

## Fish Toxicity Levels

When fighting a wildfire in a watershed with aquatic life, toxicity levels of products are of critical importance. The Forest Service has worked with the United States Geological Service (USGS) for a number of years to develop a fish toxicity test. The earlier work of Passino and Smith in 1987, testing the impact of various chemicals on aquatic life in the Great Lakes, established methodologies, subsequently adapted by the Forest Service, to evaluate the impact of wildland fire chemicals on aquatic life. Young rainbow trout were found to be representative of the most sensitive of this group and as sensitive as the threatened or endangered species that had been studied.

Scientists eventually chose a metric that measures the concentration of product in soft water that results in the death of 50 percent of the young rainbow trout within 96 hours. This metric, called the LC<sub>50</sub> level, hereafter referred to as the LC-50 level, is expressed in milligrams of product in a liter of solution (mg/L).

A product that has very little toxicity to aquatic life requires a very high amount of product before the LC-50 level is reached. It takes a lot more product before adverse effects on aquatic life are reached. Conversely, a product very toxic to aquatic life requires a comparatively very small amount of product before the LC-50 level is reached.

Therefore, the toxic effects of a product on aquatic life are inversely proportional to the LC-50 level. The higher the LC-50 level, the less the toxicity. The lower the LC-50 level, the greater the toxicity. What are the descriptors that define the effects on aquatic life as a function of LC-50? Table 1 illustrates the toxic effects on aquatic life for different LC-50 levels.

<b>Toxicity Classifications</b>	
<b>LC-50 Level</b>	<b>Effect</b>
< 0.1 mg/L	Extremely toxic
0.1 – 1.0 mg/L	Highly toxic
1 – 10 mg/L	Moderately toxic
10 – 100 mg/L	Slightly toxic
100 – 1,000 mg/L	Practically harmless
> 1000 mg/L	Relatively harmless

Table 1

The published LC-50 levels are determined using pure product concentrates, either unadulterated liquid concentrate or a scientifically determined solution of a dry concentrate. However, the mix ratios of a blended product must be considered when determining actual toxicity levels in the field.

Table 2 provides applied LC-50 values for blended gels at the USFS' minimum approved mix ratios. Selected long-term retardants and foam are also included for comparison purposes. The blended LC-50 ratings are determined by adjusting the LC-50 baseline ratings for pure concentrates into a value for the blended product at the minimum approved mix ratio.

For example, when Firewall II is mixed at 0.25%, the blended LC-50 value is  $178 \div 0.25\% (.0025) = 71,200$ . Likewise, for GelTech Fire Ice, the blended LC-50 value is  $348 \div 1.40\% (.0140) = 24,857$ . For

Phos-Chek 259F, a powder, the equivalent mix ratio is 1.14 lbs of product per 8.33 pounds (1 gallon) of water = 13.69%, giving a blended LC-50 value of  $148 \div 13.69\% (.1369) = 1,081$ .

Thus, a baseline LC-50 rating for a product does not indicate the actual toxic effects of the blended product, which vary significantly from product to product in field applications.

Product	Type	LC-50 Baseline Ratings for Pure Concentrates <sup>1</sup>	Minimum Approved Mix Ratio <sup>2</sup>	LC-50 Ratings for Blended Products <sup>3</sup>	Toxicity Ratios of Blended Products Compared to Firewall II	
AFG Firewall II	Gel	178	0.25%	71,200	1.00	
Blazetamer 380	Gel	246	0.65%	37,846	1.88	
GelTech Fire Ice <sup>4</sup>	Gel	348	1.40%	24,857	2.86	
Thermo-Gel 200L	Gel	122	0.50%	24,400	2.92	
Phos-Chek LC 95A	LTR	435	5.5:1	2,393	29.75	
Phos-Chek 259F <sup>5</sup>	LTR	148	1.14lb/gal	1,081	65.86	
Phos-Chek WD 881	Foam	11	1.0%	1,100	64.73	

Table 2

Notes:

- 1: Forest Service WFCS Standard Test STP-1.5
- 2: Per QPL
- 3: At the approved minimum mix ratio
- 4: GelTech Fire Ice is not approved for fixed tank helicopters
- 5: Phos-Chek 259F is the only LTR approved for fixed tank helicopters