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PRELIMINARY NOTE

'Polymer Fume Fever' without Polymer

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SUMMARY

'Polymer fume fever'(PFF), a temporary, intense, but only very rarely serious influenza-like syndrome previously related only to the pyrolysis of polytetrafluoroethylene (PTFE), may also be induced by fluorocarbon systems with molecular weights in the telomeric and possibly monomeric range.

During a pilot-plant scale (50 kg/hr) process study of the oxidation of R-123 (1,1,1 trifluoroethyl dichloride, CF_3CHCl_2, CAS # 306-82-2), with molecular oxygen in the gas phase under heavy UV illumination following Dittman's [1] teachings to produce trifluoracetyl chloride (CF_3COCl, CAS # 354-32-5) and HCl at conversions above 90% (operating at 100 to 125° Celsius around 8 atmospheres), personnel suffered all of the symptoms of polymer fume fever (PFF) in the apparent absence of any high molecular weight polymer, or its particulate dust.

About one half of the pilot plant crew exhibited influenza-like symptoms at one time or another. Some were apparently responding to low-level, chronic exposure levels of the causative agent. Others had more significant (but not immediate) reactions to exposure to larger quantities of process mixture fumes resulting from occasional and well-identified accidental process equipment leaks.

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PFF, as documented in the literature, is caused by decomposing fluoropolymers. It produces temporary and somewhat severe influenza-like symptoms in humans. Lewis & Kerby [2] reported "An epidemic of PFF involved 36 to 61 employees in one industry over a 90 day period. All of those involved demonstrated the classic history of an influenza-like syndrome, with fever and chills occurring several hours after exposure to the pyrolysis products of polytetrafluoroethylene (PTFE)."

Zapp [3] reports an inability to produce the PFF syndrome in experimental animals. Thus the only animal tests of significance are those inadvertent human exposures as reported herein.

Waritz & Kwon [4] report that the following compounds were identified in decomposing PTFE fumes: octafluoroisobutylene, difluoroethylene, hexafluoroethane, hexafluoropropylene, and octafluorocyclobutane. None of these compounds were ever identified in any feed or product of the instant pilot plant operation.

Zapp also reported [5] : that the symptoms reported herein are essentially identical to those of PFF; that there are only three known causes of this syndrome (metal fume fever, a virus, and PFF); and that there is no single chemical that is known to be the causative agent.

PFF has however, been previously shown to be caused by particulate matter, since the active agents can be filtered out of a gas stream containing PTFE particulates and pyrolysates. There is additional evidence that the causative agent(s) of PFF have been seen to age with time. Thus fine particulates which apparently induce the PFF syndrome when fresh, will not do so if inhaled after suitable aging, unless further pyrolysed.

No thermal processing of fluoropolymers occurred during the liquid-vapor phase process study herein reported (albeit a fair quantity of PTFE and other fluoropolymers was incidentally in use as gaskets, valve stem packings, pipe linings etc).

After considerable analytical effort, a non-volatile minor portion (less than 0.1% range) of the feed R-123 was found and identified as a fluorotelomer, which, in principle, could be similar to the presumed PTFE pyrolysates previously deemed responsible for PFF.

Much improved ventilation, closer attention to incipient process leaks, and area as well as personal atmospheric exposure

monitoring for trifluoro acetyl chloride (at the ppm level), along with appropriate use of gas masks, eliminated the occurrence of PFF in the pilot plant crew.

1 Dittman, US Pat. 3 883 407, (1975) assigned to Halocarbon Products Corporation.

2 C.E. Lewis & G.R. Kerby, 'An Epidemic of Polymer-Fume Fever'. JAMA 191 (5) : 103-106, 1965.

3 John A. Zapp, Jr., 'The Anatomy of a Rumor', Haskell Labororatory for Toxicology and Industrial Medicine, E.I. DuPont de Nemours & Co.

4 R.S. Waritz & B.K. Kwon, 'The Inhalation Toxicity of Pyrolysis Products of Polytetrafluoroethylene Heated Below 500 degrees C.' Amer. Ind. Hyg. Assoc. J. 29: 19-26, 1968.

5 John A. Zapp, Jr., Personal Communication (4/31/81 meeting at Murray Hill, New Jersey).