ATTACHMENT 1

Chlorpyrifos Water Quality Guideline Setting by USEPA Tier I Methodology
Acute Criterion

Source for methodology:
USEPA. 1995. Final Water Quality Guidance for the Great Lakes System. CFR Parts 9, 122, 123, 131, & 132. Final rule. Appendix A to Part 132 – Great Lakes Water Quality Initiative Methodologies for Development of Aquatic life Criteria and Values. Methodology for Deriving Aquatic Life Criteria: Tier I.

I. A. Material of concern: CHLORPYRIFOS

II. Collection of data: Data on toxicity to aquatic animals and plants comes from the review of Barron and Woodburn (*Rev. Environ. Contam. Toxicol.* 1995. Vol 144. pp. 1—93).

III. B. Required data:

1. Results of acceptable acute (or chronic tests) for
   a. class Osteichtyes, the family Salmonidae
   b. class Osteichtyes, other than Salmonidae, preferably an important warm water species
   c. a third representative of the phylum Chordata (an aquatic vertebrate)
   d. a planctonic crustacean
   e. a benthic crustacean
   f. an insect
   g. a representative of a phylum other than Chordata or Arthropoda
   h. a representative in any order of insect or any phylum not already represented.
2. Acute-chronic ratios with data for at least
   a. one fish
   b. one invertebrate
   c. one freshwater species
3. Data for at least one freshwater algae or vascular plant

These data are present in the compilation of Barron and Woodburn (*Rev. Environ. Contam. Toxicol.* 1995. Vol 144. pp. 1—93)

IV. Final Acute Value

The following hierarchy was used for data selection criteria to fill the requisite categories for the Tier 1 acute value computation:

- freshwater species
  - flow-through test
    - measured concentration
    - nominal concentration
      - EC_{50}
      - LC_{50}

The data base for chlorpyrifos is sufficiently rich that default criteria (such as, saltwater species, static systems) were unnecessary to complete the acute data grid. The resulting tabulation of GMAV is shown in Table 1. From Table 1, the relevant GMAV and resulting FAV calculation are:

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Sensitive genus	GMAV, µg/L	P
Amphipod, *Grammarus* sp.	0.14069599	0.0625
Cladoceran, *Daphnia* sp.	0.21	0.125
Mayfly, *Cloen* sp.	0.25	0.1875
Mayfly, *Emphemerella* sp.	0.34641016	0.25

$$S^2 = (((\ln GMAV)^2)-((((\ln GMAV))^2)/4))/((P)-((((\sqrt{P}))^2)/4)) = 12.2$$

$$L = ((\ln GMAV)-S((\sqrt{P})))/4 = -2.8$$

$$A = S(\sqrt{(0.05)})+L = -2.05$$

$$FAV = [EXP](A) = 0.129\ \mu g\ L^{-1}$$

V. Final Acute Equation

FAV may be normalized by taking into account the effect of water quality parameters as covariates that influence the expression of acute aquatic toxicity. For chlorpyrifos it is reasonable to assume that organic carbon (and perhaps pH) have an influence on acute toxicity. On-going evaluation of the existing data as well as development of new data will clarify this effect and may result in a revised FAV. As such the currently derived FAV should be judged interim at present.

X. Criterion

B. Criterion Maximum Concentration (CMC)

$CMC = FAV/2 = 0.0645\ \mu g\ L^{-1}$

DowElanco at present does not support the CMC as a regulatory criterion based on the limited information in the USEPA Tier I methodology concerning reduction of the FAV by a factor of two.

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Table 1: Data Required for FAV Determination:

LC_{50}/EC_{50} µg/L	SMAV	GMAV	Reference	Rank (R)	Probability (P)
a. class Osteichtyes, the family Salmonidae					
Rainbow trout, *Oncorhynchus mykiss*					
8.0			Holcombe et al., 1982		
9.0			Philips and Holcombe, 1985		
	8.48528				
		8.48528		8	0.5
b. class Osteichtyes, other than Salmonidae					
Bluegill, *Lepomis macrochirus*					
10			Philips and Holcombe, 1985		
	10				
		10		9	0.5625
Channel catfish, *Ictalurus punctatus*					
806			Philips and Holcombe, 1985		
	806				
		806		14	0.875
c. a third representative of the phylum Chordata					
Fathead minnow, *Pimephales promelas*					
203			Holcombe et al., 1982		
140			Jarvinen and Tanner, 1982		
120			Jarvinen and Tanner, 1982		
542			Philips and Holcombe, 1985		
	207.349				
		207.349		13	0.8125
d. a planctonic crustacean					
Cladoceran, *Daphnia pulex*					
0.21			van Wijngaarden and Leeuwangh, 1993		
	0.21				
		0.21		2	0.125
Amphipod *Grammarus fasciatus*					
0.18			USEPA, 1986		

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0.18

Grammarus pseudolimnaeus

0.18 USEPA, 1986

0.3 Siefert, 1984

0.2 Siefert, 1984

0.22104

Grammarus pulex

0.07

0.07 van Wijngaarden and Leeuwangh, 1993

0.1407 1 0.0625

e. a bentihic crustatcian

Crayfish, *Orconecetes immunis*

6 Philips and Holcombe, 1985

6

6 7 0.4375

f. an insect

Diptera, *Chaborus obscuripes*

6.6 van Wijngaarden et al, 1993

Mayfly, *Caenis horaria*

>3

3 van Wijngaarden et al, 1993 6 0.375

3

Mayfly, *Cloen dipterum*

0.25 van Wijngaarden and Leeuwangh, 1993

0.3 van Wijngaarden et al, 1993

0.25

0.25 3 0.1875

Mayfly, *Emphemerella* sp.

0.4 Siefert, 1984

0.3 Siefert, 1984

0.34641

0.34641 4 0.25

Water strider, *Corixa puctata*

2.0 van Wijngaarden et al, 1993

2.0

2.0 5 0.3125

g. a reprcsentative of a phylum other than Chordata or Arthropoda

Mollusca, snail

Anius vortex

> 94	van Wijngaarden and Leeuwangh, 1993			
> 94	van Wijngaarden et al, 1993			
94				
	94		10	0.625
Aplexa hypnorum				
> 806	Philips and Holcombe, 1985			
806				
	806		15	0.9375
Bithynia tentuculata				
> 94	van Wijngaarden and Leeuwangh, 1993			
> 94	van Wijngaarden et al, 1993			
94				
	94		11	0.6875
Lymnaea stagnalis				
> 94	van Wijngaarden and Leeuwangh, 1993			
> 94	van Wijngaarden et al, 1993			
94				
	94		12	0.75

h. a representative in any order of insect or any phylum not already represented reflected in the forgoing tabulation

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