AIRGRAM

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ANALYSIS BRANCH

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FROM : Amembassy STOCKHOLM DATE November 25, 1971

SUBJECT : Destruction of Polychlorinated Biphenyls (PCBs)

REF :

Man Sci Aff Sec

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Polychlorinated biphenyls, more commonly known as PCBs, refer to a class of organic compounds closely related to DDT and other persistent pesticides. Although these compounds were discovered almost a century ago, their industrial utility was not appreciated until about 1930. Since then, they have found wide acceptance as fire resistant, electrical and hydraulic fluids; as plasticizers for paints, sealants and adhesives; and for other commercial applications. The ubiquitous use of PCB was casually accepted until the past few years. In the mid-60's, when monitoring of insecticide residues became wide-spread, it was discovered that some of the substances previously believed to be insecticides or their degradation products were, in fact, PCBs. Inasmuch as the PCBs, like DDT, are extremely persistent and very fat soluble, their potential toxicity was immediately apparent. This was quickly confirmed in the laboratory and soon after in the field, where the deaths of certain birds were attributed to these compounds. For example, in the autumn of 1969 thousands of sea birds were washed up on the shores of the Irish Sea. These birds showed internal lesions similar to those of birds poisoned with PCB in the laboratory and their livers contained an average of 11 ppm of PCB, contrasted with 0.4 ppm in healthy birds.

In a highly unusual and laudatory corporate initiative, Monsanto Chemicals, the sole American and British manufacturers of PCB, this year voluntarily restricted its sales to so-called "controllable" applications. The "controllable" consumer largely the electrical industry which uses PCB as the dielectric fluid in capacitors and the coolant in transformers. In these instances, PCB is in enclosed, sealed systems and the dangers of environmental contamination are minimal. "Non-controllable" applications which involve greater risk of contamination are barred. Sweden has recently instituted a similar ban.

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Waste oil collected from various sources almost always contains some PCB. The amount, although small (approximately 50 ppm), poses problems in the use or disposition of the oil. Recently, AB Svenska Saltpeterverken in Kvarntorp (near Örebro) reported that the PCB in waste oil is completely degraded by its high temperature process of ammonia production. In this process, oil is burned at 28 atmospheres and 1400° C to give carbon monoxide and hydrogen. The amount of oxygen is limited to prevent complete oxidation to carbon dioxide and water. Water vapor and a catalyst converts the carbon monoxide to carbon dioxide with the generation of additional hydrogen. The hydrogen then reacts with atmospheric nitrogen to give ammonia. The reactions can be summarized as follows:

$$\text{oil (HC)} + O_2 \longrightarrow CO + H_2$$

$$CO + H_2O \xrightarrow{\text{Catalyst}} CO_2 + H_2$$

$$3H_2 + N_2 \xrightarrow{\text{Catalyst}} 2NH_3$$

In this process, any PCB is completely degraded. To test the destructive process, large amounts of PCB were added to the feed oil, with no detectable traces found after the reaction. The analytical method can detect PCB at levels of 10^{-3} to 10^{-4} milligrams per cubic meter or to roughly 1 part per trillion. Another indication that the PCB is destroyed is the low PCB content of Lake Hjälmaren which receives the run-off from the Kvarntorp plant. The PCB content in Lake Hjälmaren is only 10% of that in the Baltic Sea.

In addition to removing the toxic PCB, the [illegible]ed in attractive for economic reasons, since waste oil can be used and the importation of crude oil reduced. The company plans to utilize this system also at its ammonia plant at Köping. It is estimated that these plants will consume about 20% of Sweden's annual accumulation of 250,000-300,000 tons of waste oil.

Dr. Sören Jensen of the National Environmental Protection Board, who conducted the analytical studies at the Kvarntorp plant, plans to report his experiments soon in an international scientific journal.

HOLLAND