

Appendix F
Pendimethalin

Summary of Submitted EcoToxicity Studies

A. Aquatic Animal Toxicity studies

Several fish toxicity studies were submitted. Acute toxicity of Pendimethalin technical to fish is highly toxic and of the formulations, ranges from highly toxic to slightly toxic.

Table 1. Freshwater Fish Toxicity

Common Name Taxonomic	AI	Study Time	Toxicity (ppm)	Category	MRID
Acute Freshwater Fish Toxicity					
Bluegill sunfish <i>Lepomis macrochirus</i>	93.2	96 hr LC50	0.199	Acceptable	00046291 Sleight, 1972
Rainbow trout <i>Oncorhynchus mykiss</i>	93.2	96 hr LC50	0.138	Acceptable	00046291 Sleight, 1972
Channel catfish <i>Ictalurus punctatus</i>	93.2	96 hr LC50	0.418	Acceptable	00046291 Sleight, 1972
Bluegill sunfish <i>Lepomis macrochirus</i>	3-E	96 hr LC50	1.04 ppm formulation	Supplemental ²	00037927 Bentley, 1974
Rainbow trout <i>Oncorhynchus mykiss</i>	3-E	96 hr LC50	1.0 ppm formulation	Supplemental ²	00037927 Bentley, 1974
Bluegill sunfish <i>Lepomis macrochirus</i>	45	96 hr LC50	0.92 ppm formulation	Supplemental ²	00037927 Bentley, 1974
Rainbow trout <i>Oncorhynchus mykiss</i>	45	96 hr LC50	0.52 ppm formulation	Supplemental ²	00037927 Bentley, 1974
Bluegill sunfish <i>Lepomis macrochirus</i>	2-S	96 hr LC50	90.4 ppm formulation	Supplemental ²	00037927 Bentley, 1974
Rainbow trout <i>Oncorhynchus mykiss</i>	2-S	96 hr LC50	86.6 ppm formulation	Supplemental ²	00037927 Bentley, 1974
Channel catfish <i>Ictalurus punctatus</i>	45	96 hr LC50	1.9 ppm formulation	Supplemental ²	00131773 LeBlanc, 1983
Chronic Fish Full Life Cycle (ppm)					
Fathead minnow <i>Pimephales promelas</i>	98.3	288 D NOAEC	0.0063 ¹	Acceptable	00037940 EG&G Bionomics, 1975

¹ LOAEC = 9.8 ppb for reduction of egg production. Reduced hatchability observed at 22 and 43 ppb.

² Supplemental due to formulation product being tested and not technical

Acute toxicity of Pendimethalin technical to estuarine fish is categorized as highly toxic and the formulation is categorized as moderately toxic.

Table 2. Estuarine Fish Toxicity

Common Name Taxonomic	AI	Study Time	Toxicity (ppm)	Category	MRID
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Sheepshead minnow <i>Cyprinodon variegatus</i>	92.2	96 hr	LC50= 0.71 ppm	Acceptable	00131774 Ward, 1983
Sheepshead minnow <i>Cyprinodon variegatus</i>	45	96 hr	LC50 = 1.7 ppm formulation	Acceptable	00131774 Ward, 1983

Acute toxicity of Pendimethalin technical to freshwater invertebrates is categorized as highly toxic and moderately toxic. Pendimethalin formulation is categorized as slightly toxic and moderately toxic.

Table 3. Toxicity of Freshwater Invertebrates

Common Name Taxonomic	ai	Study Time	Toxicity (ppm)	Category	MRID
Water flea <i>Daphnia magna</i>	93.2	48 hr	EC50 = 0.28	Acceptable	00059738 LeBlanc, 1976
Crayfish <i>Procambarus simulans</i>	94.2	96 hr	EC50 >1.0	Supplemental ¹	00071123 Thompson, 1980
Water flea <i>Daphnia magna</i>	45.6	48 hr	EC50 = 5.1 ppm formulation	Acceptable	00153772 Forbis, 1985
Invertebrate life cycle study					
Water flea <i>Daphnia magna</i>	92.2	21-D	NOAEC = 0.0145 ²	Acceptable	00100504 Graney, 1981

1 Precipitate was seen of nominal concentrations over 1 ppm, the dissolved O2 concentration is less than 40% of saturation, and DMSO was used as a solvent which tends to increase mortalities rather than decrease them.

2 The NOAEC is based on reduced production of *Daphnia*. LOAEC = 0.0172 ppm (17.2 ppb). Mortality was observed in the study with 100% mortality at the 2 highest dose levels of 35.8 and 74.2 ppb. No appreciable mortality observed at 3 lowest concentration levels of 4.3, 8.2, and 14.5 ppb. Reduction of productivity of 50% occurred at 22.1 and 17.5 ppb concentration levels.

Acute toxicity of Pendimethalin technical to estuarine invertebrates is categorized as highly toxic.

Table 4. Mollusca

Common Name Taxonomic	ai	Study Time	Toxicity (ppm)	Category	MRID
Eastern oyster <i>Crassostrea virginica</i>	92.2	48 hr	EC50 = 0.21	Acceptable	00131775 Ward, 1983
Pink shrimp <i>Penaeus duorarum</i>	92.2	96 hr	EC50 = 1.6	Acceptable	00131775 Ward, 1983
Pink shrimp <i>Penaeus duorarum</i>	45	96 hr	EC50 = 11 ppm formulation	Supplemental ¹	00131775 Ward, 1983
Eastern oyster <i>Crassostrea virginica</i>	45	48 hr	EC50 = 0.45 ppm formulation	Supplemental ¹	00131775 Ward, 1983

1 Supplemental due to formulation being tested.

B. Terrestrial Animal Toxicity Studies

Acute toxicity of Pendimethalin technical to birds is categorized as slightly toxic.

Table 2. Acute Toxicity to Birds

Common Name Taxonomic	ai	Study Time	Toxicity	Category	MRID Author, Year
Mallard duck <i>Anas platyrhynchos</i>	Tech	8 D LD50	1421(mg/kg- bw)	acceptable	00059739 Fink, 1976
Mallard duck <i>Anas platyrhynchos</i>	Tech	8 D LC50	>4640 ppm ¹	acceptable	00026674 Fink, 1973
Bobwhite quail <i>Colinus virginianus</i>	Tech	8 D LC50	4187 ppm	acceptable	00026675 Fink, 1973

¹ 20% mortality at 4640 ppm and no mortality below 2150 ppm

Table 6. Avian Reproduction Studies

Species	a.i.	NOAEL (ppm)	LOAEL (ppm)	Endpoint affected	Category	MRID Author, year
Mallard duck <i>Anas platyrhynchos</i>	92.6	141	1410	14-day survivor bodyweight	Acceptable	44907601 Beavers, 1996
Bobwhite quail <i>Colinus virginianus</i>	92.4	>1410	>1410	none	Acceptable	44907602 Beavers, 1996

Acute Honey Bee Toxicity Studies

Pendimethalin is categorized as practically non-toxic to honey bees.

Table 7. Toxicity to Insects

Common Name Taxonomic	ai	Study Time	Toxicity (ug/Bee)	NOAEL	Category	MRID Author, year
Honey bee <i>Apis mellifera</i>	Tech	48 hr LD50	49.8	Not reported	Acceptable	00099890 Atkins, 1974

No mortality was reported at the highest concentration level (49.8 ug/bee).

C. Plant Toxicity Studies

Table 8. Toxicity of pendimethalin to Aquatic Plant

Common Name Taxonomic	AI	Study Time	EC ₅₀ (ppb)	NOAEL	Category	MRID
Green algae <i>Selenastrum capricornutum</i>	92.9	120 h EC50	5.4 ppb	3.0	Acceptable	42372204 Hughes, 1992
Marine diatom <i>Skeletonema costatum</i>	92.9	120 h EC50	5.2 ppb	0.7	Acceptable	42372205 Hughes, 1992
Freshwater diatom <i>Navicula pelliculosa</i>	92.9	120 h EC50	6.7 ppb	3.2	Acceptable	42372206 Hughes, 1992
Bluegreen algae <i>Anabaena flos-aquae</i>	92.9	120 h EC50	>174 ppb	98	Acceptable	42372207 Hughes, 1992
Duckweed <i>Lemna gibba</i>	93	14 D EC50	12.5 ppb	5.6	Acceptable	42137101 Hughes, 1991

Table 9. Toxicity of Pendimethalin to Terrestrial Plant

Common Name Taxonomic	EC25 (lb a.i./A)	NOAEC	Endpoint	Category	MRID Author, Year
Seedling Emergence (93 % a.i.)					
Soybean <i>Glycine max</i>	4.7	2.0	Dry weight	Acceptable	42372201 Chetram, 1992
Lettuce <i>Lactuca sativa</i>	0.09	0.063	Dry weight	Acceptable	
Radish <i>Rhaphanus sativus</i>	0.86	0.13	Plant height	Acceptable	
Tomato <i>Lycopersicon esculentum</i>	0.2	0.13	Dry weight	Acceptable	
Cucumber <i>Cucumis sativus</i>	2.4	0.25	Plant height	Acceptable	
Cabbage <i>Brassica oleracea</i>	0.44	0.25	Plant height	Acceptable	
Oat <i>Avena sativa</i>	1.0	0.25	Plant height	Acceptable	
Ryegrass <i>Lolium perenne</i>	0.01	0.065 ¹	Dry weight	Acceptable	
Corn <i>Zea mays</i>	0.68	0.5	Plant height	Acceptable	
Onion <i>Allium cepa</i>	0.08	0.06	Dry weight	Acceptable	
Vegetative Vigor					
Soybean <i>Glycine max</i>	0.27	0.13	Dry weight	Acceptable	42372203 Chetram, 1992
Lettuce <i>Lactuca sativa</i>	0.10	0.003	Dry weight	Acceptable	
Radish <i>Rhaphanus sativus</i>	>4.0	>4.0	n/a	Acceptable	
Tomato <i>Lycopersicon esculentum</i>	0.5	0.13	Dry weight	Acceptable	
Cucumber <i>Cucumis sativus</i>	>4.0	>4.0	n/a	Acceptable	
Cabbage <i>Brassica oleracea</i>	4.8	2.0	Dry weight	Acceptable	
Oat <i>Avena sativa</i>	0.78	0.5	Dry weight	Acceptable	
Ryegrass <i>Lolium perenne</i>	0.034	0.0008	Dry weight	Acceptable	
Corn <i>Zea mays</i>	2.8	2.0	Plant height	Acceptable	
Onion <i>Allium cepa</i>	0.56	0.50	Plant height	Acceptable	

¹ EC05 was used in lieu of NOEAC since study was unable to determine NOAEC value