

Mr. Stephen H. Korzeniowski
Business Manager
Fluorosurfactants and Additives

E. I. Dupont de Nemours & Co., Inc

Dear Mr. Korzeniowski:

Thank you for your letter to Dr. Dierdorf expressing your interest in our Aqueous Film Forming (AFFF) Workshop of March 16, 2001. The purpose of the workshop was to provide a forum for discussion of the Environmental Protection Agency's (EPA) proposed rule that calls for the voluntary phase-out of perfluorooctyl sulfonate (PFOS) chemicals to the Department of Defense by 2003. DoD is concerned about the availability of PFOS for use in AFFF and the pending phase-out rule's impact on military fire-fighting capabilities. Dr. Dierdorf asked me to respond to you because I am the author of the letter mentioned in your correspondence.

The application of AFFF in firefighting is inherently dispersive and results in the distribution of AFFF's chemical components on the surface and in the groundwater. Concern about this distribution prompted Military Service Departments to investigate the biodegradation, possible remediation, toxicity, fate and transport of many of AFFF's components. These studies date back to 1983 or earlier and are on going. Based on these studies and published literature, the "Lowest Observed Adverse Effect Level" (LOAEL) for perfluorinated carboxylic acids is 0.1 mg/kg/day for mice.¹ The LOAEL for perfluorooctanyl sulfonates is 0.4 mg/kg/day.² My assertion that PFOA is more toxic than PFOS is based on these data. The association of this result with telomer is based on the below unpublished Air Force tests.

Several weeks after a large-scale fire-fighting operation using AFFF in Jacksonville Bay, Florida, allegations of surfactant related bird kill caused the Air Force to screen AFFF's components to determine if they were non-persistent. The perfluorinated carboxylic and sulfonic acid surfactants were known to be persistent, leaving telomer surfactants as the only potentially non-persistent, commercially available, fluorosurfactant candidates. During 1998, the Air Force Research Laboratory, Fire Technology Group at Tyndall Air Force Base, Florida conducted the screening by monitoring the changes in "Soluble Chemical Oxygen Demand" (COD) and surface tension during biodegradation. Standard procedures for measuring "Biological Oxygen Demand" over a period of 28 days were used. Purely by coincidence, the telomer-tested surfactant samples were identified as "Zonyl" branded surfactants, which were supplied by your company.

Results indicated that the telomer fluorosurfactant did biodegrade as shown by decreased soluble COD, however, the surface tension remained essentially unchanged. Control samples of hydrocarbon

¹ **Developmental toxicity of perfluorodecanoic acid in C57BL/6N mice.** Harris MW, Birnbaum LS, Fundam Appl Toxicol, 1989, 442-8 (1989).

² **3M Submissions in EPA Docket AR-226.**

surfactants showed decreased soluble COD indicating biodegradation and as expected an increase in surface tension to that of water. The research staff involved in this work found the results consistent with the degradation of telomer surfactants to perfluorocarboxylic acids. In the case of Zonyl TBS, the only biodegradable segment is the 1,1,2,2 tetrahydro segment, which can only result in formation of perfluorononanoic acid. They considered this information insignificant at the time with the required documentation being extensive research notes.

I'm sure industry efforts in this area are being revived in light of the EPA's pending regulatory action. Dr. Dierdorf has been collaborating with manufacturers of fluorosurfactants to ensure non-persistent surfactants are developed and commercially available. These chemicals provide the properties essential to effective AFFF fire fighting. If you want a copy of the Air Force's unpublished experimental data, please contact Mr. Dick Vickers at (850) 283-3707, Dick.Vickers@tyndall.af.mil.

Curtis M. Bowling
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(Force Protection)