Monsanto
COMPANY

800 N. Lindbergh Boulevard
St. Louis, Missouri 63166
(314) OXford 4-1000

TOXICITY AND SAFE HANDLING OF TRICRESYL PHOSPHATE

A careful review of the literature on many occasions indicates that fears regarding the industrial use of low ortho-isomer Tricresyl Phosphate are exaggerated.

TCP was first indicted as a potentially dangerous product following its discovery as an adulterant in Jamaica ginger extract in 1930. This concoction was imbibed freely by many people during the prohibition era as a substitute for other alcoholic beverages. Several thousand cases of paralysis developed (and ten deaths resulted) according to Public Health Reports of the U.S. Public Health Service. Initially, TCP as such, was blamed as the offending agent. Subsequent research results, also published, have shown that it was the ortho isomer that undoubtedly caused the gravest effects.

In 1938, Monsanto and other suppliers agreed to provide a plasticizer-grade TCP which would be made from a cresylic acid containing less than 3 per cent ortho isomer. Starting with this raw material, it has been stated that statistically, there cannot be more than 0.0027 per cent triorthocresyl phosphate in the meta-para mixture. There is currently no generally accepted convenient method for determining ortho isomer content at this low level. As supplies of cresylic acid have changed over the years, Monsanto's specifications have changed so that during the last 3 years, cresylic acid with less than 1.5% ortho isomer was used. The tri-ortho cresyl phosphate in the ester product was reduced correspondingly.

Currently, supplies of 1.5% (or less) ortho cresol raw material have dwindled and are extremely erratic. For these reasons, it has become necessary to return to specifications on our raw material similar to those in effect during the 1938-1963 years.

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The literature has no reported cases of industrial poisoning in the United States from using either the old high ortho content material or the newer grades as plasticizers or synthetic hydraulic fluids. The literature does include a report on three cases of TCP poisoning which occurred in a plant in England during World War II. The men were making or handling a 60 percent triorthocresyl phosphate in a small, poorly ventilated work area under blackout conditions and at elevated temperatures. The only other reference which we have to poisoning for any other reason than ingestion, describes toxic symptoms developed by people in Germany after wearing shoes with a synthetic inner liner plasticized with high ortho content TCP. We have heard that there were cases of poisoning in Sweden and Italy in 1965 due to exposure to plastic materials containing high-ortho isomer TCP as a plasticizer. We have not as yet seen publications concerning these cases.

Historically, then, tricresyl phosphate has caused poisoning in humans principally after oral ingestion. For nearly twenty years it was generally agreed by toxicologists that the most toxic component of the mixed esters in commercial tricresyl phosphate was the triorthocresyl phosphate. This is not to imply that a mixture of the tri-meta and tri-para isomers is innocuous.

Since 1958 there have been several publications appear in the German and English literature indicating that the mono-ortho-cresyl and di-ortho-cresyl esters are more toxic than the tri-ortho-cresyl isomer. At the moment, these reports of laboratory studies have not been conclusive, but for the most part have instead raised questions which need further investigation. From a practical standpoint, it makes little difference which isomer is the most toxic if the end product as we sell it appears to present no serious toxicity hazards during its manufacture and use although no TCP can be considered "non-toxic" in the strict sense of the word.

The animal toxicity studies on our tricresyl phosphate indicate an oral lethal dose in rabbits in the order of 2000 to 2500 mg/kg of body weight. We have used rabbits in checking various batches of our material rather than rats since the latter show varying degrees of resistance to tricresyl phosphate. We find the lethal oral dose in rats varying from 10,000 to 30,000 mg/kg with severe diarrhea a major contributing effect on the survival or fatality of the animals tested.

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Tricresyl phosphate made from cresylic acid raw materials containing more than 3% of the ortho-isomer shows a lethal dose in rabbits ranging from 300 to 1500 mg/kg. At the same time, some references in the literature note that a high ortho content of tricresyl phosphate is ten to thirty times more toxic than our plasticizer grade material.

In skin absorption studies with our tricresyl phosphate, the minimum lethal dose for rabbits is between 1500 to 2000 mg/kg. Some of our data showing these results has been obtained from two animal toxicological laboratories.

Although TCP is not a skin irritant, prolonged and repeated contact of tricresyl phosphate with the skin may lead to skin irritation from the solvent action of the tricresyl phosphate. This has not occurred to our knowledge, probably because the oily nature of tricresyl phosphate tends to discourage prolonged skin contact.

R. Emmet Kelly, M.D.
Medical Director

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