3/29/85

Disciplinary Review
Ecologicla Effects Profile
Technical Picloram (acid)

Picloram technical appears to be moderately toxic to cold water (rainbow trout) and warm water fish (bluegill, fathead minnow). Acute toxicity values range between 5.5-19.3 ppm (cold water species, Mayes, 1982, ID: ; Batchelder, 1974, ID:) and 14.5-55.3 ppm (warm water species, Mayes, 1982, ID: ; Batchelder, 1974, ID:).

According to Hill, 1975, (ID:) picloram is practically non-toxic to birds (mallard ducks, bobwhite quail, pheasant). Acute dietary LC_{50} values were calculated at greater than 5000 ppm.

Picloram is slightly toxic to aquatic invertebrates, as suggested by Mayes, 1982, (ID:), McCarty, 1977, (ID:); and Johnson, 1980, (ID:). The acute LC_{50} values calculated by these researchers range between 10.0- 50.7 mg/l.

Technical picloram (isooctylester)

According to McCarty, 1978, (ID:) the acute toxicity value of picloram isooctylester to bluegill was 32.9 ppm. This study suggests that picloram isooctylester is slightly toxic to warm water fish.

Technical picloram (potassium salt)

Picloram potassium salt is slightly toxic to warm and cold water fish (bluegill, channel catfish, rainbow trout). The acute LC50 values range between 13-32.9 ppm (Alexander, 1966, ID: ; McCarty, 1978; ID:).

Formulation No 1: pellets (2.3%, 5.8% 11.6%)

No data reviewed

Formulation No 2: Liquid (24.0%; 24.4%; 34.7%)

The acute toxicity value of 48 mg/l, suggests that the potassium salt of picloram is slightly toxic to rainbow trout (ID:). Tests using bluegill (LC_{50}=137 ppm) and Daphnia (LC_{50}=212 ppm) suggest that this formula is practically non-toxic to these organisms.

Ecological Effects Branch Hazard Assessment for Manufacturing Use Picloram

The Ecologicla Effects Branch (EEB) does not conduct a hazard assessment on the manufacturing use product.

Formulated Product

Picloram is a systemic herbicide that is used for brush and broadleaf weed control in and around agricultural premises (farm buildings, fence

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rows), grass rangelands, rights-of-way, industrial sites, forests, chaparal, nonagricultural and wasteland and aquatic areas (outer ditch banks adjacent to water). This pesticide is highly mobile in the soil, transports laterally in subsurface water and remains active in the soil for more than one season.

Picloram appears moderately toxic to coldwater and warm water freshwater fish (LC_{50} = 5,5-19.3 ppm). Aquatic invertebrate studies indicate that picloram was moderately toxic to Daphnia magna, Gammarus fasciatus, and young Pteronarcys (LC_{50} = 14.5 - 55.3 ppm).

The use of picloram for weed control in outer ditch banks, adjacent to water, suggests that certain populations of aquatic invertebrates, aquatic plants and developing fish larvae and fry could be exposed to runoff. According to Wanchope (1978)[1], soil-surface applied, wettable - powder formulations of herbicides may result in runoff of 5.0%, depending on weather and slope. The highest application rate of picloram to areas adjacent to water is 1 lb ai/A. This application is to occur any time during the growing season and preferably when rainfall can be expected soon after application. The resulting runoff residue of 36.7 ppb (1.0 lb ai/A =734 ppb residue after direct application to water; 734 x .05 = 36.7 ppb) does not appear acutely hazardous to aquatic organisms. However,because of chemical persistence and mode of application, ~~the chronic effects of picloram to aquatic organisms should be tested.~~ residue monitoring should be required

Picloram appears to be practically non-toxic to birds. Acute dietary values were greater than 5000 ppm for mallard ducks, pheasant and bobwhite quail. However, use of picloram like most herbicides (specially non-selective) may cause an indirect impact to wildlife through the removal of cover and food sources.

Ecological Effects "Generic" Data Gaps Technical Picloram

The following toxicity tests are required on technical picloram in order to complete a hazard evaluation.

(1) Single-dose oral LD_{50} testing performed on one avian species (preferably mallard duck or bobwhite quail). 163.71-1. This test is required to support the registration of every manufacturing-use product and of each formulated product intented for outdoor application.

(2) An aquatic invertebrate life-cycle toxicity study on Daphnia magna. 163.72-4. This testing is required because of pesticide persistence and use pattern (application to outer banks adjacent to water).

(3) A) Determine phytotoxic effectsof picloram on algae growth, Selenastrum capricornutum capricornutum or Chlorella sp. Refer to Alga Assay Bottle Test, USEPA, Corvallis, Oregon 97330 (EPA-600/9-78-018). A measure of algae growth is essential, because, picloram may leach or runoff from outer banks adjacent to water.

4) Aquatic plant study. To determine

1) Wauchope, R.D. 1978. "The Pesticide Content of Surface Water Draining from Agricultural Fields", J. Environ. Qual., Vol. 7, no. 4, 1978.

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B) Terrestrial Macrophytes: Seed germination (in soil) and vegetative vigor. Traelore, B. 1977. Research Methods in Weed Science. Southern Weed Science Society

4) A fish embryolarvae test. 163.72-4. This testing is required because of pesticide persistence and use pattern (application to outer banks adjacent to water).

Ecological Effects Labeling Requirements

The following statements should be included on all labels for outdoor use.

(a) Do not apply directly to water or wetlands
(b) Do not contaminate water by cleaning of equipment or disposal of wastes

~~Ditch bank use~~ NPDS standard.

(a) ~~Do not contaminate water by cleaning of equipment or disposal of wastes.~~ In case of spills collect granules for reuse or proper disposal.

Effects on Freshwater Fish

Twenty-three studies contained in 10 references) were evaluated under this topic. Sixteen studies were accepable for use in this hazard assessment and are listed as follows:

Author	ID
Alexander	650096-007
Fogels	
McCarty	
Woodward (79)	
Woodward (76)	
Dill (84)	
Dill (82)	
Mayes (80)	
Batchelder (74)	00112016
Johnson	650144-012

In order to establish the acute toxicity of picloram to fish, two 96-hour acute aquatic studies are required on the technical material. These studies should be conducted on one coldwater species (preferably rainbow trout) and one warmwater species (preferably bluegill).

Based on the available data, the following is known about the toxicity of picloram to freshwater fish:

Acute Toxicity Table 1.

Species	Formulation	Effect	Author	Fiche ID	Fulfills Guideline Requirements
Rainbow trout[3]	91% LC50=13 ppm		Alexander (66)	650096-007	Yes
Bluegill[3]	91% LC50=24 ppm		Alexander (66)	"	Yes
Catfish[3]	91% LC50=14 ppm		Alexander (66)	"	Yes
Bluegill[1]	93.8% LC50=21.9 ppm		Mayes (82)		Yes
Fathead Minnow[1]	93.8% LC50=55.3 ppm		Mayes (82)		Yes
Rainbow trout[1]	93.8% LC50=19.3 ppm		Mayes (82)		Yes
Bluegill[3]	91.9% LC50=32.9 ppm		McCarty (78)		Yes
Rainbow trout[1]	92.9% LC50=5.5 mg/l		Batchelder (74)	00112016	Yes
Bluegill[1]	92.9% LC50=14.5 mg/l		Batchelder (74)	"	Yes
Cutthrout trout[1]	90% LC50=4.8 mg/l		Johnson (80)	650144-012	No
Lake trout[1]	90% LC50=4.3 mg/l		Johnson "	"	No
Rainbow trout[1]	90% LC50=12.5 mg/l		Johnson "	"	No
Bluegill[1]	90% LC50 =23.0 mg/l		Johnson "	"	No
Channel catfish[2]	90% LC50=6.3 mg/l		Johnson "	"	No
Rainbow trout[2]	90% LC50=4.0 mg/l		Johnson "	"	No
Channel catfish	90% LC50-1.4 mg/l		Johnson "	"	No

The requirements for fish acute testing have been fulfilled. Picloram appears to be slightly toxic to coldwater fish (trout) and warm water fish (catfish, bluegill).

Picloram Potassium Salt (K-Salt

One study (Dill and Myes, 1982, _____) was submitted on the potassium salt liquor (37.5% active ingredient), a manufacturing-use product. These data indicate that the K-salt liquor is slightly toxic to practically non-toxicto the species tested. The reported 96 h LC_{50} values for the rainbow trout, bluegill and fathead minnow were 48.0, 137 and 201 mg/L, repspectively.

One study was submitted on technical grade (91% active ingredient) picloram potassuim salt (Alexancer and Batchelder, 1966, ID: _____). Information from this study indicated that technical grade picloram potassium salt was slightly toxic to the species tested. The reported 96 h LC50 values are 13, 14, and 24 mg/L for the rainbow trout, bluegill and channel catfish, repsectively.

[1] technical material (acid)
[2] isooctylester
[3] potassium salt

Two studies were found acceptable for evaluating the toxicity of an end-use product containing 24.4% picloram potassium salt. The data reported by Fogels and Sprague (1977, ID: _____) indicate that 24.4% potassium salt formulation of picloram was slightly toxic to rainbow trout, flagfish (Jordanella floridae) and zebrafish (Brachydanio rerio) with 96 h LC_{50} values of 26.0, 26.1 and 35.5 mg/l respectively. Lorz et al. (1979, ID: _____) exposed coho salmon (Onchorhynchus kisutch) to a 24.4% potassium salt formulation of picloram and reported the 24 h LC50 as 17.5 mg/L. They also found that exposure to potassium picloram did not affect Na, K-stimualted ATPase activity of the gills. Histopathological examinationnn of fish exposed to 144 h to 5 mg/L of potassium picloram revealed degenerative changes of the liver.

A study by Dill and Mayes (1982b, ID: _____) provided information on the toxicity of a picloram triisopropanolamine solution (36.4% active ingredient) to fishes. There data indicated that picloram TIPA salt solution was practically non-toxic to the bluegill and fathead minnow with 96 h LC_{50} values of 109 and 150 mg/L respectively; and slightly toxic to the rainbow trout with a 96 h LC50 value of 51 mg/L.

Mixtures of Picloram with Other Active Ingredients

Four studies contained in one report (Duddles, 1968a, ID: _____) were found acceptable for reviewing the toicity of picloram mixtures to fishes.

There were two studies which examined the toxicity of mixture of picloram TIPA salt + salt of 2,4-D. This information indicated that a mixture of picloram TIPA salt (2.5% active ingredient) + a salt of 2,4-D (40.8% active ingredient) was practically non-toxic to rainbow trout with a 96 h TLM of 1,250 mg/L. A study conducted with a mixture containing picloram TIPA salt (8.1% active ingredient) + a salt of 2,4-D (37.7% active ingredient) indicated that this mixture is slightly toxic to rainbow trout with a 96 h TLM of 25 mg/L.

A study with a mixture of picloram TEA salt (15.2% active ingredient) + a salt of 2,4,5-T (14.9% active ingredient) indicated that this mixture was slightly toxic to rainbow trout with a 96 h TLm of 42.5 mg/L.

One study was conducted with a mixture of picloram isooctyl ester (16.8% active ingredient) + an ester of 2,4,5-T (63.4% active ingredient). Information from this study indicated that this mixture was moderately toxic to rainbow trout with a 96 h TLm of 7.8 mg/L.

Effects on Estuarine and Marine Organisms

Six studies (contained in two references) were received and evaluated under this topic. These studies appear to be scienfifically sound, but are unacceptable for use in a hazard assessment.

Author	ID
1975 Heitmuller	
1975 Heitmuller	

Estuarine and marine organism toxicity tests on technical and formulated pesticides are required to support registration if there is an intended direct application to an estuarine or marine environment, or if the pesticide may be expected to enter the environments in significant concentration because of use of mobility pattern. These studies include LC50 testing on shrimp, oysters and estuarine fish.

No studies were submitted on technical picloram. However, estuarine studies on picloram formulations were reviewed.

Species	Formulation Effect	Author	Fiche ID	Fulfill Guideline Requirements
eastern oyster	11.6% 48 h EC50 >1000 mg/L	Heitmuller	(75) 00111560	No
pink shrimp	11.6% 96 h LC50 >1000 mg/L	Heitmuller	" "	No
fiddler crab	11.6% 96 h LC50 >1000 mg/L	Heitmuller	" "	No
eastern oyster	24.9% 48 h EC50 >18 <32 mg/L	Heitmuller	00129073	No
pink shrimp	24.9% 96 h LC50= 125 mg/L	Heitmuller	" "	No
fiddler crab	24.9% 96 h LC50 >1000 mg/L	Heitmuller	" "	No

II. Effects on Freshwater Aquatic Invertebrates

Five studies were evaluated and found acceptable for use in assessing the hazard of picloram to aquatic invertebrates.

Four of the studies are scientifically sound and are acceptable for use in a hazard assessment.

Author	ID
Mayes	
McCarty(77)	
Johnson	

In order to establish the acute toxicity of picloram to aquatic freshwater invertebrates a 48-hour acute aquatic study is required on the technical material. Test organisms should be first instar Daphnia magna, or early instar amphipods, stoneflies, or mayflies. Formulated product testing will be required, also, if there is a direct application to water.

The following is a list of toxicity values of picloram to aquatic invertebrates.

Species	Formulation	Effect	Author	Fiche ID	Fullfill Guideline Requirement
Daphnia magna	93.8%	48 h LC50=50.7 mg/L	Mayes (82)	00129076	Yes
Daphnia magna	90.0%	48 h LC50=34.4 mg/L	McCarty (78)	GS0096-009	Yes
Gammarus fasciatus	90%	96 h LC50=27.0 mg/L	Johnson (80)	GS0144-012	No
Pteronarcella	90%	96 h LC50 >10 mg/L	Johnson (80)	"	No
Pteronarcys	90%	96 h LC50=48.0 mg/L	Johnson (80)	"	No

The requirement for aquatic invertebrate acute testing have been fulfilled. Picloram appears to be slightly toxic to daphnids. However, because of the pesticides persistence and use pattern (application to outer banks adjacent to water) a chronic aquatic invertebrate life-cycle study on Daphnia will be required.

Three studies were submitted on a mixture (Heitmuller 1975, ID:) containing 10.3% picloram TIPA salt + 39.6% of a salt of 2,4-D. The data indicates that this mixture is slightly toxic to eastern oyster (48 h EC^{50} >18 <32 mg/L) and practically non-toxic to pink shrimp and fiddler crab (96 h LC50 values of 306 and >1000 mg/L, respectively).

Effects on Birds

Nine studies were submitted (contained in seven reviews) and reviewed under this topic. Three studies are acceptble for use in a hazard assessment.

Author	ID
Heath	00129068
Fink (75)	00129070
Fink (75)	
Somers	
Fink 75	
Fink (75)	
Stevenson 85	

Species	Formulation	Effect	Author	Fiche ID	Fulfills Guideline Requirements
			Hill		
Bobwhite quail	Technical	LC50>5000 ppm	Heath 75		Yes
pheasant	Technical	LC50>5000 ppm	Heath 75		Yes
Mallard	Technical	LC50>5000 ppm	Heath 75		Yes
			Patrick		

The above studies fulfill the requirements for avian acute dietary studies. According to these findings, picloram appears to be practically non-toxic to birds. However, a single dose oral LD50 is still required.

The following avian studies were conducated on picloram formulations:

Species	Formulation	Effect	Author	Fiche ID	Fulfills Guideline Requirements
bobwhite quail	24.4%	LC50 >10,000 ppm	Fink	00129068	No
mallard	24.4%	LC50 >10,000ppm	Fink	00129070	No
white leghorn	24.4%	Spray treatment of Somers fertilized eggs (11.2 kg/ha) did not effect embryonic development or growth of hatched chicks, no effect on reproductive success and viability of f, generation.			No
mallard	11.6%	LC50 >10,000 ppm	Fink		No
bobwhite quail	11.6%	LC50 >10,000 ppm	Fink		No
bobwhite qual	~~50.0%~~ 92.9%	LC50 ~~>10,000~~ 25,000 ppm	Stevenson		No

Five studies were submitted on picloram mixtures. All were acceptable and fulfill possible Guideline requirements on a mixture.

Fink (1975e, ID: 00129069, 1975f, ID: 00129071) reported that a mixture containing 10.2% pjicloram TIPA salt + 39.6% of a salt of 2,4-D, was practically non-toxic-to-both bobwhite quail and mallard duck. The eight-day dietary LC50 value for both species exceeded 10,000 ppm. Somers et al. (1974a, ID: _____, 1974b, ID: _____, 1974C, ID: _____) tested the same formulation and found that spray treatment (approximating 2.8 kg/ha) of fertile single-comb white leghorn chicken eggs or ringneck pheasant (Phasianus colchius) eggs did not affect embryonic development of subsequent growth of hatched chicks.