily forms alloys (amalgams) with practically all metals, except iron. Amalgams of mercury and silver are widely used as dental fillings. Mercury in various compounds has a long history of use in medicine. Mercury is capable of entering into hundreds of compounds, each having its own chemical properties. Both man and nature can convert one form of mercury to another. Synthesization by man has resulted in hundreds of mercury compounds, far more than have been found to result from natural conversions.

Sources of Mercury

Mercury, being an element, its total amount in, on, or around the earth is constant. Because of the volatility of mercury and its vaporization at ordinary temperatures, it has long been recognized that there is a "mercury cycle" whereby the metal is circulated throughout the lithosphere (earth's crust), atmosphere, hydrosphere (earth's waters) and biosphere (living organisms, plants and animals). The mercury circulates and is redistributed in nature. Vaporized mercury in the air that is deposited on the land mass by rainfall is again vaporized since the rainfall material is bound to the upper several inches of soil.

Mercury in various forms is released into the environment from various sources. These include natural sources -- degassing, weathering and volcanic action; and man-made sources -- burning of fossil fuels, industrial and agricultural uses.

Various estimates have been made of the yearly amounts of mercury released into the atmosphere by nature and by man. They vary greatly and can hardly be reconciled. All estimates for releases from natural weathering and degassing per year are in the range of many millions of pounds. The two principal sources of man-made releases in the United States are generally accepted to be the burning of fossil fuels (coal and oil) and smelting of ores (tin, zinc, copper, gold). These estimates are also in the range of millions of pounds per year.

Worldwide production of mercury metal is approximately 20 million pounds per year. Again, it is not possible to reconcile all the figures (estimates and others) regarding the total amount of mercury used in the United States. Several estimates from which appear to be reliable sources set the figure between 4 and 6 million pounds. It is estimated that chloralkali plants[4/] and the electrical apparatus industry use about one-half of the total of which a substantial portion is recyclable. Additional uses other than pesticides include control instruments, laboratories, dentistry, pharmaceuticals, and catalysts.

Based primarily on figures submitted under section 7(c) of FIFRA, it has been stipulated in the record that the total pounds of mercury used in the production in pesticides for the calendar year 1973 was between 340,000 and 365,000 pounds. This breakdown in approximate amounts for various uses, which give a total of 359,000 pounds, is as follows:

4/ Discharges of mercury into the atmosphere are permitted by EPA, see *infra*, p. 11.

Turf industry	26,000
Paint industry	321,000
Seed industry	7,000
Other uses (plastics, fabrics, dry formulations, wood treatment, Dutch elm disease	5,000

The total amount of mercury introduced into the environment from pesticidal uses is only a small fraction of that introduced into the environment from industrial and unintentional man-made discharges.

Mercury in the Atmosphere

One of respondent's principal witnesses, Dr. Leonard T. Kurland, a physician who has done extensive research concerning the effects of mercury on man and other animals and who has done extensive study on the Minamata incident, testified that the present atmospheric level of mercury is reasonably safe, and this despite the pesticidal uses of mercury for many years. One of the registrants' witnesses, Dr. J. Crispin Smith, a toxicologist who also has done extensive research relating to effects of mercury on man, testified to the effect that if all of the PMA used in pesticides was released into the atmosphere, it would not increase the background levels of the atmosphere significantly. The evidence also shows that with the exception of the point sources, where some forms of mercury have been discharged into certain locations, mercury concentrations in the environment are apparently no different now from what they were 100 years ago.

In April 1973 EPA established as a standard an allowable release of 2300 grams (about 5 pounds) of mercury per day (about 1300 pounds per year) for each chloralkali plant in the United States. In permitting such release, EPA said, "The environmental impact of this standard was evaluated and it was concluded that the standard will not cause any adverse effects since the control of emissions to the atmosphere will have only minimal impact on other areas of environmental concern." In another action EPA concluded that mercury emissions from a Washington, D.C., Solid Waste Reduction Center of 12 pounds per day would not constitute a hazard to public health.

So far as the uses being permitted are concerned, the registrants have sustained the burden of proof of showing that mercury that may result from volatilization does not generally cause unreasonable adverse effects on the environment.[5/]

Whether the uses being permitted will generally cause unreasonable adverse effects on aquatic and terrestrial environments will be considered under the particular uses.

5/ See, <u>infra</u>, pp. 29-30, 34-35.

Minamata and Other Incidents

The worldwide concern regarding the harmful effects of mercury arose primarily with events that occurred in the vicinity of Minamata Bay, Japan. Minamata City is located on the Southwest coast of Kyushu, the southernmost of the main Japanese Islands. In 1953 a severe neurological disorder was first recognized among persons living in this area. The neurological syndrome has come to be known as Minamata disease. This disease is characterized by widespread involvement of the central nervous system, resulting in loss of sensation of the extremities of the hands and feet and areas around the mouth; loss of coordination in gait, slurred speech, tremors, diminution of vision (concentric constriction of the visual field), and loss of hearing. Severe poisoning can cause blindness, coma, and death.

Minamata City is situated near a large chemical plant, and the effluent from this plant emptied into the bay. The bay had been used regularly as a source of seafood for many of the families inhabiting the small villages along the shores of the bay. It was established that the effluent from this plant, containing a compound of mercury, contaminated the fish and shellfish, which, when ingested, caused the neurological impairments. Whether the effluent contained methylmercury or inorganic mercury, which was subsequently methylated, is a question of some controversy. Several reports from authoritative Japanese investigators show that the effluent was methylmercury or contained large quantities of methylmercury. On the evidence I find that large quantities of methylmercury were present in the factory discharge.[6/]

There was essentially no difference in incidence of Minamata disease by sex or age except that nursing children were not affected. It was concluded that methylmercury penetrates the placental barrier in humans and there were 23 fetal cases of the disease. The disease broke out mainly among people who had eaten large amounts of fish and shellfish that contained considerable amounts of mercury from 1 ppm to 50 ppm per net weight in some organs.

Through 1970, 121 cases of the disease were recorded in the area. This number included 68 cases adults, 30 cases children and the 23 cases of fetal disease (cerebral palsy-like disease) of infants. The infants had not consumed contaminated fish: however, their mothers had done so but were apparently free of symptoms of the disease. There were 46 deaths resulting from the Minamata incident.

A similar outbreak of this disease occurred in the early 1960's in the riverside villages of the Agano River in the Niigata prefecture of Japan where 47 cases with 6 deaths were observed through 1970. The affected persons in this area had also eaten fish from the nearby waters containing organic mercury compounds. The source of mercury contamination in Niigata was also determined to be the discharge from a plant using a mercury catalyst in industrial manufacturing.

6/ The respondent's first pretrial brief states "The waters of Minamata Bay and of the Agano River were contaminated by the release of methylmercury compounds from the plastic industries in which inorganic mercury compounds were used as catalysts."

An epidemic of methylmercury poisoning broke out in Iraq, in 1972, when Iraqian farmers and their families consumed home-made bread prepared from seed wheat, which had been treated with a methylmercurial fungicide and was not intended for consumption.[7/] As the result of this catastrophic incident, 6,350 cases were admitted to hospitals and 459 hospital deaths were attributed to the outbreak. The symptoms were the same as those in Minamata and Niigata. The study confirmed also that there was great hazard for the fetus.

An incident in Alamogordo, New Mexico, occurred in 1969 and also arose out of consumption of seed treated with methylmercury not intended for consumption. Here, the seed was fed to several hogs and the family then consumed the hogs over a period of 3 months. Three of the children subsequently displayed ataxia, agitation, visual impairment and impaired consciousness. The mother, at the time the family began to consume the mercury-contaminated meat, was 3 months pregnant. She ceased consumption after 3 months. Examined during the 7th month of pregnancy, the mother was within normal limits, and neurological and visual fields were normal. The child, delivered at full term, was born blind and retarded, and experienced convulsions and involuntary movements. The child's symptoms were attributed to methylmercury poisoning.

7/ More than 73,000 metric tons of wheat intended for seed grain were imported and distributed.

Methylation

One of the difficult problems in this case is that relating to methylation and demethylation of mercurials in an aquatic environment and how such processes affect mercurial compounds used as pesticides. The difficulty arises because of the mass of technical evidence on the subject, the differences of well qualified experts on some subjects, the extent to which demethylation offsets the methylation process, and the many areas in which the experts admit that there are many unknown factors and that much is yet to be learned of these processes. The question of methylation is important because the respondent's case, as it relates to the hazards of mercury, is directed primarily at methylmercury.

Methylation is a chemical or biological process by which mercury or mercury compounds are converted to methylmercury, which is acknowledged to be highly toxic. Methylmercury is an organic chemical compound consisting of an organic methyl radical in combination with a mercuric ion.

Conversion of mercury and mercury compounds to methylmercury has been shown to occur both in nature and in controlled laboratory experiments. The exact process by which the conversion takes place has not been shown. The difficulty lies in identifying and quantifying all of the variables that may enter into the process. Methylation can occur in nature only under specific and favorable conditions. These include sufficient mercury concentration, proper acidity and temperature, the presence of proper type of bacteria, whether the system is aerobic or anaerobic, and the presence of other elements or compounds. The introduction of nutrients into natural aquatic systems by way of untreated sewage greatly increases the methylation process.

Mercury, when introduced into an aquatic system, becomes attached to particulate matter and settles to the bottom sediments. There are certain species of organisms in the sediment capable of converting the mercury from inorganic or metallic form into toxic methylmercury. There are also species of organisms in the sediment that are capable of demethylating methylmercury.

When methylation does occur, not all of the inorganic mercury is converted to methylmercury. The most active sediments are capable of converting less than 5% of the inorganic mercury to methylmercury. In a controlled study of the sediments from two different sites in Wisconsin, the actual conversion rate was between 0.5% and 1.5%. There would have to be a hundredfold increase in the use of mercury to double the methylation rate.

Scientific studies in the United States reported in 1972 and 1973 show that there are environmental sediment organisms that are shown actively to degrade methylmercury to inorganic mercury and methane. Where methylation was observed under laboratory conditions, it was followed by a rapid disappearance of the methylmercury produced after the peak period of 50 days.

These investigators found methylation of inorganic mercury in sediments under laboratory conditions but were unable to find methylmercury in fresh sediment samples taken from environmental sources. They also found that certain species of bacteria in the sediments were responsible for the degradation of methylmercury and the degrading species can easily be isolated from a variety of sources, including sediments and fish slimes. Because of the ease with which the methylmercury degrading bacteria can be isolated from environmental samples, the frequency of occurrence of these organisms and the inability to find methylmercury in naturally occurring sediments containing these organisms, the investigators concluded that such species are widespread in the environment and perform an important function in maintaining methylmercury at a minimal level. These investigators were unable to show that any methylmercury degrading species are also capable of methylating mercury. In many cases the demethylating species were predominant in cultures. Independent studies in Belgium reported in 1973 confirm these findings.

In a study by still other investigators it was found that certain organic mercurial compounds, including PMA (the most widely used mercurial pesticide) were decomposed by a bacterial strain found in soil to form metallic mercury.

One of the areas of dispute is whether biologically methylated mercury is different from chemically synthesized methylmercury. I make no attempts to resolve this question. If we accept as fact that the Minamata and Niigata incidents were the result of chemically synthesized methylmercury, there are no reported incidents of poisoning from mercury that had been biologically methylated.

When we consider the following factors: the demethylization process, the low levels of mercury in aquatic environments that are converted to methylmercury, the increased amount of mercury that is necessary to convert as much as 5% to methylmercury; then the amount of mercury introduced into the environment through ment through the use of pesticides which are being permitted herein would not at any time increase the amount of methylmercury available to aquatic biota so as generally to cause unreasonable adverse effects on the environment as defined in the statute.[8/]

Toxicity

The primary thrust of respondent's case is directed at the adverse effects of methylmercury. None of the registered products we are considering contain methylmercury, its use in pesticides having been banned in March 1972 under PR Notice 72-5. Of the mercurials used in pesticides phenylmercurials are the most widely used and most are used in paint, usually in the form of phenylmercuric acetate (PMA). Two registrants are supporting the use of mercurials other than phenylmercurials. Mallinckrodt uses a combination of mercurous and mercuric chloride as a turf fungicide and Freers uses mercuric chloride for the treatment of Dutch elm disease. The toxicities of the various phenylmercurials on a contained mercury basis are comparable and in this regard they will be considered as a class.

The toxicity of phenylmercurials is of a low degree. After extensive studies at Columbia University it was reported by qualified investigators:

"1. For human exposures there appears to be no significant difference in the toxicity of the various phenylmercurials.

8/ See infra Turf and Paint.

"2. Phenylmercurials may be absorbed through the intact skin or mucous membranes, but relatively high concentrations must be applied before measurable amounts will be absorbed through these channels.

"3. Persons may be occupationally exposed to phenylmercurials in concentrations many times the accepted Threshold Limit Value of $0.1 mg/m^3$ in air for many years without showing evidence of poisoning, even though they absorbed sufficient amounts of the compounds to cause them to excrete mercury in their urine in the milligram per liter range.

"4. Poisoning due to the phenylmercurials is extremely rare and chronic occupational poisoning is unknown."

Painters who have been applying paints containing phenylmercurials for 30 years have not shown adverse effects from such use. There is no evidence of adverse effects to those exposed to rooms or other areas that have been painted with a paint containing a phenylmercurial.

Mercurous chloride is used in medicine as a therapeutic agent for several purposes. Mercuric chloride,also called bichloride of mercury and corrosive sublimate,is a highly toxic compound. However, the respondent's case is not directed at these inorganic compounds because of the inherent toxicity of either of them but rather because of the effect of such volatilization as may result from their use and their translocation, primarily from turfgrass areas to aquatic environments by runoff.

There is an abundance of evidence in the record introduced by respondent that has well demonstrated in laboratory experiments that low levels of mercurials, primarily methylmercury compounds, fed to aquatic plant life and fish can cause serious adverse affects. These studies include phytoplankton, mosquito fish, brook trout, zebra fish, fiddler crab, mud-flat snail and American oyster. There are also results of laboratory experiments that demonstrate adverse affects on experimental animals. These include dogs, minipigs, monkeys, rats, mice, pigeons. This evidence stands unrebutted. It has also been suggested, but not established, that methylmercury may cause genetic changes in human population. This suggestion is on the basis of changes caused by methylmercury to the onion root tip and fruit flies. It has also been reported that methylmercury has been teratogenic in experimental animals. Many drugs are known to be teratogenic in experimental animals and can safely be used by man.

The evidence with regard to Minamata and Niigata established that some individuals who,over a long period of time, consumed fish containing high levels of methylmercury, caused by industrial effluents, developed severe neurological symptoms. This evidence also established that methylmercury penetrates the placental barrier and may cause Minamata symptoms to the infants even though the mothers were free of such symptoms.

The evidence as to the foregoing adverse effects has been considered and is striking and terrifying. The question in this case, however, is whether the amount of mercury from pesticides could increase the environmental burden of mercury above that from natural and other man-made sources as to cause such results as were demonstrated in laboratory studies and as occurred in Minamata. I cannot answer this question in the affirmative.

We are concerned with mercury, an element that is found naturally in the environment. The highly toxic compound, methylmercury, is not used as a pesticide. Compared to the amount of mercury naturally in the environment and from man-made sources, only minimal amounts from pesticidal uses possibly find their way to aquatic environments. Of such mercury as may be translocated from pesticidal uses, not more than 5%, and more likely less, may, under a variety of the most favorable conditions, be transformed to methylmercury. Such minimal amounts as could possibly be biomethylated does not have an unreasonable adverse effect on the environment.

Studies were carried out by a group of scientists from the University of Rochester (reported in 1974) on two groups of individuals each of which had very high diets of ocean fish. Both groups had high levels of blood and hair mercury. Symptoms of methylmercury poisoning were deliberately sought and none were found. These investigations pointed out that the victims in Minamata and Niigata consumed fish from localized areas that had been contaminated with mercury by industrial effluents. They also considered as pertinent the fact that the victims were members of fishing families without agricultural land and that their diets were not varied.

The questions as to the hazards posed in the use of mercurials in pesticides are completely different from those that were posed in the DDT and Aldrin/Dieldrin cases. In those cases millions of pounds of man-made chemicals were used annually as pesticides.[9/] Substantial

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9/ In the DDT case, close to 12 million pounds was used annually (37 F.R. 13369). The combined Aldrin/Dieldrin consumption in 1971 was 12.3 million pounds and estimate for 1973 was approximately 11 million pounds (39 F.R. 37266).

quantities were applied directly to or in the soil. The chemicals were found to be potential carcinogens in humans. Residues of the very same chemicals that were applied were found to be widely distributed in the environment and in animal and human tissues.

Paint

We are concerned with two types of paint which are produced at the present time. One type is the latex or water based paint, the other is the solvent reduced oil, oleoresinous, or alkyd type (oil based). Water based paints are now more widely used than oil based paints -- the range is roughly in the vicinity of two-thirds and one-third and the trend toward water based paints is increasing.

Biocides are used in paints for two purposes -- as an in-can preservative and as a fungicide. The evidence establishes that in oil based paints mercurials are not necessary for either of these purposes.

A paint system is a fairly complex combination of finely dispersed pigments of various absorptive capacities in one or more of a variety of vehicles together with additives such as pigment wetting agents, anti-settling agents, flow control agents, driers, and antioxidants. In water based paints, various types of latices are used. Each paint manufacturer has his own combinations of ingredients and these will vary with the type of paint and color. The development of a paint formulation is more of an art than a science.

Water based paints are susceptible to spoilage in the can caused by the growth of bacteria and, after application, are susceptible to the growth of fungi causing mildew on paint films.

The mercurial compound most commonly used in water based paints is PMA. Others sometimes used are: di(phenylmercuric) dodecenyl succinate, phenylmercuric oleate, phenylmercuric propionate. As above noted, the toxicities of these several phenylmercurials are comparable on a contained mercury basis. Their activity in paint is similarly comparable. The choice of a particular product by the paint manufacturer depends on the particular type of paint to be protected, and the factors involved in the choice include solubility, compatibility, and resistance to leaching from the dried paint film.

(a) <u>In-can preservatives</u>

The susceptibility of water based paints to contamination by bacteria is high. The bacteria may contaminate the paint through the air, water, raw materials, handling, or insanitary conditions in the plant. Paint additives such as thickening agents, pigments, dispersants, and plasticizers provide nutrients for the growth of bacteria. The result is in-can deterioration of the paint, posing a serious threat to the stability of the paint during its shelf life. An additional reserve of protection from spoilage is necessary while the paint is in possession of the consumer, particularly when the container is opened and part of the contents used, thereby exposing the paint to additional sources of contamination.

One of the qualities essential in paint is optimum viscosity necessary for the application of the product. Spoilage of water based paints is most commonly found in loss of viscosity. Gas formation, which may cause the can to explode, and unpleasant odors are also occasionally encountered. In water based paints a thickener is used to achieve the desired degree of viscosity. Most water based paints use some form of chemically treated cellulose for this purpose. To a limited extent some formulas have as a base styrene butadiene and protein. A good thickener is one that effectively suspends the insoluble coloring pigments for an indefinite period.

The cellulosic thickener and pigment sources provide the nutritional environment to support the growth of bacteria. The bacterial activity produces enzymes, called cellulases, which degrade the cellulose. The degraded products are food for the bacteria and they multiply, resulting in loss of viscosity and the gradual reversion to a watery character. One of the principal types of micro-organisms that results in paint thinning are pseudomonads. Pseudomonads synthesize cellulases which can cause a dramatic decrease in the viscosity of latex paint.

A chemical preservative is necessary to control the initial growth of the various types of bacteria normally present in the water based paint. Good housekeeping or effective sanitation control in a paint factory can reduce the extent of bacterial contamination but cannot eliminate it. PMA, other equivalent phenylmercurials, and chemicals other than mercurials are used for this purpose.

The normal range of phenylmercurials as an in-can preservative is between 50 to 100 ppm mercury but serious potential spoilage situations may require as high as 200 ppm.

There are a number of registered non-mercurials products on the market for use as in-can preservatives. The respondent has put forth three as alternatives to the mercurials and introduced detailed evidence with respect to them -- Dowicil 100, Dowicil 75 (both manufactured by Dow Chemical Co.) and Merbac 35 (manufactured by Merck & Co.) and has proposed these as substitutes for such use. Dowicil 100 was Dow's original formulation for the product for this purpose and it was found to be subject to spontaneous combustion under certain conditions. A portion of the formulation (25%) was replaced with a decomposition suppressant (sodium bicarbonate) and the new product is called Dowicil 75. The two Dow products have been evaluated as comparable.

An effective in-can preservative must have a broad spectrum so as to protect against the various strains of bacteria in a wide variety of paint formulations. It must have the property to "quick-kill" the bacteria to prevent the micro-organisms from acclimatizing to the bactericide. Unless there is "quick-kill," the enzymes produced by the bacteria are in existence and cause loss of viscosity of the paint. PMA causes inactivation of the cellulose enzyme whereas non-mercurials do not.

None of the in-can preservatives put forth as alternatives have the broad spectrum bactericidal properties of PMA in the great variety of paint formulations that are produced. It may be that the alternatives in some formulations under some conditions may be effective. However, the convincing evidence, not only from producers of the biocides, but also from paint manufacturers and independent testing organizations is that none of the non-mercurial preservatives are as effective as PMA.

Evidence of several instances of failures of non-mercurials as in-can preservatives was introduced into evidence. Paints lost their viscosity and otherwise spoiled. In a recent incident, four plants of a large paint company that had discontinued the use of mercurials in 1971 and were using a non-mercurial bactericide became contaminated with bacteria. This was attributed to the use of non-mercurials. This bacteria contamination affected 190,000 gallons of paint. The company returned to the use of PMA.

To prohibit the use of phenylmercurials in paint as an in-can preservative would likely result in increased bacteria contamination of paint and losses from spoiled paint. Such occurrences would result in economic loss to the paint producers and particularly to the small operators. Consumers in many instances would also experience financial loss by reason of spoilage of the paint in the can before complete use of the contents.

(b) Mildewcides

There are various species of organisms that cause mildew growth on paint film. The principal organism is pullalaria pullulans which is capable of growth at temperatures as low as 40°F and humidities as low as 30°. If conditions are adverse, this organism can revert to a dormant state until conditions become more favorable for its continued growth.

Phenylmercurials are used in paint as mildewcides. The operating range for the use of mercury as a mildewcide is between 250 and 1500 ppm of mercury and in severe exposure conditions a level of 2000 ppm may be required.

Paints for interior use do not generally require a mildewcide, since mildew is ordinarily not a problem in interiors. A mildew resistant paint for interiors has to be produced on special order or an over-the-counter mildew inhibitor may be added to the paint by the user.

There are a number of registered non-mercurials products on the market for use as mildewcides in paint. The respondent has presented detailed evidence with respect to only Skane M-8 (manufactured by Rohm and Haas), Dowicil S-13 and Dowicil A-40 (manufactured by Dow Chemical Co.), and Metasal TK-100 (manufactured by Merck & Company). Dowicil S-13 has a fault in that it hydrolyzes in an alkaline medium of water based paints. Dowicil A-40 is a sequel to Dowicil A-13 and apparently does not have the fault of hydrolyzing.

There is evidence to show that several large paint manufacturers discontinued the use of phenylmercurials in paints and have been marketing these paints for several years. The convincing evidence shows that most, if not all, of these manufacturers discontinued the use of such mercurials not because of their ineffectiveness or the superiority of the substitutes but rather because they anticipated that such use would be prohibited. Some have returned to the use of phenylmercurials because of the ineffectiveness of the substitutes and others would return to such use if restrictions on their use do not become effective.

The service life of a good exterior paint is approximately five years. Non-mercurial mildewcides are generally quite effective up to 24 months and thereafter their effectiveness diminishes and fails. Phenylmercurials are generally effective for a much longer time -- four years or more.

Du Pont, one of the major paint manufacturers in the country, has not been using mercurials in paint since March, 1973. It has been engaged in efforts to find a satisfactory substitute for mercurials since 1970. Dr. John C. Richards, the company's Director of Research and Development for certain products including paint, testified that "our efforts have not yet led to a replacement mildewcide which is as effective as the phenylmercurial compound we had been using."

Glidden-Durkee, another large manufacturer of paints, uses both mercurial and non-mercurial mildewcides. Stephen T. Bowell, in charge of Research and Development for paint, testified that in a ten-year period his company has tested on exterior exposure 120 products claiming to be substitutes for mercurials and none has been entirely satisfactory.

Water based exterior paints containing mercury are subject to sulfide staining (discoloration of the paint film) in areas with high atmospheric content of hydrogen sulfide, usually highly industrial areas. Such sulfide staining as may occur is preferable to a mildewcide whose effectiveness is relatively short lived.

As in the case of in-can preservatives, the non-mercurial mildewcides are not effective in all the great variety of paint formulations and in some formulations their use may be contraindicated. In some formulations they may cause chalking, yellowing, and non-resistance to fading.

Whether or not the use of non-mercurials would increase the cost of paint at the retail level is the subject of some dispute. There are estimates that such cost would be increased from $.60 to $2.00 per gallon, which is approximately four times the added cost of the non-mercurials at the manufacturer's level. In recent years there has been an increase in the retail cost of paint, as is generally true of all commodities. Three of the large paint manufacturers who use non-mercurials have not suffered in their sales when compared to their competitors who use mercurials. Whether they have absorbed the additional cost, if any, in the use of non-mercurials or passed it along to the consumer with the general increase in the price of paint is not shown.

The real economic loss from the use of non-mercurial mildewcides falls on the ultimate consumer, in many instances a homeowner. Exterior surfaces painted with non-mercurials require repainting at an earlier date because of the premature failure of the mildewcide. In addition, there is the expense of cleaning the mildew from the surface before repainting. It was estimated that the cost of repainting an average house is in the range of $600-$900.

(c) Loss of mercury to the environment

The greater part of the loss of mercury from paint is by slow volatilization to the air from the paint film. The mercury that is volatilized immediately after application is quickly dispersed and the amount which may be inhaled after application has not been shown to be hazardous. As above noted, painters who have applied mercurial paints for 30 years have shown no harmful effects from inhalation. The evidence shows that the total effect of the concentration of mercury in the air from paint volatilization would be so slight as to be almost incapable of measurement. Such escape of mercury in the air would not cause the concentration to approach levels that were not acceptable.

The amount of mercury "rained-out" from the volatilization of paint to aquatic or terrestrial environments would not significantly increase the "rained-out" mercury in the environment above that which is "rained-out" from other sources. In any event, when mercury reaches the ground it is bound to the soil by inorganic matter naturally and normally present in the soils such as humates, fulvates, and sulfides. By this process mercury released to the air and returned to the ground generally will be quickly immobilized. Mercury or its compounds do not pass freely through soil into water. Such mercury from use in paint as may reach aquatic environments will have minimal environmental effect.

Turf

Three of the active registrants (Mallinckrodt, Scott and Cleary) introduced evidence in support of the use of mercurials to control fungi on turf. Cleary's product contains PMA, Scott's products are granular formulations containing as active ingredients PMA and thiram (a sulfide). Mallinckrodt's products contain mixtures of inorganic mercurials -- mercurous and mercuric chlorides. All of these products are contact fungicides and to accomplish their purpose must remain bound to the foliar portion of the greens.

There are two broad categories of fungal turf diseases -- summer turf diseases and winter turf diseases. Mercurials are effective for combatting a wide spectrum of diseases that attack fine turf in both of these categories.

(a) The summer diseases

The principal summer diseases are dollar spot (Sclerotinia homeocarpa), brown patch (Pellicularia filamentosa), leaf spot (Helminthosporium spp.), copper spot (Gleocerospora sorghi), and red thread (Corticium fuciforme).

In recent years a number of chemicals have been replacing mercurials for effective summer turf disease treatment. These include non-mercury organic contact fungicides such as anilazine, chlorthalonil, and cycloheximide. Systemic fungicides including benomyl, thiophanate-methyl, and thiophanate ethyl are also used. The particular products Dyrene, Maneb, Tersan LSR, and Daconil, all provide a broad range of effectiveness in controlling summer turf fungal diseases. Brown patch can be controlled by a number of chemicals including materials containing organic sulfur and Acti-dione. Acti-dione also provides good protection for leaf spot.

Two witnesses for Mallinckrodt testified that summer diseases can be controlled by non-mercurials.[10/] This confirms testimony on behalf of respondent that several non-mercurials control the same set of summer diseases that mercurials control.

10/ Neither Dyrene nor Daconil control Pythium blight, nor does mercury. Systemic fungicides have provided effective treatment of this disease.

(b) <u>The winter diseases</u>

The principal winter turf diseases that attack fine turf are called snow mold. Primarily these are gray snow mold (Typhula or Typhula blight) and pink snow mold (Fusarium nivale or Fusarium patch).[11/]

Snow mold flourishes in cool wet periods of late fall, the ideal temperature for its development is about 32-40 degrees F. Disease activity continues under melting snow through winter and spring. Areas that receive heavy snowfall (New England, Northern mid-Atlantic states, the Great Lakes regions, northern Great Plains, and Mountain states) are most vulnerable to severe turf damage from snow mold. It may also occur in other areas that have periods of cool wet weather during the winter months.

Control of the snow mold requires an effective treatment which need only be applied once in the fall before snow fall. The snow cover presents a physical barrier both to the observation of the activity of the disease and to the application of a fungicide. Even in the absence of snow cover, application in the winter is inadvisable because of the high probability of damage to the frozen greens. Mercury's longevity of effectiveness is an important consideration in its ability to combat snow mold.

Adequate control of golf course greens must approach 100%. A putting green with more than a small percentage of damaged tissue is regarded as a failure in disease control.

11/ Snow mold may be caused by as many as six different species of fungi acting singly or collectively.

For effective control of golf course greens, both the gray snow mold and pink snow mold must be controlled. Mercurials are effective in controlling both diseases.

Chloroneb was recommended as a control for snow mold. It does at times control gray snow mold but not consistently and effectively and is likely to fail under severe conditions where adequate treatment is most crucial. It does not provide the broad and effective range of control that is available with mercurials.

One of respondent's witnesses testified that while the non-mercurial fungicides have given adequate control of summer diseases, none of them has adequately controlled gray snow mold in areas of severe disease incidence. He stated that some of the non-mercurial organics are effective against this disease in areas where thawing occurs and repeated applications can be made, but in areas of permanent snow cover they fail to control this disease.

Chloroneb is not effective in achieving adequate control of pink snow mold. It may at times be partially effective but not of such sufficiency as to provide adequate control for golf course greens.

Systemic fungicides of the benzamidazole configuration were recommended as substitutes for the mercurials for snow mold control, including pink snow mold. However, the evidence shows that the snow mold fungi are developing a tolerance to the systemics.

A witness for respondent testified that under limited winter snowfall there are adequate substitutes for mercury compounds for snow mold control.

He further testified that the <u>mainstay of the substitutes</u> include the benzimidazole configuration materials, but with their widespread use tolerance to turfgrass disease fungi is becoming a problem.

Of the substitutes put forth for the mercurials, combinations of two or more may at times, where conditions are not severe, control snow mold. However, none of the non-mercurials have the wide spectrum of control that is afforded by the mercurials. The elimination of mercurials as turf fungicides would not provide the reliable and necessary control for golf course greens at all times under severe conditions.

The need to control fungi on areas of golf courses other than putting greens with the effectiveness and reliability that is obtained through the use of mercurials has not been established. Substitutes are available that will give satisfactory control of golf course areas other than greens. The permitted use of mercurials to control fungi on golf courses should be confined to the control of snow mold on greens.

(c) <u>Volatilization from turf</u>

It is respondent's position that there is significant methylation in the soil from the application of mercurial fungicides and that this is a potential hazard. The evidence on this point is not convincing.

While methylmercury is extremely volatile the volatility of PMA and organic mercury is lower by several orders of magnitude.

Dr. Robert S. Braman, an expert in analytical and environmental chemistry, testified on behalf of respondent regarding volatilization of mercury from turf. He stated that he would expect to find concentrations of mercury in the air significantly higher and measurable over the soil where applied but that the general level of mercury in the air in general would not be significant. His calculation as to the amount of volatilization was one millionth of the total mercury applied and at another point he testified that the methylation rate would be approximately 1/50 of 1.28 times 10^{-4} (or .000000256) after six weeks in soil. Whatever volatilization there may be in the soil from the application of mercurial fungicides is quickly dispersed and discontinuance of their use would not result in any measurable degree of reduction in the overall air concentrations of mercury.

The respondent's evidence is far from convincing to show that volatilization is hazardous to the environment.

(d) Runoff from turf

The respondent's evidence does not establish that runoff, erosion, or percolation introduces any significant amount of mercury into aquatic environments.

As one of its principal pieces of evidence to establish runoff from golf courses to golf course lakes, respondent introduced a study by Dr. S. R. Koirtoyohann, associate professor of biochemistry at the University of Missouri. He compared the mercury content of fish caught from lakes in Missouri near four golf courses that had used mercurial fungicides with the mercury content of fish from selected control lakes.

Two of the golf course lakes were near large industrial cities (St. Louis and Kansas City). One course was in a distinctly rural setting and one in a city with little industrial activity. The control lakes were in central Missouri where there was no known source of mercury contamination. He stated that many lakes with no known source of mercury contamination produced bass which contain significantly more than 0.5 ppm of mercury (the FDA guideline). It is apparent that factors other than application of fungicides to golf course greens (e.g. geological differences of mercury content of the area) have an effect on the mercury content of fish. There was lack of background information in several respects with respect to this study. Although Dr. Koirtyohann concluded that mercurial fungicides used in maintaining golf course greens can lead to elevated levels of mercury in fish from receiving greens' drainage, he cautioned in drawing conclusions from the data he submitted. He said that "there are far too many variables among the golf courses to expect detailed cause and effect information from a single small study of this type."

The registrants introduced several studies to show that there is no significant runoff of mercury from golf course greens to near bodies of water. While some of these studies are not without deficiencies, taken as a whole, the substantial and convincing evidence establishes this fact.

Volatilization from the application of mercurials (PMA or inorganics) to golf course greens does not increase atmospheric mercury significantly. It is also shown that mercury is bound to the thatch and the upper 12 inches of soil. The respondent argues that it was the amount of mercury that was recovered and not the amount of mercury that was applied that was bound to the thatch and upper portion of the soil. However, the registrants have introduced evidence from investigators (some registrants connected and others independent) relating to runoff of mercury from golf course greens to nearby bodies of water. These studies included examination of mercury in adjacent and drainage areas, sampling of soil, sediment, water and fish. The investigators in separate studies concluded, in effect, that whatever runoff there may be from greens to nearby water bodies is insignificant and would not significantly change the background levels of mercury in such water bodies. I accept these conclusions.

One of respondent's witnesses, Earl J. Hariss, an analytical chemist with the New York State Department of Environmental Conservation in a paper published in 1972, after a study of the mercury content of fish concluded as follows:

> Although the buildup of mercury in the biomass, particularly in fish has been thought of as a phenomenon of recent origin, the data presented in this paper would indicate this is an incorrect view. Mercury contamination was probably present in the animal protein consumed by our prehistoric ancestors. Certainly freshwater fish caught in Northeastern United States a century ago contained some body burden of mercury. Those taken from Lake Ontario and Lake Champlain 30 or 40 years ago contained about as much mercury as they have in them today. However, in spite of this, there is no evidence at present to indicate that injury to human health has occurred as a result of eating these fish. Likewise there is at the present time no evidence to indicate that freshwater fish have been damaged as a result of their body burden of mercury.
>
> Historical evidence exists to indicate that man-made mercury pollution is not an act of recent occurrence.

Dr. Peter A. Krenkel, a highly qualified expert in the environmental field who has performed numerous mercury research projects testified as follows:

> With exceptions caused by localized conditions, mercury levels existing in foodstuff, fish, and wildlife which may be consumed by man, are not significantly different today than in the past. The exceptions to the foregoing statement are bird populations which have consumed mercury treated seed and fish in locations immediately below certain industrial plants discharging mercury directly into the aquatic environment.

Whatever doubt there may be in my mind as to the potential hazard of the continued use of mercurials as a fungicide for snow mold on golf course greens, I resolve in favor of the registrants on the basis that the benefits outweigh whatever risks there might be.

Fabrics

Registrants Vikon, Troy and Steri-tized have registrations for phenylmercuric compounds used primarily as mildewcides for treating fabrics. The principal uses are on cotton fabrics used for out of doors, such as awnings, boat covers, canopies, and tarpaulins.

These three registrants have registrations for products containing phenylmercuric triethanol ammonium lactate. Troy's products are called Puratized N5DS (containing 22.5% of the compound) and Puratized N5X (containing 11.2% of the compound). Vikon's product is called Merkyl PM-TL (containing 22.5% of the compound). Steri-tized's product is called Steri-tized 515 (containing 22.5% of the compound). Vikon also has a product containing 15.8% phenylmercuric ammonium propionate which it calls Merkyl MAP. The pick-up of mercury in the fabric based on dry weight is in the range of .025 to .10% of mercury as metal, depending on the amount of protection desired. There was evidence concerning products containing these compounds. Steri-tized also has products containing phenylmercuric hydroxide and phenylmercuric acetate. There was no evidence from any registrant concerning products containing these latter two compounds. As stated above (p. 18) the toxicities of the various phenylmercurials on a contained mercury basis are comparable and in this regard they will be treated as a class.

Certain of the mercurial products are registered for use on materials that could be used for wearing apparel, footwear, and shoe linings. No evidence was presented to support the use of mercurials for these purposes.

Fabrics that are used out of doors are subject to the conditions of the environment and may be attacked by fungus strains that cause mildew. In order to remain free of fungus growth the fabrics are chemically treated.

Many fabrics provide a source of food for fungi. While synthetics, such as nylon and dacron, do not themselves serve as nutrients, they may be contaminated by extraneous materials which act as nutrients and furnish an environment for the growth of the fungi. Among the common strains of mildew fungi are <u>Aspergillus niger</u>, <u>Chaetomium globosum</u> and <u>Myrothecium verrucaria</u> and <u>Alternaria brassicicola</u>.

Mildew is most prevelant in hot, moist climates, where awnings, canopies, and boat covers are most widely used. When attacked by fungus, the fabric first discolors, discoloration intensifying as the fungus grows. Eventually the fabric is tenderized and degraded, becomes unsightly and is discarded.

Phenylmercuric triethanol ammonium lactate and phenylmercuric ammonium propionate have been used as fungicides for outdoor fabrics for many years and have proved to be very effective for all strains of fungus that usually attack such fabrics.

An outstanding expert (connected with the U.S. Army) on the treatment of materials to prevent deterioration, including uses of fungicidal compounds, testified on behalf of respondent. Mercurials have not been used as textile fungicides by the army for over 20 years. The fungicidal requirements of the army for textile materials have been and are being satisfactorily met by non-mercurial compounds.

The following non-mercurial compounds are used or can be used as fungicides in textile fabrics: (a) 2,2' methylene bis-(4 chlorophenol); (b) copper-8-quinolinolate; (c) a mixture of zinc salts of dimethyl dithiocarbamic acid and 2 mercaptobenzothiazole; and (d) copper nephthenate.

Copper-8-quinolates as fungicides on textiles are favored by the army. They are the most effective of the non-mercurials and are used to treat a broad range of cotton textiles, vinyls, vinyl coated fabrics, and cellulosic cordage. They discolor the fabric on application and their use is limited to various shades of orange, yellow and green. They may be contraindicated where the materials are red, blue or white. Another copper compound, copper naphthenate, is also effective as a fungicide on textiles but has an unpleasant odor and, like the quinolates, discolors the fabric on application. Thus, copper compound applications are limited to textiles of fairly dark color.

The respondent also represented that salicylanilide is an available substitute to control fungi which attack cotton fabrics. No evidence was submitted as to the efficacy of this chemical as compared to other treatments, or as to any advantages or disadvantages associated with its use.

Certain colorless treatments were mentioned as possible substitutes. There are 2,2' methylene bis-(4-chlorophenol), (bisphenol) and zinc Dimethyldithiocarbamate and zinc 2-Mercaptobenzothiazole (zinc salts). However, bisphenol tends to turn brown under weathering, may weaken the fabric, is susceptible to water leaching and generally is not as effective as copper treatments. Zinc salts are not as persistent in outdoor use as might be desired. They are especially ineffective for vinyl films, although protection can be increased by adding resistant plasticizers. Another compound, bis-tribyltenoxide, has been tried, but it degrades rapidly when exposed to sunlight.

Resistant plasticizers have also been suggested as a non-chemical alternative. These plasticizers, however, are not fungus inhibiters. Fungi will not attack the resistant plasticizers, as they supply no nutrient, but if fungi reaches the susceptible fabric, a biocide becomes necessary.

A large manufacture of textiles for outdoor use, has over the years, experimented with many of the chemical non-mercurials and found a commercially available fungicide 2-(4-Thiazolyl) Benzimidazole Metasol TK-100) which it used for about a year. This was effective against two common strains of fungus, but at a concentration costing considerably more than that of the phenylmercurials. Further experience with this product has shown that it is not effective against Alternaria brassicicola, one of the common strains of fungi that attack fabrics. The manufacturer has returned to the use of mercurials.

There are no adequate and effective substitutes for phenylmercurials as fungicides in the treatment of all types and colors of fabrics to be used out of doors. The benefits from the use of phenylmercurials in treating such fabrics outweigh whatever risks may be involved in such use.

Wood

Freshly sawn lumber is highly susceptible to various types of fungus infection if left untreated usually for more than 24 hours. The fungi may develop in a forest, in a mill, in transit, or in service. These fungi may cause sapstain, mold, or decay. The susceptibility of lumber from different species of trees to the same fungal organisms varies.

Decay caused by organisms weakens the lumber. Products containing sodium pentachlorophenate have been found to provide control of decay.

Mold and sapstain organisms do not weaken the lumber but degrade its value because of appearance caused by discoloration. Where lumber of high grade is desired for its appearance, infected lumber is not useful. Infected lumber which is degraded is generally used for structural purposes which constitute the bulk of lumber shipments. Monetary losses attributable to downgrading because of appearance cannot be estimated with any degree of precision since the lumber market is characterized by fluctuating supply and demand. The losses, however, at times, may be substantial.

The principal degraders of unseasoned wood are blue stain (Ceratocystic or Ceratostomella) and common stains of green mold (Penicillium sp. and Trichoderma sp.). Brown mold (Cephaloascus fragrans), another degrader, is usually innocuous because of its woodlike color and sparse growth habit but may at times degrade the lumber in storage. Fir and hemlock are particularly susceptible to brown mold but all species are vulnerable. The discoloration caused by brown mold does not penetrate below the surface of lumber and is easily removed by planing.

Unseasoned wood can be protected against sapstain and mold by using water-soluble chemical solutions applied by spraying or dipping. Wood can also be protected against fungi by drying, either by kiln or air, to a moisture content of less than 20%. Drying is much more expensive than control by a fungicide.

The registered products we are concerned with for controlling sapstain and mold on unseasoned wood contain chlorinated phenols, borax and phenylmercuric lactate (PML). These products are effective for the purposes. The registrants who are parties to these proceedings are

Koppers, Chapman and Forshaw. Koppers was the only one of these registrants who introduced evidence at the hearing.

Koppers' mercury-containing products are called Liquid Noxtane 120 (LN-120 for dip and spray application) and Liquid Noxtane SS (LN-SS for spray application). These contain 0.384 and 0.43 percent of PML, respectively. When LN-120 is diluted with water for use in treating wood as recommended on the label (1 gallon to 120 gallons of water) and applied in a dip system, the resulting deposit of mercury is 0.0007 lbs. of mercury for 1000 sq. ft. of lumber surface.

Chapman and Forshaw produce products respectively called Permatox and No-MO-Stane for sapstain and mold control. In addition to chlorinated phenols and borax (sodium metaborate) these contain 0.40% PML. The directions for use on these products call for mixing one gallon of the product with 100 or 110 gallons of water. Under severe conditions or for spray application stronger concentrations are recommended.

Koppers also produces a non-mercurial product called Liquid Noxtane SS-1 (LN SS-1) for treating wood to control sapstain and mold. This is the only product that respondent has put forward as a substitute for this use. The active ingredients are chlorophenols (penta, 13.96%, tetra, 8.14%; others 5.52%) with borax (sodium metaborate) as a buffer. LN SS-1 is effective against all organisms that products containing PML control, except for brown mold.

Partial control of brown mold, Cepheloascus fragrans, is obtained with LN SS-1 at a significantly increased cost by the use of concentrations that are stronger than is required when a product containing PML is used. Brown mold is generally no great problem but it appears cyclically in epidemic proportions and in such cases control is necessary. When it does appear, it is conducive to the development of the blue stain fungi. The blue stain infection follows the tract pattern of brown mold colonies and is etched in the wood when the infected area is surfaced.

The use of mercurials to control brown mold on wood does not cause unreasonable adverse effects on the environment. Taking into account the factors that must be considered, including the economic benefits, I must conclude that the benefits outweigh the risks.

Seed Treatment

There are several registrations (Gustafson, Troy, Vikon, and Parsons) for products containing phenylmercuric ammonium acetate (PMAA) for seed treatment to control diseases on wheat, oats, barley, sorghum, flax, and cotton. There is one registration for a product containing phenylmercuric acetate for these purposes.

The fungicidal seed treatments are used to control such diseases as seedling blights, rots and smuts on grain and other crops and thereby increase stands and yields. The diseases for which control is sought on food crops include the following: loose smut (Ustilago tritici) of wheat; brown loose smut (U. nuda) of barley; loose (U. avenae) and covered (U. Kolleri) smut of oats; covered kernel smut (Sphacelotheca sorghi) of sorghum; bunt (Tilletia foetida) of wheat; stripe (Helminthosporium gramineum) of barley; and covered smut (Ustilago hordei) of barley; seed rots and seedling blights of wheat and sorghum (Fusarium, Pythium, and Rhizoctonia).

Commencing about 1936 ethylmercurial fungicides were recommended by experts in the field for the treatment of seedling diseases in wheat, sorghum, oats and barley. A methylmercurial fungicide was recommended in 1957. These compdunds played an important role in controlling many seed borne diseases of these crops until the use of ethyl and methyl mercurial fungicides was terminated in 1970.

Some research had been conducted prior to 1970 on the viability of non-mercurial fungicides as potential replacements for the mercury compounds but this work greatly expanded commencing in 1970. Extensive experiments were conducted from 1966 through 1973 to compare the efficacy of mercurials with non-mercurials in seed treatment. There are now organic non-mercurial chemicals which are equal to or superior to mercurial fungicides. Research has also produced systemic fungicides which control diseases that were not controlled by mercurials. The significant results are as follows:

(a) Control of seed decay and seedling blights of wheat

The non-mercurial treatments Arasan 75, Captan 75, Dithane M-45, D G Yellow, Granol N M, Vitavax 75 and Vitavax 34 were equally as effective as mercury compounds for control of rot and blight.

(b) Increase in yields of wheat

The non-mercurial seed treatments Arasan 75, Captan 75 were at least equal to the mercurial seed treatments for increases in yields of wheat.

(c) Control of bunt of wheat

Combination of non-mercurials Captan, Maneb, and Thiram with hexachlorobenzene; as well as combination of Captan, Maneb, and terrazole with pentachlorobenzene were comparable to methylmercurial fungicides for control of bunt and stinking smut of wheat.

(d) Control of loose smut on wheat

A methylmercury gave no control of loose smut. Moderate control was obtained with Plantvax and complete control was obtained with Vitavax 75.

(e) Control of seed decay and seedling blights of sorghum

Seed decay and seedling blights were markedly reduced when the soil had been treated with non-mercurial fungicides. (Arasan 75, Captan 75, Dithane M-45 80W, Vitavax 75W, Vitavax 34F), as well as with methylmercury fungicides. The phenylmercurial fungicide did not increase the stand of the seedling over that of the untreated check.

(f) Control of convered kernel smut of sorghum

Excellent control was obtained with non-mercurial fungicides. (The same non-mercurials mentioned under (e)).

(g) Loose smut and covered smut of oats

Excellent control was obtained with the systemic fungicide Vitavax.

(h) Brown loose smut of barley

Complete control was achieved with Vitavax 75.

(i) Stripe of barley

Vitavax 75 affords complete control.

Loose smut (Ustilago tritica) of wheat and brown loose smut (Ustilagouda) for which mercurial fungicides provided no protection are successfully controlled by the systemic fungicide Vitavax.

Systemic fungicides, when combined with other chemicals such as thiram and Captan, provide a broader range of protection for seedlings than do mercury compounds alone. While treatment may require the use of greater amounts of the non-mercurials many non-mercurials provide superior control to PMAA and thus, result in an increased stand. When equated to the actual stand the farmer gets in the field, this more than makes up the difference in the cost of the fungicide.

Effective seed treatments are essential to efficient cotton production; consequently, treatment of cottonseed, Gossypium hirsuthum L., with a protectant fungicide is a standard practice throughout the cotton belt. Cotton may also be treated with a systemic fungicide, systemic insecticide or both.

The Cotton Disease Council, whose membership consists of plant pathologists and industry representatives interested in controlling the seedling diseases of cotton, was established in 1935. The Council generally meets annually to discuss the plan control methods for these diseases. The testing program of the Council is coordinated through the Chairman of the Seed Treatment Committee. The Chairman treats seed lots and mails samples to cooperators in each cotton producing state. The cooperators make suggestions based on their data and also on data from other states. The suggestions are revised annually based on three years performance data and registrations of the Environmental Protection Agency and by the respective states for use on cotton.

Prior to 1972, alkylmercury compounds, such as Ceresan M, were the principal materials used for cotton seed treatments. In 1971, 90% of all treated cottonseed contained an alkylmercury fungicide, and 95% or more of planting seed was treated with some seed protectant fungicide. Today, only a small percentage of cottonseed is treated with mercury fungicides (PMA). The use of alkylmercury compounds as a cottonseed protectant was discontinued in 1972 as the result of government action (cancellation of registrations in 1971). Although some work had been done on the development and testing of non-mercurial substitutes prior to 1971, the agricultural chemical industry, in cooperation with state and federal plant pathologists, accelerated their efforts in 1971. Since cancellation of the alkylmercury compounds, most treatments have been combinations of registered fungicides and experimental materials used alone or in combination with registered fungicides.

Based on a minimum of three years study, the statistics of the Cotton Disease Council show that there are a number of registered alternative chemical treatments available which match or even out perform the protection afforded by PMA, which have been on the "suggested list" for the past several years. Non-mercurials are at least as effective as mercury compounds in increasing the stands and lint yields of cotton, and can be applied with existing seed treatment equipment. The addition of a systemic fungicide improves seedling survival. A nine year study (1965-1973) conducted by the Council computed an overall average of seedling survival and thus provided an index with which to evaluate the effectiveness of seed protectants and systemic fungicides. All of the chemicals were not tested in each of the years but those mentioned as substitutes were studied for at least three years. The overall average percent seedling survival for the test period was as follows: untreated check, 37%; PMA, 38%; three mercurials, 47, 21 and 45%, respectively; Vitavax, Thiram, and Terracoat each 48%; Busan 72, 47%; Captan, 46%. Combinations of chemicals tested were even more efficacious: a combination of Captan and Vitavax and a combination of Busan 72 and Demosan each averaged 49%; a combination of thiram and Demosan average 50%.

For nearly all test parameters, the non-mercurials have been at least as effective, and often more so in the protection of cotton seeds which compared to phenylmercurials (and even when compared to alkylmercurials). The evidence further shows that the change from mercurials to other seed treatment materials should not substantially alter the cost of fungicide treated cottonseed to the grower.

There was some evidence concerning levels of mercury content of soil, water runoffs, and products of animal origin in North Dakota in areas where seed had been treated with mercury compounds. The type of crop for which the seeds were treated was not shown or the amount of mercury used in the seed treatment or the duration of the treatment.

In any event, since there are safe, effective and available alternatives for mercurials in seed treatment, this evidence does not support continued use of mercurials for this purpose.

Some of the registrations for mercurials in seed treatment include use of flaxseed. None of the registrants presented evidence relating to this use.

There are effective and adequate substitutes for all seed treatments for which mercurial compounds are registered. Since there are such substitutes, the risks in the continued use of mercurials for these purposes outweigh the benefits.

Dutch Elm Disease

The registrant Charles R. Freers, owner of The Freers Company, objected to the cancellation of the registration of his product called Freers Elm Arrester. This product is registered for use in the states of Missouri, Iowa, Illinois and Indiana. Its label represents it for use "for the arrest and prevention of Dutch elm disease." The product contains as its active ingredients 0.12 percent mercuric chloride and 95.65 percent methyl alcohol. It also contains 4.23 percent inert ingredients which are described as nutrients that are part of a secret formula. The product was developed by Mr. Freers. He is not a plant pathologist and has had no formal training in this field. He admits that he is not qualified to diagnose plant disease.

Freers Elm Arrester was registered on July 19, 1968, for use by trained professional personnel in the four states above mentioned, to be monitored for one year to obtain more data. It has not since been registered in any other states.

Dutch elm disease is a highly fatal fungal disease that attacks American elm trees (Ulmus americana). American elm trees are widely distributed in various parts of the country and are ornamental and shade trees. Dutch elm disease is caused by a fungus _Ceratocystis ulmi_ that invades the water conducting vessels of the tree. The clogs the vessels causing "vascular wilt", as the result of which the tree wilts and dies.

The fungus is spread initially over distances by elm bark beetles which emerge from diseased wood. When the beetles feed on healthy trees, spores of the fungus are introduced into the vascular system of the healthy trees infecting them. Once a tree is infected with Dutch elm disease by beetles the fungus can spread to adjacent elms through connecting roots. Freers Elm Arrester is applied to the infected tree by systemic injection. The registrant introduced into evidence results of two tests by independent testing laboratories. The first compared mercury content of a sample consisting of six twigs of a tree treated with this product in 1962 with the mercury content of a sample of six twigs of a tree treated in 1972. One of the samples was moldy. The second test reported mercury content of elm leaves in a control tree and a treated tree. This test was an attempt to show that no mercury used in the treatment was released into the environment. In neither test was there information as to the size of the trees, the amount of product used, or other background information. The results of these limited test do not have any scientific or statistical significance.

Only one study involving the use of Freers Elm Arrester is reported. The report is in the publication Plant Disease Reporter in August 1966. It reports a study using Freers Dutch Elm Arrester and the conclusion of two plant pathologists was as follows: "While foliar symptoms in treated trees were less severe than the checks, there is no indication that the reduction was great enough to make Freers Dutch Elm Arrester an effective control for Dutch elm disease." Mr. Freers disagreed with this conclusion because he stated that test was supposed to run for two years and the test was terminated and the trees cut down at least six months before the two-year period.

Mercury at a concentration sufficient to kill fungus cells in an elm tree will also kill the cells of the elm tree itself. Mr. Freers testified that when using only mercury and alcohol the tree "would get a burn" and to offset this he added the two nutrients. What effect the nutrients have in the treatment is not explained.

Dr. Eugene G. Smalley, Professor of Plant Pathology and Forestry at the University of Wisconsin has been engaged in the study of Dutch elm disease and the effort to preserve the American elm for almost a score of years. He testified that in the early stages of these studies, around 1957-1958, a few mercurials were tested and were ruled out because of the high phytotoxicity. He further testified that he was not aware of any published information in any technical research journal indicating efficacy of mercuric chloride containing materials in the prevention or therapy of Dutch elm disease.

As the result of many studies by research investigators in the United States, Canada and the United Kingdom, a chemical called benomyl has become available commercially as an aid in the control of Dutch elm disease. Benomyl, under the registered name Benlate, is produced by E. I. duPont De Nemours & Co. and is registered with EPA as an aid in the control of Dutch elm disease by trunk injection and foliar spray.

There are reports of numerous studies in scientific journals relating to the effectiveness of benomyl as an aid in controlling Dutch elm disease. Well-documented published research investigations indicate that, when used properly, applications of benomyl provide practical protection and therapy of Dutch elm disease.

Benomyl may be applied in a mist-blown foliar spray in the spring or as a trunk injection. This chemical is most effective in preventing the spread of the disease, although it has evidenced some effectiveness when applied immediately after symptoms appear. Benomyl is a fungistat and is almost totally non-toxic to the tree. Its unique mechanism of action does not result in the immediate killing of the fungus, but rather serves to stop fungus multiplication. While there is no reversal of the blight, benomyl, by halting the spread of the disease to healthy portions of the tree, prolongs the tree's life.

Dr. Smalley testified that a Dutch elm disease program to be effective should include (a) sanitation to achieve bark beetle population control; (b) root graft transmission control; (c) insecticidal sprays to prevent beetle feeding; (d) use of resistant elms in replant programs; and (e) use of systemic fungicide for prevention and therapy. He rated use of systemic fungicides of least importance.12/

The use of benomyl as an aid in the control of Dutch elm disease is clearly an adequate and superior substitute for the mercury-containing pesticide in question.

Because of the limited use of Freers Elm Arrester, its use may have minimal adverse effect on the environment. However, there is an adequate and superior substitute for this product and there are no benefits from its continued use.

* * *

It is on the basis of a risk-benefit assessment that I am permitting the use of mercurials in pesticides where most of the mercury is used (paint and snow mold) and prohibiting certain uses where relatively small quantities are used.

The respondent has presented considerable evidence to support its contention that the use of mercury in pesticides will generally cause unreasonable adverse effects on the environment. The registrants have presented considerable evidence to the contrary. It is not a black or white situation -- there are gray areas. It cannot be said with certainty -- now and for all time -- that the use of mercury in pesticides poses no risks at all. In deciding

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12/ Dr. Smalley predicted the ultimate extinction of the American elm. However, there are species of elms that are resistant to Dutch elm disease and such elms are being used in replant programs in this country.

whether particular uses should be permitted or prohibited, I have weighed the risks against the benefits. In those cases where there are no adequate or effective substitutes, I have decided that the benefits from the use of mercurials outweigh the risks. On the contrary, where there are adequate and effective substitutes, whatever risks there may be outweigh the benefits. This Agency pointed out in its decision in the Stevens Industries case (Consolidated DDT hearings) that the application of the risk-benefit test to the facts in a particular case is by no means simple. It was there stated that "environmental problems should be parsed with a scalpel, not a hacksaw."

Further support to this approach to the problem is found in EDF v. EPA, 465 F.2d 528 (C.A.D.C. 1972) where the Court quoted with approval the following portion of a statement by EPA:

> "In applying these statutory tests, the final decision with respect to whether a particular product should be registered initially or should continue to be registered depends on the intricate balance struck between the benefits and dangers to the public health and welfare resulting from its use. The concept of the safety of the product is an evolving one which is constantly being further refined in light of our increasing knowledge." (Emphasis added)

The Court pointed out the wide flexibility of choice where a hard look is taken at hard problems. The Court suggested that the Administrator should consider registrations selectively with restrictions on kind or extent of use.

I have not overlooked the provision in section 3(c)(5)(D) of FIFRA, 7 U.S.C. 136a3(c)(5)(D), which provides in pertinent part:

> The Administrator shall not make any lack of essentially a criterion for denying registration of any pesticide. Where two pesticides meet the requirements of this paragraph, one should not be registered in preference to the other.

This provision does not eliminate the need for a risk-benefit assessment with respect to a pesticide and its uses in a cancellation proceeding.

Findings of Fact

1. Mercury is a naturally occurring element that is ubiquitous in nature. Its total amount in, on, and around the earth is constant. It volatilizes at ordinary temperatures. It circulates in the environment and is redistributed in nature.

2. Mercury is released into the environment from natural and man-made sources. The releases from natural sources include degassing and weathering. The releases from man-made sources include burning of fossil fuels, smelting, industrial uses, and pesticidal uses. The releases from natural and man-made sources, other than pesticides, are in the range of many millions of pounds per year. The total amount of mercury used in pesticides in the United States in 1973 was not in excess of 365,000 pounds. The total amount of mercury released into the environment by industrial and non-intentional discharges (e.g., burning of fossil fuel and smelting) is many times greater than that released from pesticidal use.

3. Mercury from man-made sources is released into the environment by direct discharge into the atmosphere or waterways, or by indirect discharge through volatilization, runoff, or leaching. There is no direct discharge of mercury into the atmosphere or waterways from pesticidal use.

4. The hazards to the environment with respect to mercury are related primarily to the presence of methylmercury in aquatic environments. Methylmercury is a highly toxic compound of mercury. Methylmercury is not used in pesticides.

5. Forms of mercury relatively less harmful than methylmercury can be converted to methylmercury by the methylation process.

6. Methylation can occur in the sediments of natural aquatic environments under limited and favorable conditions. Such conditions include: sufficient concentration of mercury, favorable type of sediment, organisms, temperature and acidity; whether the system is aerobic or anoerobic. When methylation does occur in a natural aquatic environment, only a small proportion of the mercury, not more than 5%, and more likely in the range of 0.5 to 1.5%, is transformed to methylmercury. A hundred fold increase in the use of mercury would be required to double the methylation rate.

7. There are organisms in the sediments of natural aquatic environments that readily demethylate methylmercury. Such organisms are widespread in the environment. Where methylation has been observed, it is followed by the rapid disappearance of the methylmercury produced.

8. Methylation and demethylation in aquatic environments are natural processes in which the demethylation process neutralizes the activity of the methylation and maintains the methylmercury at minimal levels.

9. Methylation can occur in some soils but the methylation from this source as the result of the use of pesticides is insignificant.

10. Mercury is bioaccumulated throughout the aquatic food chain and may result in mercury levels above 0.5 ppm in species at or near the top of the food chain. Most of the mercury in fish is in the form of methylmercury. The Food and Drug Administration has set an action level of 0.5 ppm of mercury in the edible portion of fish.

11. The most serious threat to human health from mercury lies in the ingestion over a long period of time of fish containing methylmercury. A great number of fish in the United States contain levels in excess of 0.5 ppm. It is not shown that pesticidal uses have contributed significantly to such levels.

12. Mercury levels in fish consumed by man are not significantly different today from levels in the past 30 or 40 years, except in locations immediately below industrial plants discharging mercury directly in the aquatic environment.

13. Methylmercury poisoning can cause very severe neurological impairments in man. Methylmercury can cross the placental barrier and result in the birth of children with methylmercury poisoning even though the mother appear unaffected.

14. In the Minamata and Niigata incidents, which caused widespread neurological impairments, effluents from industrial discharges containing high levels of methylmercury caused contamination of fish and shellfish. Consumption of such fish over a long period of time resulted in severe neurological impairments.

15. Other incidents of methylmercury poisoning have been the result of the consumption by humans and animals of seed which had been treated with methylmercury and which were not intended for consumption. There are no reported cases of methylmercury poisoning in which methylmercury was present as the result of biological process.

16. The very serious adverse effects shown in the studies of man and other forms of life from the use of methylmercury and other mercury compounds do not necessarily establish that such or similar adverse effects will result from such mercury as may be introduced into the environment by use of pesticides.

17. Phenylmercurials are used as biocides in paint. Mercury is slowly released from painted surfaces through volatilization and is widely dispersed in the general environment. The total amount of mercury that is volatilized does not increase the background levels of mercury in the atmosphere significantly. The volatilized mercury is returned to earth by natural process and is lightly bound to the soil. It does not move freely from soil to water. Such mercury as reaches a natural aquatic environment is tightly bound to the silt.

18. Such small amounts of mercury as may be leached from paints have no significant effect on the environment.

19. Mercury compounds are not needed either as an in-can preservative or mildewcide in oil based paints.

20. Water based paints require an effective and broad spectrum in-can preservative to control the growth of bacterial organisms. Phenylmercuric compounds are effective for this purpose. The substitutes put forth by respondent may be adequate and effective in some paint formulations but they do not have the broad spectrum and long lasting bactericide effect in all of the water based paints as do the phenylmercurials and are not effective and adequate substitutes.

21. A mildewcide is generally not necessary in paints used in interiors. A mildewcide is necessary for water based paints for exterior application. The substitutes put forth by respondent may be adequate and effective in some paint formulations but they do not have the long lasting effectiveness against mildew in all of the great variety of water based paint formulations used in exterior and are not effective and adequate substitutes for phenylmercurials.

22. Mercury is used on golf courses to control fungi that can seriously damage the greens. The volatilization of mercury from use on golf course greens does not increase the amount of mercury in the atmosphere to any measurable degree. Most of the mercury applied to golf course greens is tightly bound to the thatch and upper 12 inches of the soil. There is no significant transport of runoff of mercury used on golf course greens to aquatic environments.

23. The relationship between the use of mercury on golf course greens and the concentrations of mercury found in fish on golf course water bodies is not definitely established. Other conditions, natural and man-made, may account for such varying concentrations of mercury as may be found in such fish.

24. Adequate and effective substitutes for mercurials are available to satisfactorily control fungi on all areas of golf courses other than fungi of the snow mold complex (Typhula blight and Fusarium nivale) on golf course greens. The use of mercurials on golf courses should be confined to the control of snow mold on greens.

25. There are registered non-mercurial products which give adequate and effective control for all uses for which mercurials are used in seed treatment. The registrations of products containing mercurials for seed treatment should be canceled.

26. The respondent has not put forward any registered non-mercurial products which give adequate and effective control for mildew on textiles and fabrics for use out of doors. The registration of products containing mercurials for this purpose should not be canceled.

27. The respondent has not put forward any registered non-mercurial products which give adequate and effective control for brown mold (Cepheloascus fragrans) on freshly sawn lumber. The registration of products containing mercurials for this purpose should not be canceled.

28. There is a registered product for the treatment of Dutch elm disease that is adequate, effective and superior to the mercurial product Freers Elm Arrester. The environmental risk from the use of the mercurial product may be minimal but there is no benefit in its continued use. The registration of Freers Elm Arrester should be canceled.

Conclusions

A. The use of mercury-containing pesticides for the following purposes, when used in accordance with widespread and commonly accepted practice, will not generally cause unreasonable adverse effects on the environment within the meaning of section 2(bb) of FIFRA and the registrations for such uses should not be canceled:

(1) As an in-can preservative in water based paints and coatings.

(2) As a fungicide in water based paints and coatings used for exterior application.

(3) As a fungicide on golf course greens for the control of fungi of the snow mold complex.

(4) As a fungicide in the treatment of textiles and fabrics for out-of-door use.

(5) As a fungicide to control brown mold (Cephaloascus fragrans) on freshly sawn lumber.

B. The use of mercury-containing pesticides for all other purposes when used in accordance with widespread and commonly accepted practices will generally cause unreasonable adverse effects on the environment within the meaning of section 2(bb) of FIFRA and the registrations for such uses, including the following, should be canceled:

(1) All uses in paints and coatings except those set forth in A(1) and (2) above.

(2) All uses as a fungicide on golf courses except as set forth in A(3) above.

(3) All uses for seed treatment.

(4) As a treatment for the control of Dutch elm disease.

(5) All uses for any material that could be used in wearing apparel and other uses for textiles and fabrics except those set forth in A(4).

Bernard D. Levinson

Bernard D. Levinson
Administrative Law Judge

December 12, 1975

ATTACHMENT A

Participants

Docket Number	Registrants
246	Chapman Chemical Company, Limited
247	Forshaw Chemicals Incorporated, Limited
250	Gustafson, Inc., Active
254	Vikon Chemical Company, Inc., Active
261	Mallinckrodt, Inc., Active
264	Parsons Chemical Works, Inc., Limited
274	Troy Chemical Corporation, Active
275	Tenneco Chemicals, Inc., Active
276	The O. M. Scott & Sons Company, Active
278	Wood Treating Chemicals, Department of Koppers Company, Inc., Limited
279	W. A. Cleary Corporation, Active
280	Steri-tized Inc., Inactive 10-21-74
283	Charles R. Freers, d/b/a The Freers Company, Active
284	Cosan Chemical Corporation, Active
287	McCloskey Varnish Company, Inactive 10-21-74
	Amicus Curiae
249	Dr. Leonard J. Goldwater
	Intervenors
	National Paint & Coatings Association, INc.
	Johns-Manville Sales Corporation