



**CHEMICAL CONCENTRATES**

A SUBSIDIARY OF BAKER INDUSTRIES, INC.

*Corporation*

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15 June 1970

The Editor  
Fire Journal  
National Fire Protection Association  
60 Batterymarch Street  
Boston, Massachusetts 02110

Sir:

At the recent NFPA Meeting in Toronto information about the toxicity of "Light Water" was asked of me frequently. We had made a limited study on the effects of "Light Water" on marine life in preparation for substantial and controlled field tests. These effects were highly derogatory to marine life and the entire test program had to be abandoned to avoid severe local stream pollution. I am asked by concerned people to report our data on the "Light Water" studied and do herewith comply.

The only commercially available product was FC-194 and this was checked over a range which allowed for 48-fold to 16,000-fold dilution. These results are reported. Other "Light Water" formulations not commercially available were also checked and the results were similar.

A series of five ten-gallon tanks were used and these were stocked and restocked with a recommended group of hardy fish. Tank temperatures were maintained at  $72^{\circ}\text{F} \pm 2^{\circ}\text{F}$ , uniform aeration maintained by Tiger pumps and filter.

Each tank, fitted with stainless lids, housed a) 3 goldfish (average length 2-1/4 inches, average weight 1-1/2 grams), b) 2 Blackmoors (average length 2-1/2 inches, average weight 3 grams) and c) 2 Calicos (average length 2 inches, average weight 1-1/2 grams). There were fed standard fish food at a rate of 0.025 grams per tank per day. The tanks contained nine gallons of tapwater and foam concentrate as shown in the following summary chart.

**Exhibit  
1083**

State of Minnesota v. 3M Co.,  
Court File No. 27-CV-10-28862

3M\_MN02267863

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| <u>Foam Liquid</u><br>Type | <u>Conc. :%</u> | <u>Fluorochemical</u><br>:ppm | <u>Surface Tension</u><br>:dynes/cm | <u>Survival</u><br>Time |
|----------------------------|-----------------|-------------------------------|-------------------------------------|-------------------------|
| FC-194                     | 2.0             | 1,250                         | 14.8                                | 3-10 min.               |
| "                          | 0.2             | 125                           | 16.3                                | 5-60 min.               |
| "                          | 0.02            | 12.5                          | 36.7                                | 4-8 hrs.                |
| "                          | 0.006           | 4                             | 39.7                                | 2-7 days                |
| "                          | 0.002           | 1                             | 52.5                                | Over 7 days             |
| Blank                      | -               | -                             | 67.5                                | Over 10 weeks           |

*1/20 FC*

We regard the 4 parts per million as the threshold concentration with lower concentrations probably safe. However, at all listed concentrations (including the 1 part per million) erratic motion, loss of stability and other visibly odd effects were present.

There appeared to be two principal possible causes of death for all the fish. The erratic motion, rapid rotation and general inability to remain upright led to the apparent drowning of the fish. The same characteristic, by which fluorochemical greatly lowers the interfacial tension allowing for film-formation, also permits the intrusion of water as the oil film on which protection of the fish's stabilizing mechanism depends is destroyed by the fluorochemical. The fish appears to drown as a result. There also appears to be an attack on his nervous system as evidenced by high speed swimming and crashing headlong into the sides and bottom of the tank.

Faithfully yours,

CHEMICAL CONCENTRATES CORPORATION

*S. I. Kalkstein*  
S. I. Kalkstein  
President

SIK/k