

B. F. GOODRICH CHEMICAL COMPANY
Inter-Organization Correspondence

To: W.E. McCormick

Date: March 24, 1969

Location: Akron

From: L.B. Crider ✓

Subject: Some New Information on the Relative Toxicity of Vinyl Chloride Monomer

Our continuing search of the literature for information concerning the toxicity of vinyl chloride monomer has revealed that a considerable amount of work has been done in Europe that we were not aware of. A summary of this work was presented at a Symposium on Aerosols in England in 1961 and subsequently published in *Aerosol Age* (April, 1964 p. 44). In this work a comparison was made of the relative toxicity of vinyl chloride monomer with other commonly used aerosol propellants. In general, VCl monomer was found to be less toxic than Freon 11, Freon 12, and Freon 114.

These conclusions were based on animal tests at Battelle Institute in Frankfurt. These tests included 100 day exposures of mice, rats and guineapigs at concentrations of 0.5, 1.5 and 5.0% VCl by volume. Including the controls, 120 animals of each type (in groups of 10) were exposed 7 hours daily for 100 days. These tests showed the following results;

1. No deviations from normal conditions appeared up to 1.5% by volume of VCl monomer. Inhalation of 5% by volume of VCl at first increased the mobility of the animals. With repeated exposures, however, this did not occur.
2. Growth function was not influenced at all.
3. The blood patterns of all animals was normal.
4. The autopsy of all test animals showed no morphological changes.

Another series of tests were also carried out at Battelle using vinyl chloride monomer as a propellant in a shellac-based hairspray. Three groups of white mice were sprayed 30 seconds daily for 5 weeks. The animals were closely observed and dissected after the tests. Again, the autopsies showed no morphological changes.

Another study at Battelle was to investigate the amount of toxic gases produced from the burning of halogenated hydrocarbons. The thermal decomposition of vinyl chloride, Freon 11, Freon 12 and Freon 114 was carried out in the presences of O₂ at temperatures between 100-1000°C. The amounts of carbon monoxide, phosgene and HCl produced at 1000°C. were measured:

	CO	COCl ₂	HCl
1g Vinyl Chloride	39.5mg	+ 0.11mg	+102mg
Propellant 11	1.5mg	+ 7.00mg	+94mg
Propellant 12	1.5mg	+ 2.40mg	+79mg
Propellant 114	0.8mg	+ 12.00mg	+59mg



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The propellants tested were only partially decomposed by the method used. The results do show, however, that the amount of phosgene produced from VCl monomer is much lower than the other propellants. With complete burning of 100 grams of VCl gas in a flame at 1000°C in a room having a capacity of 50 M³ the concentration of phosgene would be 0.05 ppm, well below the ppm MAC. Vinyl chloride monomer is the only halogenated propellant that passes this test where the combustion products are below the MAC for carbonyl halide.

The relatively low toxicity of VCl monomer as shown by the work at Battelle in Europe has certainly had some influence on its wide acceptance as an aerosol propellant. About 20 M[#]'s/yr of VCl monomer is now being used in aerosol products. BFG sales for end use in aerosol propellants amounts to 1.5 M[#]'s/year.

The people in the cosmetics trade have been concerned about the possible toxicity of these propellants. Some calculations have been made to show the concentration of propellant in a typical small hair dressers room. When VCl monomer is used as the propellant in a hairspray and the operator treats 20 customers in an 8 hour period the average concentration of VCl monomer is 250 ppm by volume. In some cases where the duration of spraying is long (3 minutes) the concentration may be as high as 1400 ppm. All of this suggests that beauty operators may be exposed to concentrations of VCl monomer equal to or greater than the level in our polys.

I feel that the work at Battelle is most significant with respect to our over all concern about the toxicity of VCl monomer and its possible implication in causing decalcification of bone tissue. They had a total of 360 test animals exposed for 90 days to monomer levels much higher than any of our testing at Kettering. I have asked Bob Meyer to contact the appropriate people at Battelle in Frankfurt to obtain the complete details of their study.

Now to a slightly different subject. I have talked to the people in monomer sales about the use of trace inhibitors in VCl monomer. Two of our monomer customers, Hooker and Panasote, are now using inhibitors. Hooker is using 2 ppm of phenol in their bulk polymerization process. In their aqueous systems they use the same level of hydroquinone. Panasote is using 25 ppm of phenol as an inhibitor in their monomer. It might be worthwhile to check with Dr. Dinman to see if these two companies were included in the MCA survey and if they showed lower incidence of the hand problem.

If you would like more details on the use of VCl monomer in aerosol propellant or the use of trace inhibitors in VCl monomer I would suggest that you contact Jim Wolff or Bill Schloenbach in our monomer sales group in Cleveland.

L.B. Crider
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cc: O.F. Beckmeyer
J.E. Jansen
C.H. Lufter
J.L. Nelson - E.W. Harrington
F.L. Ramp
Dr. R.H. Wilson
R.D. Scott
R.J. Wolf
B.M.G. Zwicker
Technical Council
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