Appendices to Triclopyr

Human Health and Ecological Risk Assessment

Final Report

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Appendix 1: Information from MSDSs for Triclopyr Formulations

Formulation Name [a]	Oral LD_{50} (mg/kg bw)	Dermal LD_{50} (mg/kg bw)[d]	Inhalation LC_{50} (mg/L)	Eye Irritation [c]	Skin Irritation	Dermal Sensitization
BEE 13.6% a.i. (≈9.7% a.e.)						
Pathfinder II	1000 (F)	>2000	>5.0	Slight	Moderate	No (guinea pigs)
Remedy RTU	2389 (M) 1000 (F)	>2000	>5.0	Slight	May cause	No (guinea pigs)
BEE 60.5% a.i. (≈43.5% a.e.)						
Garlon 4 Ultra	3200	>5000	>5.05	Slight	Yes	Yes (mice)
Remedy Ultra	N/A	N/A		May cause	May cause	
BEE 61.6% a.i. (≈44.3% a.e.)						
Forestry Garlon	1581 (M) 1338 (F)	>2000 >5000 (rat)		Slight	May cause	May cause
Garlon 4	1581 (M) 1338 (F)	>2000	>5.2	Yes [1]		Yes (guinea pigs)
Remedy	1581 (M) 1338 (F)	>2000		Slight	Yes	May cause
Tahoe 4E	1581 (M) 1338 (F)	>2000	N/A	N/A	N/A	No
Triclopyr 4 Ester R&P	>1000	>2000	N/A	Minimal	Moderate	May cause
Triclopyr 4E	>1000	>2000	N/A	Minimal	Moderate	May cause
Triclopyr R&P	>1000	>2000	N/A	Minimal	Moderate	May cause
Triquad	1581 (M) 1338 (F)	>5000 (rat)	N/A	Moderate	N/A	Yes (guinea pig
BEE 83.9% a.i. (≈60.3% a.e.)						
Forestry Garlon XRT	2,966	>5000	>5.90	Moderate/C	Slight	Yes (mice)
TEA 14% Granular a.i. (≈10.0% a.e.)						
Renovate OTF[3]	5000[2]	5000[2]		Moderate	May cause	**Inhalation**[3]
TEA 44.4%, a.i. (≈31.7% a.e.)						
Garlon 3A	2574 (M) 1847 (F)	>5000		Irreversible/C	May cause	May cause
Renovate 3	2,574 (M) 1847 (F)	>5000		Irreversible/C	May cause	May Cause
Tahoe 3A	2574 (M) 1847 (F)	>5000	N/A	Corrosive Irreversible	N/A	May cause
Triclopyr 3A	>1500	>2000	>2.5	Corrosive	Slight	May cause
Triclopyr 3SL	>1500	>2000	>2.5	Corrosive	Slight	May cause

[a] Sources: Specimen labels from www.Greenbook.net and www.CDMS.net.
[b] "N/A" designates that the MSDS explicitly states that no data are available. A blank indicates that no statements are made in the MSDS.
[c] A "/C" indicates the possibility of corneal damage.
[d] Rabbit unless otherwise specified.
[1] *May cause pain disproportionate to the level of irritation to eye tissues.*
[2] These appear to be the results of limit tests and should probably be reported as > values.
[3] May cause sensitization by inhalation. This effect is not noted in any MSDSs for other formulations.

Appendix 2: Toxicity to Mammals

Note: Body weights are specified in the Species column except for studies taken from U.S. EPA/OPP summaries in which information on body weights are not available.

A2 Table 1: Acute Oral Toxicity

Species	Exposure	Response	Reference
Acid			
Rats, Sprague Dawley, males and females, fasted weight on day of dosing = 203-298 g (males) and 163-204g (females)	Single oral dose of 1200 (males only), 2000, or 5050 mg/kg technical grade triclopyr	No mortality at 1200 or 2000 mg/kg. Clinical signs of toxicity included decreased activity, diarrhea, hunched posture, polyuria, facial swelling, stained fur, and walking on tiptoe, which were no longer evident in survivors at day 6. Abnormal necropsy findings in animals that died pertained to fur, testes, lungs, liver, and contents of the GI tract. In animals that were sacrificed, abnormal necropsy findings pertained to lungs, liver, hearts, kidneys, and contents of the GI tract. LD_{50}s Males: 1915 mg/kg Females: >2000 but <5050 mg/kg	Kuhn 2001, MRID 45451304
Rats	Triclopyr acid, Acute gavage	LD_{50}s Males: 729 mg/kg Females:630 mg/kg	MRID 00031940, U.S. EPA/OPP 1998a

Appendix 2: Toxicity to Mammals *(continued)*

A2 Table 1: Acute Oral Toxicity

Species	Exposure	Response	Reference
Horse Adult Shetland pony geldings, 151-203 kg 3 in control and 6 in each dosed group.	Acid administered by gavage in corn oil/acetone vehicle. Vehicle controls used. Daily doses of 0, 60, and 300 mg/kg for 4 days. Six day post-treatment observation period.	No clinical signs of toxicity at 60 mg/kg [Cumulative dose of 240 mg/kg]. At 300 mg/kg [Cumulative dose of 1200 mg/kg], signs of toxicity included depression and prostration. Decrease GI activity. Increased and labored respiration with cyanotic mucus membranes in some animals. Ataxia, stiffness and weakness with fine tremors. Slight changes in blood urea nitrogen, blood glucose, serum calcium, and serum iron. Pale liver and swollen kidneys. Mild to moderate hepatosis and cellular swelling and fatty changes around the central veins of the liver. Vacuolar swelling and cast formation in the renal tubules at 300 mg/kg. At 300 mg/kg, 2/6 ponies died on days 5 and 6 of study and a third pony was euthanized on day 5. Another pony, moderately affected, was euthanized on day 6. The remaining 2 ponies were only mildly affected. Estimated LD_{50} = >1000 mg/kg.	Osweiler 1983
TEA Salt			
Rats, Fischer, male and female	Doses: 1000, 2500 or 3200 mg/kg (Garlon 3A, 44.4% a.i., 32.2% a.e. w/w triclopyr)	Study LD_{50}s Males: 2574 mg formulation/kg or 828 mg a.e./kg Females: 1847 mg formulation /kg or 594 mg a.e./kg U.S. EPA/OPP 2009a LD_{50}: 572 mg a.e./kg bw	Mizell and Lomax 1988, MRID 41443301
BEE Ester			
Rats	Triclopyr BEE, technical grade	LD_{50}: 578 mg a.e./kg bw LD_{50} =803 mg a.i./kg bw	MRID 40557004 in U.S. EPA/OPP 1998a and 2009a U.S. EPA/OPP 1998a, Table 4, p. 7

Appendix 2: Toxicity to Mammals *(continued)*

A2 Table 2: Acute and Subchronic Dermal Toxicity			
Species	**Exposure**	**Response**	**Reference**
Acute Dermal			
Acid			
Rabbits, New Zealand White, 5 males and 5 females, weighing 2.200-2.600 kg (males) and 2.550-3.275 kg (females)	Dermal application of 5050 mg/kg technical grade triclopyr to intact skin	No mortality; no clinical signs of toxicity. The only sign of dermal irritation was erythema in 4/10 animals. No effects on body weight gain. Abnormal necropsy findings in 5/10 animals pertained to lungs and kidneys. LD_{50}: >5050 mg/kg (Category IV)	Kuhn 2000a MRID 45451305
Rabbits		LD_{50}: >2000 mg/kg	MRID 00056009 in U.S. EPA/OPP 1998a
TEA Salt			
Rabbits, New Zealand white, (n=6 per sex)	Garlon 3A (46.5% a.i.), dermal exposure for 24 hours	No mortality or changes in gross pathology. LD_{50}: >5000 mg/kg (>1660 mg a.e./kg)	Gilbert 1996, MRID 43952401
Rabbits, New Zealand white, males and females	Garlon 3A	No effects on weight gain or gross pathology. On male dies from an undetermined cause. LD_{50}: >2000 mg/kg (>665 mg a.e./kg)	Mizell and Lomax 1989, MRID 41443302
BEE Ester			
Rats, Fischer 344, 5 males and 5 females, initial weight of 120-180 g	Dermal exposure to 5000 mg/kg bw of NAF-5 (Pathfinder II) (13.9% a.i.) to shaved backs of rats for 24 hours.	LD_{50}: >5000 mg/kg bw (>500 mg a.e./L) No mortality; no treatment-related gross pathology	Brooks and DeWildt 2000, MRID 45181402
Rabbits	Technical grade	LD_{50} >2000 mg/kg (>1440 mg a.e./kg)	MRID 40557005 in U.S. EPA/OPP 1998a
Subchronic Dermal			
Rabbits, New Zealand white, two, weighing 2.91 and 2.95 kg	**Garlon 4** Dermal application of Garlon 4 diluted 1:1 with water at a dose equivalent to 500 mg triclopyr/kg body weight/day 5 days/week for 3 weeks.	Severe skin effects consisting of moderate erythema, slight edema, distinct scales, and slight to distinct necrosis. Autopsy indicated that treatment-related changes were in the skin only. Microscopic examination of the skin showed slight to moderate treatment-related changes. Average triclopyr recovery in the urine over days 1, 7, 14, or 21 of treatment was about 8.5%, with less recovered on day 21 than on days 1,7, and 14.	Van Beeck and Leeg-water 1981a MRID 00153845

Appendix 2: Toxicity to Mammals *(continued)*

A2 Table 2: Acute and Subchronic Dermal Toxicity			
Species	**Exposure**	**Response**	**Reference**
Rabbits, New Zealand white, young adult females, two/dose group, initial weights of 2.66-3.18 kg	**Garlon 4** Dermal application of Garlon 4 diluted 1:1 with water at doses equivalent to 125 or 250 mg triclopyr/kg body weight/day 5 days/week for 3 weeks.	Treatment caused moderate skin effects at low dose and moderate to severe skin effects at the high dose. Microscopic examination of the skin indicated slight to moderate treatment-related lesions. Average triclopyr recovery in the urine collected on days 1,7, 14, and 21 was about 8% at the low dose and about 9% at the high dose. There was no significant increase or decrease in triclopyr excretion during the course of the 3-week application period.	Van Beeck and Leeg-water 1981b MRID 00153846
Rats, Wistar, 25 males and 25 females, 8- to 9-weeks-old, weighing 200-300 g (males) or 150-200 g (females)	**Garlon 4** Dermal application of 1 mL/kg body weight/day (i.e., daily doses of 0.05, 0.5 or 1.0 mL Garlon 4/kg body weight) 5 days/week for 3 weeks. [The Garlon 4 contained 480 mg a.i./mL. Thus, the doses corresponded to 24, 240, and 480 mg a.i./kg bw/day.] Dermal applications were made to the shaved skin area of the shoulder (surface of exposed areas was as close to 10% of the body surface as possible).	Effects included: •very slight skin irritation in males at low dose •slight to moderate skin irritation in males and females at mid-dose •severe skin irritation in males and females at high dose •abnormal behavior in males and females at high dose •significant growth retardation in males at all dose levels •significantly decreased food intake in males at all dose levels •significantly decrease in food efficiency in males at all dose levels and in females at the high dose level •histopathological changes in the skin of males and females at mid and high dose levels. NOEL (males): < 24 mg a.i./kg bw (<≈17 mg a.e./kg bw) NOEL (females): 24 mg a.i./kg bw (≈17 mg a.e./kg bw). LOAEL (females): 240 mg a.i./kg bw (≈170 mg a.e./kg bw).	Van Beeck et al. 1984 MRID 00153806
Rabbits	Triclopyr BEE: 1000 mg/kg/day for 21 days	Increased absolute and relative liver weight in male rabbits at 1000 mg/kg/day. *Decreased alkaline phosphatase in both sexes of rabbits at 1,000 mg/kg/day and increased absolute and relative liver weight in males at 1,000 mg/kg/day were considered marginal and not of toxicological significance* (U.S. EPA/OPP 2002a, p. 58714).	MRID 42212701 as summarized in U.S. EPA/OPP (1996b, 1998a, 2002a)

Appendix 2: Toxicity to Mammals *(continued)*

A2 Table 3: Skin Irritation Studies

Species	Exposure	Response	Reference
Acid			
Rabbits, New Zealand White,3 males and 3 females, weighing 2.400-2.550 kg (males) and 2.275-2.750 kg (females)	Dermal application of 500 mg of triclopyr technical to intact skin, which was covered with semi-permeable dressing, and maintained in contact with the skin for 4 hours	Slightly irritation (Category IV)	Kuhn 2000c MRID 45451308
TEA Salt			
Rabbits, New Zealand white (n=6)	Garlon 3A	No irritation	Mizell 1988b MRID 41443305
BEE Ester			
Rabbits, white		No irritation	MRID 40557008 in U.S. EPA/OPP 1998a

Appendix 2: Toxicity to Mammals *(continued)*

A2 Table 4: Skin Sensitization Studies			
Species	**Exposure**	**Response**	**Reference**
Acid			
Guinea pigs, Hartley-albino, 10 males and 10 females, weighing 360-411 g (males) or 342-393 g (females)	Challenged with dermal dose of 400 mg triclopyr technical after treatment 1/week for 3 weeks with 400 mg triclopyr technical.	No skin sensitization.	Kuhn 2000d MRID 45451309
TEA Salt			
Guinea pigs, Hartley, males, 10	15% Garlon 3A	No delayed contact hypersensitivity.	Berdasco 1990a, MRID 41830601
Guinea pigs, Hartley, males, 10	30% Garlon 3A	No delayed contact hypersensitivity.	Berdasco 1990b, MRID 41830602
Guinea pigs, Hartley, 10	Four samples of 0. 4 mL of Garlon 3A, each containing a different levels ethyl pyridone contaminant as the challenge dose. Positive controls received a challenge dose of 7.5% DER 331	Challenge application with 0.4 mL of Garlon 3A caused slight erythema in 3/10, 4/10, 1/10, and 2/10 animals (in order of increasing concentration of contaminant). Investigators conclude that Garlon 3A has the potential to cause delayed contact hypersensitivity in guinea pigs, but that this potential is not associated in a dose-related manner with the level of ethyl pyridone in the sample.	Berdasco 1994a MRID 43230202
Guinea pigs, Hartley, males, weighing 300-360 g	Garlon 3A	No skin sensitization.	Carreon 1985, MRID 40055701
Guinea pigs, Hartley, males, 10	50% Garlon 3A	Challenge application of 50% Garlon 3A caused slight erythema in 4 of 10 animals.	Mizell 1989, MRID 41443306
BEE Ester			
Guinea pigs, Hartley, 10/sample	Four samples of 0. 4 mL of Garlon 4, each containing a different levels ethyl pyridone contaminant as the challenge dose. Positive controls received a challenge dose of 7.5% DER 331	Challenge application with 0.4 mL of 10% of 5% Garlon 4 caused slight erythema in 4/10, 3/10, 3/10, and 1/10 animals (in order of increasing concentration of contaminant). Investigators conclude that Garlon 4 has the potential to cause delayed contact hypersensitivity in guinea pigs, but that this potential is not associated in a dose-related manner with the level of ethyl pyridone in the sample.	Berdasco 1994b MRID 43230203
Guinea pigs, Hartley, males, 10	7.5% Garlon 4	No sensitization response.	Berdasco 1990a MRID 41830601

Appendix 2: Toxicity to Mammals *(continued)*

A2 Table 4: Skin Sensitization Studies

Species	Exposure	Response	Reference
Guinea pigs, Hartley, males, 10	2.5% Garlon 4	No sensitization response.	Berdasco 1990c MRID 41830603
Guinea pigs		Skin sensitization (NOS)	MRID 40557009 in U.S. EPA/OPP 1989a

Appendix 2: Toxicity to Mammals *(continued)*

A2 Table 5: Acute Inhalation Toxicity

Species	Exposure	Response	Reference
Acid			
Rat, Sprague-Dawley, 5 males and 5 females, weighing 247-324 g (males) or 186-220 g (females)	4-hour exposure to undiluted test substance (triclopyr technical) (fine powder) at 2.56 mg/L	No mortality. Clinical signs of toxicity included decreased activity and piloerection, no longer evident by day 1. No effects on body weight except in one male during the week 1. No abnormal necropsy findings except spotted lungs in one rat. LC_{50}: >2.56 mg/L (Category IV)	Carter 2000, MRID 45451306
TEA Salt			
Rats, male and female		LC_{50}: >2.6 mg/L	MRID 41443303 in U.S. EPA/OPP 1998a
BEE Ester			
Rats, male and female		LC_{50}: >4.8 mg/L	MRID 40557006 in U.S. EPA/OPP 1998a

A2 Table 6: Acute Eye Irritation Studies

Species	Exposure	Response	Reference
Acid			
Rabbits, New Zealand White, 3 males and 3 females, weighing 2.000-2.350 kg (males) or 2.250-2.300 kg (females)	Application of 0.1 mL by volume (42.7 mg) to conjunctival sac of right eye for 24 hours, followed by 1 minute of washing with room temperature deionized water	Mild irritation. No irritation at 7 days after treatment. Toxicity Category II	Kuhn 2000b MRID 45451307
TEA Salt			
Rabbits, New Zealand white, six		Corrosive	Mizell 1988a, MRID 41443304
BEE Ester			
Rabbits		Minimal irritation.	MRID 40557007 as summarized in U.S. EPA/OPP 1998a

A2 Table 7: Reproductive and Developmental			
Species	**Exposure**	**Response**	**Refer-ence**[1]
Reproduction			
Rats, Sprague-Dawley, 35- to 40-days-old, 11-2 males per dose and 23 females per dose	DOWCO 233 (technical grade triclopyr) at dietary concentrations adjusted to provide daily intake of 3, 10, or 30 mg test material per kg of body weight for 3 generations	No effect on the reproductive capacity, growth, or maturation of rats. Third generation pups from one litter at 3 mg/kg/day appeared weak and evidenced retarded growth. This was associated with non-functioning mammary glands in the dam. No similar effects were observed at higher doses. Working Note: Also included in Hanley et al. 1983, MRID 00137618, and as a publication by Hanley et al. 1984.	Beliles and Wosu 1976, MRID 00057084 **Not cited in U.S. EPA/OPP 1998a**
Rats, Sprague-Dawley, mated females, weighing 217-221 g, 25/dose group	Dowco 233 [triclopyr acid] administered by gavage at doses of 0, 50, 100, or 200 mg/kg/day once daily, on days 6-15 of gestation.	Signs of maternal toxicity observed in some rats from all dose groups included rough hair, salivation, occasional dyspnea. Retarded ossification at 200 mg/kg/day. Working Note: This submission appear to cover the same study as MRID 00072441 above. The cover page of MRID 41688301 indicates that the "Reformat" is prepared by Breslin.	Breslin 1990a, MRID 41688301

A2 Table 7: Reproductive and Developmental

Species	Exposure	Response	Reference[1]
Rats, Sprague-Dawley, male and female, 30/sex/dose	Triclopyr acid (technical, 99.4%) in the diet at nominal doses of 0, 5, 25, or 250 mg/kg/day (P1 high dose males received 100 mg/kg/day for the first 29 days of the study) for 10 weeks prior to breeding. After 10 weeks, P1 rats were mated to produce F1 litters. After weaning, groups of 30 male and 30 female F_1 pups were randomly selected to become the second parental (P_2) generation. After approximately 12 weeks of dietary exposure the P_2 adults were mated to produce the F_2 litters	No adverse treatment-related effects observed on any parameter in adult and neonatal males or females given 5 mg triclopyr/kg/day; no reproductive or developmental effects noted at 25 mg/kg/day; decrease in adult male and female feed consumption and body weights throughout the study at 250 mg/kg/day, compared with controls. NOEL = 5 mg/kg/day for parental systemic toxicity. NOEL = 25 mg/kg/day for fertility and neonatal toxicity. `Working Note: This study is the basis for the U.S. EPA/OPP (1998a) RfD for triclopyr cited in the RED.`	Vedula et al. 1995 MRID 43545701
Additional Notes on Vedula et al. 1995 Treatment related increases in relative kidney weights observed at 25 (P1 males only) or 250 mg/kg/day (P1 and P2 male and females); decreased liver weights in adult rats at 250 mg/kg/day; kidneys identified pathologically as the target organ for toxicity in both generations of adult rats; treatment related degeneration of renal proximal tubules in some male and female rats at 25 mg/kg/day and the majority of male and female rats at 250 mg/kg/day; no histopathological findings accompanied the decreased liver weights at 250 mg/kg/day; no treatment related gross or histopathological changes in either adult generation of male or female rats at 5 mg/kg/day; and no primary treatment related toxicological or histopathological changes on the reproductive organs in either generation of male or female rats in any dose group. Pup weights, pup survival, and litter sizes significantly decreased at the 250 mg/kg/day dose in both generations; and fertility and conception rates in second generation males and females decreased at 250 mg/kg/day. The lower fertility rates were attributed to the female in light of the effects on litter size and pup survival and lack of effects on spermatogenesis as indicated by histopathological evaluation of the testes.			
Developmental			
Rats, Sprague-Dawley, mated females, weighing 217-221 g, 25/dose group	Dowco 233 [triclopyr acid] administered by gavage at doses of 0, 50, 100, or 200 mg/kg/day once daily, on days 6-15 of gestation.	Signs of maternal toxicity observed in some rats from all dose groups included rough hair, salivation, occasional dyspnea. Retarded ossification at 200 mg/kg/day.	Breslin 1990a, MRID 41688301

Appendix 2: Toxicity to Mammals *(continued)*

A2 Table 7: Reproductive and Developmental

Species	Exposure	Response	Reference[1]
Rabbits, New Zealand, white, females	Triclopyr **TEA** via gavage on days 6 through 18 of gestation at dose levels of 0, 10, 30, or 100 mg/kg/day.	Severe maternal toxicity at 100 mg/kg, including mortality, body weight loss, decreased feed consumption, increased abortions (attributed to maternal toxicity), and increased liver and kidney weights. Equivocal effects on abortions and early deliveries, associated with weight loss or anorexia in affected dams were observed at 30 mg/kg/day No developmental or teratogenic effects even at maternally toxic dose levels. Maternal NOEL = 10 mg/kg/day Developmental NOEL = 100 mg/kg/day	Breslin and Billington 1995 Working Note: This is an abstract only published in the open litera-ture.
Rabbits, New Zealand, white, females	Triclopyr **BEE** via gavage on days 6 through 18 of gestation at dose levels of 0, 10, 30, or 100 mg/kg/day.	Severe maternal toxicity at 100 mg/kg, including mortality, body weight loss, and decreased feed consumption. Developmental effects were observed only at 100 mg/kg and included increased resorption, decreased litter size and litter weight, and increases in minor skeletal alterations, specified as additional sterbral centers, reduced ossification of digital bones, and extra (13) ribs. No teratogenic effects even at maternally toxic dose levels. Maternal NOEL = 30 mg/kg/day Developmental NOEL = 30 mg/kg/day	Breslin and Billington 1995 Working Note: This is an abstract only published in the open litera-ture.
Rats, CD, mated females	Gavage doses of 0, 30, 100, or 300 mg/kg/day triclopyr **TEA** on days 6 through 15 of gestation.	Marked maternal toxicity at 300 mg/kg/day manifested as mortality, clinical signs, body weight loss or decreased body weight gain, increased water and decreased feed consumption, and increased kidney weights. At lower doses, signs of maternal toxicity included decreased feed consumption and increased water consumption at 100 mg/kg/day. Developmental effects included decreased fetal weight and decreased ossification at 300 mg/kg/day. Maternal NOEL = 30 mg/kg/day Developmental NOEL = 100 mg/kg/day	Breslin et al. 1996 Working Note: This is only an abstract published in the open litera-ture.

Appendix 2: Toxicity to Mammals *(continued)*

A2 Table 7: Reproductive and Developmental

Species	Exposure	Response	Reference[1]
Rats, CD, mated females	Gavage doses of 0, 5, 30, 100, or 300 mg/kg/day triclopyr **BEE** on days 6 through 15 of gestation.	Marked maternal toxicity at 300 mg/kg/day manifested as mortality, clinical signs, body weight loss or decreased body weight gain, increased water and decreased feed consumption, and increased kidney and liver weights. (Note: Liver effect not seen with TEA as summarized above). At lower doses, maternal effects included decreased increased water consumption at 100 mg/kg/day and decreased body weight at both 30 and 100 mg/kg bw/day. Developmental effects included an increased incidence of extra (14^{th}) rib at 300 mg/kg/day. Maternal NOEL = 30 mg/kg/day Developmental NOEL = 100 mg/kg/day	Breslin et al. 1996 Working Note: This is only an abstract published in the open litera-ture.
Rabbits, New Zealand white, females	Triclopyr **BEE** technical (96.9% a.i.) administered at doses of 0, 10, 30, or 100 mg/kg/day on gestations days 6-18 inclusive.	Evidence of maternal toxicity at 100 mg/kg included mortality during test article administration, decreased number of live fetuses, decreased number of live fetuses/dam, increased post-implantation loss ($p<0.05$), and increased number of fetal deaths. Evidence of developmental toxicity at 100 mg/kg included decreased number of live fetuses, increased number of fetal deaths, and increased number of fetal and/or litter incidence of skeletal anomalies and variants. Maternal NOEL = 30 mg/kg Maternal LEL = 100 mg/kg, based on increased mortality at this dose. Developmental NOEL = 30 mg/kg Developmental LOEL = 100 mg/kg	Bryson 1994a, MRID 43217601

Appendix 2: Toxicity to Mammals *(continued)*

A2 Table 7: Reproductive and Developmental

Species	Exposure	Response	Reference[1]
Rats, time-mated Crl: CD (SD) BR VAF/Plus females	Triclopyr triethylamine (**TEA**) salt technical (46.5% a.i.) administered at doses of 0, 30, 100, or 300 mg/kg, corrected for compound purity, on days 6 through 15 of gestation.	Maternal toxicity at 300 mg/kg included increased incidence of clinical signs (salivation) and mortality (1 death). Maternal NOEL = 100 mg/kg Maternal LOEL = 300 mg/kg, based on increased incidence of salivation and mortality. Developmental toxicity at 300 mg/kg was manifested as decreased mean fetal body weight, increased fetal and litter incidence of skeletal anomalies (reduced ossification), and an increased incidence in the number of fetuses with unossified sternebrae. Developmental NOEL = 100 mg/kg Developmental LOEL = 300 mg/kg, based on decreased mean fetal weight, increased fetal and litter incidence of skeletal anomalies, and increased fetal incidence of unossified sternebrae.	Bryson 1994b, MRID 43217602
Rabbits, New Zealand white females	Triclopyr TEA technical (46.5% a.i.) administered at doses of 0, 10, 30, or 100 mg a.i./kg on days 6 through 18 of gestation, inclusive.	Maternal toxicity at 100 mg/kg manifested as increased mortality during test article administration, decreased body weight gain and food efficiency, and increased liver and kidney weights. Maternal NOEL = 30 mg/kg Maternal LOEL = 100 mg/kg day, based on decreased body weight gain, decreased food efficiency, and increased liver and kidney weight. Developmental toxicity at 100 mg/kg was manifested as decreased number of litters, decreased number of corpus lutea, decreased number of total implants, decreased number of total live fetuses, increased embryonic deaths and deaths/dam, and increased pre-implantation loss. Developmental NOEL = 30 mg/kg Developmental LOEL = 100 mg/kg, based on decreased number of live implants, decreased number of live fetuses, and increased embryonic deaths.	Bryson 1994c, MRID 43217603
Rats, Crl:CD (SD) VAF/Plus, 25 dams/group	**Triclopyr TEA**, 0, 22, 72 or 216 mg a.e./kg bw/day on GD 6-15	216 mg/kg Dose: Maternal toxicity – mortality in one dam, reduced body weight gain with reduced food and water consumption, increased liver and kidney weight. Fetal Effects: increased incidence of unossified sternebrae. 72 mg/kg Dose: reduced food and water consumption in dams. 22 mg/kg Dose: no effects.	Carney et al. 2007

A2 Table 7: Reproductive and Developmental

Species	Exposure	Response	Reference[1]
Rats, Crl:CD (SD) VAF/Plus, 25 dams/group [designated as Study 1]	**Triclopyr BEE**, 0, 22, 72 or 216 mg a.e./kg bw/day on GD 6-15	216 mg/kg Dose: Maternal mortality 3/25; Severe signs of toxicity in 2 surviving dams; Transient initial decrease in maternal body weight gain. Decreased maternal bw gain throughout study. Significant decrease in fetal body weight and gravid uterine weights. Increase in late resorptions. Significant increase in total number of malformations (16), 13 of which occurred in 3 litters. Based on Table 2 from the study, the incidence of microphthalmia and anophthalmia (abnormally small or missing eyes) was statistically significant (p=0.05) in the high dose group. This endpoint was not assessed in the high dose group of Study 2. 72 mg/kg Dose: Transient initial decrease in body weight gain. Significant decrease in gravid uterine weights. 22 mg/kg Dose: Transient initial decrease in body weight gain.	Carney et al. 2007
Rats, Crl:CD (SD) VAF/Plus, 30 dams/group[designated as Study 2]	**Triclopyr BEE**, 0, 3.6, 22, 72 or 216 mg a.e./kg bw/day on GD 6-15	216 mg/kg Dose: Maternal mortality 1/30; Transient initial decrease in body weight gain. Signs of maternal toxicity in one surviving dam. 72 mg/kg Dose: Transient initial decrease in body weight gain. 22 mg/kg Dose: Transient initial decrease in body weight gain. 3.6 mg/kg Dose: No effects	Carney et al. 2007
		Summary of Fisher Exact tests of data from Carney, Studies 1 and 2 from Table 2 of the publication. Number of litters with any fetal malformations Dose (a.i.) / Study 1 / Study 2 / Combined 0 / 2/25 / 3/27 / 5/52 5 / / 2/27 / 2/27 30 / 1/25 / 1/29 / 2/54 100 / 3/25 / 1/29 / 4/54 300 / 6/26 0.17 / 4/29 (p=0.54) / 10/55 (p=0.16) Based on the Fisher Exact test, none of the observations are statistically significant. Carney et al. (2007) also reports late resorptions in 2/26 liters in the high dose group and 0/25 in the control group. This is not statistically significant (p=0.25).	Carney et al. 2007
Rabbits, New Zealand white, females	Triclopyr acid (98.5% purity) by gavage at dose levels of 0, 10, or 25 mg/kg/day on days 6 through 18 of gestation.	Transient, dose-related decreases in maternal body weight gain. No signs of treatment-related effects on fetal growth or development	Hanley et al. 1983 MRID 00137618

Appendix 2: Toxicity to Mammals *(continued)*

A2 Table 7: Reproductive and Developmental

Species	Exposure	Response	Reference[1]
Rats, Sprague-Dawley, female adults	Triclopyr acid, (98.5% purity) at gavage doses of 0, 50, 100, or 200 mg/kg/day on days 6 through 15 of gestation.	Dose-related, transient maternal toxicity, including roughening of the hair and excessive shedding was observed in all dose groups. Body weight gain was decreased 13% in the 100 mg/kg/day group and 17% in the 200 mg/kg/day group. Food consumption was also decreased in the 100 and 200 mg/kg/day groups. No significant adverse effects were observed with respect to the number of corpora lutea, implantations, or litter size. An increased resorption rate at 200 mg/kg/day was attributable to complete resorption of one entire litter. A slight, but not statistically significant decrease in fetal body weight was observed at 200 mg/kg/day. Two fetuses from the 200 mg/kg/day dose group had major malformations – i.e., cleft palate, brachycephaly (short broad head), and various skeletal abnormalities. Minor soft tissue and skeletal variations were observed in fetuses from the control and treated groups.	Hanley et al. 1983 MRID 00137618

Appendix 2: Toxicity to Mammals *(continued)*

A2 Table 7: Reproductive and Developmental

Species	Exposure	Response	Reference[1]
Rats, CD, time-mated females, 25/dose group in Phase I and 30/dose group in Phase II.	Phase I: Gavage doses of 0, 30, 100, or 300 mg/kg/day **triclopyr BEE** (97.0% pure) on days 6 through 15 of gestation. Phase II: Gavage doses of 0, 5, 30, 100, or 300 mg/kg/day **triclopyr BEE** (97.0% pure) on days 6 through 15 of gestation.	At 300 mg/kg/day, signs of marked maternal toxicity including four deaths, overt clinical signs in a few dams, mean body weight loss and decreased mean body weight gain, decreased mean feed consumption, increased mean water consumption, and increased mean liver and kidney weights. At 100 and 30 mg/kg/day, slight initial reduction in body weight gain that persisted throughout the study; increased water consumption at 100 mg/kg/day. The only litter effects seen in both Phase I and Phase II was an increased incidence of extra ribs at 300 mg/kg/day. In Phase I, an increase in late in utero deaths at 300 mg/kg/day. Decreased uterine weight and litter weight at 100 and 300 mg/kg/day in Phase I only. Effect was not dose dependent. In Phase I, a dose-related increase in number of litters with malformed fetuses: 2/25, 1/23, 3/24, and 6/16 at 0, 30, 100, or 300 mg/kg/day. Related to the control groups, the increase in litters with malformed fetuses was significant [p=0.028] only in the high dose group. In the 100 mg/kg bw dose group, the increase is not significant [p=0.48] Abnormalities included microphthalmia/anophthamia (small or missing eyes) and other craniofacial abnormalities. Malformed litters were from dams with the most severe signs of toxicity at 300 mg/kg/day. The malformations were not seen in Phase II. NOEL for embryotoxicity = 100 mg/kg/day **Working Note: Note: Phase I and II are two separate studies. Phase II was conducted to assess the reproducibility of effects seen in Phase I.** **This study is cited but not discussed in U.S. EPA/OPP (1998a) RED for triclopyr. This study** appears **to be used by U.S. EPA/OPP (2002) as the basis for the acute RfD of 1 mg/kg/day.**	Jones 1995 MRID 43675801
Rabbits, New Zealand white, females	Triclopyr **TEA** single bolus dose in corn oil suspension at dose levels of 0, 10, 25, or 75 mg/kg/day on days 6-18 of gestation.	Slight increase in maternal mortality at 75 mg/kg/day; no effects on other maternal parameters at any dose level. No treatment-related effects on observed on any developmental parameters at any dose level. NOEL = 75 mg/kg/day for developmental toxicity	Kirk et al. 1989

Appendix 2: Toxicity to Mammals *(continued)*

A2 Table 7: Reproductive and Developmental

Species	Exposure	Response	Reference[1]
Rabbits, New Zealand white, females	DOWCO 233 [triclopyr acid] at dose levels of 25, 50, or 100 mg/kg/day by gavage during days 6-18 of gestation,	Maternal toxicity, including mortality was observed at all dose levels; no evidence of toxicity to the developing embryo and fetus as a result of maternal treatment; no gross anomalies observed at any dose level; no soft tissue anomalies among litters of treated animals, compared with controls. Investigators conclude that DOWCO 233 administered to pregnant rabbits at dose levels that caused some maternal deaths was neither embryotoxic nor fetotoxic.	Smith et al. 1960 MRID 00057083
Rats, Sprague-Dawley, mated females with initial mean body weights of 205-215 g, 25 rats/dose group	Dowco 233 [triclopyr acid] administered by gavage at doses of 0, 50, 100, or 200 mg/kg/day once daily, on days 6-15 of gestation.	Signs of maternal toxicity, including rough hair, salivation, occasional dyspnea and tremors, and apparent abdominal discomfort immediately after treatment were observed at all dose levels. Food consumption was decreased at 100 and 200 mg/kg/day and body weight gain was significantly depressed at 200 mg/kg/day. Treatment did not significantly affect the numbers of implantations, viable fetuses, resorptions, or corpora lutea, fetal body weights or sex ratios. Among litters from dams exposed to 200 mg/kg/day, there was a statistically significant increase in the incidence of retarded ossification of the skull bones. Also, two fetuses from the same group had major malformations, which, because of the low incidence, could not be equivocally attributed to treatment. Doses of 50 or 100 mg/kg/day, although mildly toxic to the dams, did appear to cause adverse effects in the developing fetuses.	Thompson et al. 1979 MRID 00072441

A2 Table 8: Subchronic and Chronic Oral Toxicity			
Species	**Exposure**	**Response**	**Refer-ence**
Subchronic oral			
Rats, Fischer 344, weanling, male and female, 10/sex/dose group	Dietary exposure to **triclopyr BEE** in the diet at doses equivalent to 0, 7, 28, 70, or 350 mg/kg bw/day for 13 weeks.	70 mg/kg bw/day caused histopathological renal alterations and elevated relative kidney weights in males, but not females. 350 mg/kg bw/day caused lower body weights and feed consumption, elevated relative kidney weights, and degeneration/regeneration of the descending portion of the renal proximal tubules in both males and females. Hepatic toxicity in both males and females at 350 mg/kg bw/day evidenced by minor elevations in ALP, ALT, and AST values, elevated relative liver weights, and histopathological changes. NOEL Males: 28 mg/kg bw/day triclopyr BEE in males for subchronic dietary exposure (≈20 mg a.e./kg bw/day). Females: 70 mg/kg bw/day triclopyr BEE in females for subchronic dietary exposure. (≈50 mg a.e./kg bw/day). LOAEL Males: ≈50 mg a.e./kg bw/day Females: ≈250 mg a.e./kg bw/day The investigators indicate that the results of this study are *consistent* with the results reported by Landry et al. (1984) which uses the same strain of rats and equivalent dose levels of triclopyr (acid). As summarized below, the NOEL and LOEL from Landry et al. 1984 are below those from this study – i.e., Barna-Lloyd et al. 1992.	Barna-Lloyd et al. 1992, MRID 42274901 **Not cited in RED or HED Science Chapter.**

Appendix 2: Toxicity to Mammals *(continued)*

A2 Table 8: Subchronic and Chronic Oral Toxicity			
Species	**Exposure**	**Response**	**Refer-ence**
Rats, Fischer 344, M&F	Dietary exposure to **triclopyr technical** (98% a.i.) at doses equivalent to 0, 5, 20, 50, or 250 mg/kg bw/day for 13 weeks.	At equal to or greater than 20 mg/kg/day, increased incidence of proximal tubule degeneration of the kidneys in both sexes; at 50 mg/kg/day, significant increase in absolute and relative kidney weight in males; at 250 mg/kg/day, increase in relative kidney weight in males and females. Slight decrease in body weight in females at 250 mg/kg and in males at 50 and 250 mg/kg. Dose/severity related degeneration of the proximal tubules of the kidneys at dose equal to or greater than 20 mg/kg. This was accompanied by an increase in kidney weight. Slight functional changes in kidneys at 250 mg/kg. Centrilobular liver cells of male rats at 250 mg/kg were slightly more eosinophilic than controls. This was accompanied by a slight elevation of SGPT and a decrease in serum proteins. Systemic NOEL = 5 mg a.e./kg/day Systemic LOEL = 20 mg a.e./kg/day, based on histopathological changes in kidneys of male and female rats.	Landry et al. 1984 MRID 00150378
Dogs, beagle, male and female, 4 dogs/sex/ dose group	Dietary doses of triclopyr technical at 0, 0.1, 1, 0.5, or 2.5 mg/kg/day for 183 days (males) or 184 days (females).	No significant treatment related effects on body weight, food consumption, hematology, or clinical chemistry in male or females; at 2.5 mg/kg/day, a decreased rate of phenolsulfonthalein (PSP) excretion was observed; however, the effect, later determined to be the result of triclopyr and PSP competing for renal excretion, was not considered toxicologically relevant. NOEL: Equal to or greater than 2.5 mg/kg/day LOEL: Not determined.	Quast et al. 1977, MRID 00071794

Appendix 2: Toxicity to Mammals *(continued)*

A2 Table 8: Subchronic and Chronic Oral Toxicity			
Species	**Exposure**	**Response**	**Refer-ence**
Dogs, beagle, male and female, 14 months old, 4 dogs/ sex/dose group	Dietary concentrations of DOWCO 233 [triclopyr technical] at doses of 0, 5, 10, or 20 mg/kg/day for 228 days.	Decreased body weight and food consumption in females at all dose levels; slight thinning of coat hair in females at 10 and 20 mg/kg/day; decrease in erythroid values in males and females at 20 mg/kg/day; effects on clinical chemistry, including increased SGPT activity in all females at all dose levels and in males at 20 mg/kg/day, increased AP and OCT activity in females at 20 mg/kg/day, increased SGOT activity in males and females at 20 mg/kg/day, and decreased renal excretion of PSP dye in males and females at all dose levels. [A 38-day supplemental study suggested the existence of a competitive mechanism of renal excretion for the test material and the PSP dye at dose levels of 1 or 2, but not 0.5, mg/kg/day. This effect is now well understood in terms of active transport mechanisms in the kidney] Principal organ weight changes included increased relative liver weights in males at 10 and 20 mg/kg/day and in females at 20 mg/kg/day; relative kidney weight were increased in females at 10 and 20 mg/kg/day; necropsy examination revealed decreased amounts of adipose tissue in females at 20 mg/kg/day; microscopic examinations revealed minimal (reversible) degenerative changes in liver and kidneys in males and females at all dose levels. NOEL = 10 mg/kg/day LOEL = 20 mg/kg/day for male and female dogs, based on decreased body weight gain and decreased hematological parameters in males; changes in clinical chemistry in males and females, and liver histopathology in male and female dogs.	Quast et al. 1976 MRID 00071793
Dogs, beagle, male and female, 14 months old, 4 dogs/ sex/dose group	Gelatin capsules and dietary exposures to DOWCO 233 [triclopyr technical] at 0, 0.5, and 2 mg/kg bw/day for 10 days.	This is a supplemental study reported with the above entry study. Designed to evaluated the effects of DOWCO 233 on PSP excretion in dogs. NOAEL for an inhibition of secretion of PSP (given either in gelatin capsules or by incorporation into the diet) by male dogs was 0.5 mg/kg/day. LOAEL: 2 mg/kg/day resulted in a slight inhibition of PSP secretion. Inhibition of PSP secretion was reversible after a minimum of 10 days.	Quast et al. 1976 MRID 00071793

Appendix 2: Toxicity to Mammals *(continued)*

A2 Table 8: Subchronic and Chronic Oral Toxicity			
Species	**Exposure**	**Response**	**Refer-ence**
Mice (NOS), male and female	Dietary concentrations of technical grade triclopyr at doses levels of 0, 200, 400, 800, 1600, or 3200 ppm (equivalent to nominal doses of 30, 60, 120, 240 or 480 mg/kg/day) for 28 days (range finding study).	At equal to or greater than 120 mg/kg/day, dose-related adverse effects included centrilobular swelling and degeneration of hepatocytes in males and mild increases in liver enzymes at 240 mg/kg/day; at 480 mg/kg/day, effects in males included single cell necrosis of the liver, significant increases in alkaline phosphatase, AST, and ALT, and liver enlargement and dark color. An increase in the incidence of thymic enlargement was observed in high dose male and female mice	Tsuda et al. 1987 MRID 40356601, also as summarized in U.S. EPA/OPP 1998a
Chronic Oral			
Rats, Fischer 344, male and female, 50/sex/dose group	Dietary exposure to triclopyr technical (98.0% a.i.) at dose levels of 0, 3, 12, or 36 mg/kg bw/day for 2 years. [Additional groups of 10 rats/sex/dose group received dietary exposure to same dose levels of triclopyr for 6 and 12 months.]	No treatment-related mortality; statistically significant decreases observed in red cells at 12 months, in hemoglobin at 6 months, and in hematocrit at 6 and 12 months. Absolute and relative kidney weights significantly increased (10-17%) in high dose (36 mg/kg/day) male rats, with an apparent dose-related trend at 12 months. Female rats at all dose levels had an increased incidence of pigmentation of the proximal descending tubule, compared with controls, while male rats in the 6-month treatment group had an increased incidence of proximal tubule degeneration at the 12 and 26 mg/kg/day dose levels, compared with controls. NOEL for chronic toxicity = 12 mg/kg/day for males and 36 mg/kg/day for females. LOEL = 36 mg/kg/day for males based on marginal increases in proximal tubular degeneration at 6 months. No significant trends in tumor incidence for male rats. There were significant pair-wise differences vs controls at 3 and 12 mg/kg triclopyr in the incidence of adrenal gland benign pheochromocytomas and benign and/or malignant pheochromocytomas combined and in the incidence of skin fibromas at 3 and 12 mg/kg/day ($p<0.05$) for all comparisons except the incidence of pheochromocytoma (benign and combined) at 12 mg/kg ($p<0.01$ vs controls). Female rats had significant increasing trends in mammary gland adenocarcinomas ($p<0.05$) and in adenomas and/or adenocarcinomas combined ($p<0.01$). There was a significant difference in the pair-wise comparison fo the 36 mg/kg/day dose group with controls for mammary gland adenomas and/or adenocarcinomas combined ($p<0.05$). There were no significant pair-wise comparisons or trends for the incidence of adrenal gland pheochromocytomas in female rats.	Eisenbrandt et al. 1987 MRID 40107701

Appendix 2: Toxicity to Mammals *(continued)*

A2 Table 8: Subchronic and Chronic Oral Toxicity			
Species	**Exposure**	**Response**	**Refer-ence**
Dogs, beagles, male and female, 3 months old, 4/sex/dose group	Dietary concentrations of triclopyr technical (98.9% a.i.) at doses of 0, 0.5, 2.5, or 5.0 mg/kg/day for 1 year.	No significant effects of treatment on mortality, clinical signs, body weight, or food consumption in males or females at any dose levels. Statistically significant increases in creatinine (30 and 40% in males dogs at 2.5 and 5.0 mg/kg/day dose levels; 55 and 44% in females at 12 months). No histopathological changes in the kidney. A decrease in PSP excretion in the middle- and high-dose dogs. Significant increases in serum urea nitrogen and creatinine at 2.5 mg/kg. There effects were more pronounced at 5 mg/kg. No effects at 0.5 mg/kg. **This is the basis for the OPP/RfD.** **This study was used as the basis for the previous U.S. EPA/OPP (1995b) RfD on triclopyr.**	Quast et al. 1988 MRID 41200301
Mice, ICR, 60 mice/sex/ dose group	Dietary concentrations of triclopyr technical (98.0% a.i.) at dose levels of 0, 50, 250, or 1250 ppm corresponding to equivalent oral doses for males of 5.55, 28.6, or 143 mg/kg/day and equivalent oral doses for females of 5.09, 26.5 or 135 mg/kg/day for 95 weeks	In high dose males (143 mg/kg/day), water consumption increased an average of 25 % beginning at week 13; plasma BUN increased 25%, compared with controls, at 26 weeks, and liver weight increased by 17% at week 26 only. In high dose females (135 mg/kg/day), kidney weight increased 10-16%, while urinary protein was also increased at week 52. There were, however, no pathology data to support a true toxic effect on the kidney of treated males or females. A significant increasing trend in mammary gland adenocarcinomas ($p<0.05$) was observed in female mice; no compound-related tumors were observed in male mice. There were no significant differences in the pair-wise comparisons of treated groups and controls.	Tsuda et al. 1987 MRID 40356601

Appendix 2: Toxicity to Mammals *(continued)*

A2 Table 9: Mutagenicity Studies

Organism	Exposure Level	Assay System	Effects	Reference
Salmonella typhimurium	≤5000 µg/plate	Ames assay	negative results with strains TA98 and TA100	Moriya et al. 1983
Salmonella typhimurium (TA 98, TA 100, TA 1535, and TA 1537)	triclopyr BEE (98% a.i.) 50-5000 µg/plate with or without metabolic activation	Ames assay	negative results	MRID 41732202
B. subtillis	triclopyr technical acid at 20-2000 µg/disk	recombination repair assay using rec-assay mutant (H17) and recombination repair deficient mutant (M45)	no evidence of growth inhibition for the repair competent or repair deficient bacterial strains used.	MRID 00038408
Salmonella typhimurium (TA 98 and TA 100)	triclopyr technical acid at 1-5000 µg/plate	reverse mutation assay	no increases in number of revertant colonies in the absence or presence of liver S-9 for strains tested.	MRID 00038408
Salmonella typhimurium (TA 98, TA 100, TA 1535, TA 1537 and TA 1588)	triclopyr technical (98% a.i.) at 10, 1000, 10,000 µg/plate with or without metabolic activation (rat liver S-9)	Ames assay	no significant increases in the number of revertant colonies in the absence or presence of metabolic activation	MRID 00031939
Mice	triclorpyr BEE at 0, 60, 200, or 600 mg/kg	*in vivo* micronucleus assay	not clastogenic	MRID 41747101
Mice, ICR, males, 10/dose group	triclopyr at single oral doses of 0, 0.7, 7.0, or 70 mg/kg followed immediately by ip injection of *Salmonella* TA-1530, *Salmonella* G-46 or *Saccharomyces* D-3	host-mediated assay	no significant increases in mutant or recombinant frequencies at any dose level, compare with controls	MRID 00057085
Mice, ICR, males, 10/dose group	triclopyr at doses of 0, 0.7, 7.0, or 70 mg/kg once/day for 5 days followed by ip injection of *Salmonella* TA-1530, *Salmonella* G-46 or *Saccharomyces* D-3 on day 5	host-mediated assay	no significant increases in mutant or recombinant frequencies at any dose level, compare with controls	MRID 00057085

Appendix 2: Toxicity to Mammals *(continued)*

A2 Table 9: Mutagenicity Studies

Organism	Exposure Level	Assay System	Effects	Reference
Mice, 30 treated males per dose group each mated to 4 untreated mature virgin females	dietary levels of 0, 3, 15, or 70 mg/kg/day triclopyr (NOS) for 9 consecutive weeks	dominant lethal assay	no significant toxic effects in treated males and no significant differences in body weights; no significant effects on fertility index, average number of implantations, average resorption rate, or average litter size in any of the untreated females bred to treated males	MRID 00028996
Rat	triclopyr BEE at 1.0-1000µg/mL	unscheduled DNA synthesis with rat hepatocytes	No DNA damage or inducible repair in hepatocytes	MRID 41747102
Rats, Sprague-Dawley, 5/dose group	triclopyr (NOS) at single doses of 0.7, 7.0, or 70 mg/kg	*in vivo* cytogeneticis study	no cells with chromosomal aberrations observed upon sacrifice at 6, 24, or 48 hours	MRID 00057086
Rats, Sprague-Dawley, 5/dose group	triclopyr at single doses of 0.7, 7.0, or 70 mg/kg for 5 days	*in vivo* cytogeneticis study	no cells with chromosomal aberrations observed upon sacrifice on day 5	MRID 00057086
Rats, Sprague-Dawley males, 10/dose group, sequentially mated to 2 untreated females/week for 7 weeks	triclopyr (NOS) at 0.7, 7.0, and 70.0 mg/kg for 7 weeks 0.3 mg/kg triethylene melamine served as positive control; negative control = corn oil plus saline	dominant lethal assay	at week 1 a decrease in mating index at 7 and 70 mg/kg dose levels; trend toward increase in average number of resorptions at 7 and 70 mg/kg dose levels, with statistical significance apparent at week 4 (7 mg/kg), week 5 (70 mg/kg), and week 7 (70 mg/kg). At 70 mg/kg/, increased proportion of one or more dead implanta-tions, compared with controls	MRID 00057087

A2 Table 9: Mutagenicity Studies				
Organism	**Exposure Level**	**Assay System**	**Effects**	**Reference**
Rats	$5x10^{-3}$, $1.56x10^{-3}$, $5x10^{-4}$, $1.56x10^{-4}$, $5x10^{-5}$, $1.56x10^{-5}$, $5x10^{-6}$M triclopyr for 18 hours in the presence of µCi/mL ^{3}H-thymidine	rat hepatocyte unscheduled DNA synthesis	toxicity to hepatocyte cultures, manifested as granular appearance of hepatocytes, occurred at $1.56x10^{-5}$M and increased in dose related manner until no cells remained viable at $5x10^{-3}$M. Triclopyr did not elicit significant DNA repair in primary cultures	MRID 40055702

A2 Table 10: Field Studies

Application	Observations	Reference
Triclopyr (not otherwise specified) at 2.2 kg a.i./ha applied in 1983 with and without prescribed burning in 1985, 1986, and 1987. Area: Cross Timbers Experimental Range (CTER) near Stillwater, Oklahoma, 648 ha area composed of blackjack oak, post oak, red cedar, savannas, and prairies.	Increase in the population of cotton rats in all treated areas attributed to improved habitat for the cotton rat - i.e. increase in understory cover and more abundant food. This increase was more pronounced on burned areas. Decrease in numbers of rats with helminth infections in treated areas - more pronounced in areas treated with both herbicide and burning.	Boggs et al. 1991a
See Boggs et al. 1991a above.	Prevalence of Cuterebra (larvae of botflies) infestations in small mammals (white-footed deer mice, eastern woodrats, harvest mice, and cottontail rabbits) was significantly greater on unburned sites compared to burned sites. This effect could be associated with high soil temperatures during burning.	Boggs et al. 1991a
Aerial applications of Release (triclopyr BEE) at 1.9 kg a.e./ha for conifer release in Ontario.	Effects on populations of small mammals appeared to be related primarily to changes in vegetation. No indication of toxicity.	Lautenschlager et al. 1997 and 1998
Aerial application of triclopyr TEA at a rate of 2.2 kg a.i./ha to cross timbers region of Central Oklahoma with and without prescribed burning . Objective of study to evaluate habitat use by male and female white-tailed deer on areas treated with herbicides, prescribed fire, and both in the cross timber.	Deer: Both sexes selected and avoided specific brush treatments throughout the year. Female deer were considerably more selective than males of human altered habitats. No clear pattern of selection or avoidance of triclopyr and tebuthiuron treatments were apparent. Variable herbicide and burn application patterns (mosaic) seems to enhance cross timbers rangeland for white-tailed deer.	Leslie et al. 1996
see description under Boggs et al. 1991a above	Oak overstory replaced by elm and eastern red cedar. Understory dominated by pioneer forbs and grasses. Effects on cotton tail rabbits examined. Compared to untreated controls, triclopyr did not influence body mass or size of rabbits and had no effect on kidney fat or relative kidney weight. A slight but statistically significant increase in relative mass of the spleen on triclopyr treated areas with or without burning compared to untreated area. This difference was not significant when compared to burned areas without herbicide treatments.	Lochmiller et al. 1995

Appendix 2: Toxicity to Mammals *(continued)*

A2 Table 10: Field Studies

Application	Observations	Reference
see description under Boggs et al. 1991a above	Increase in population density of woodrats on triclopyr treated site compared to control site associated with an increase in forage and nest-building material. No significant differences in sex and age ratios between triclopyr and triclopyr/burn sites. No effect on reproductive activity. No effect on testes or seminal vesicle gland weights for either triclopyr and triclopyr/burn sites compared to controls. No effect of treatment on body mass or stomach content weights.	McMurry et al. 1993a
See description under Boggs et al. 1991a above	Detailed study of rat diets in treated and untreated areas. In general, forb and browse diet classes were used in accordance with availability - i.e. eastern woodrats are opportunistic feeders.	McMurry et al. 1993b
See description under Boggs et al. 1991a above	Increase in population density and reproductive activity of cotton rats. This was associated with an increase in herbaceous dicots, compared to the untreated plot. Nutritional quality of herbaceous vegetation may have been enhanced by annual burning.	McMurry et al. 1994
A 1:1 mixture of triclopyr TEA and picloram applied on June 21, 1992 and June 16, 1993 by helicopter at a rate of 47.5 L/ha with 1.9 L each of picloram and triclopyr in a 1:5 diesel oil emulsion to a randomized, complete block design with three treatments: controls (no treatment), treated with herbicide in 1992 only, and treated with herbicide in 1993 only. Experimental units were 13.3 ha in size. A drift retardant (38 F) and a commercial surfactant (blend of paraffin oil, polyol fatty acid esters, polyethoxylates esters, and ethoxylated alkyl aryl phosphate esters) were used. Treatments were designed to control honey mesquite (*Prosopis glandulosa*) in Texas.	No negative impact on plant and vertebrate species richness and diversity during the first 2 years after treatment when annual rainfall was 16% above average.	Nolte and Fulbright 1997

Appendix 3: Toxicity to Birds

A3 Table 1: Acute Oral/Gavage Toxicity to Birds

Species	Exposure	Response	Reference[1]
Mallard duck (*Anas platyrhynchos*), 14 days old, average Day bw ≅ 220 to 250 g/bird, 50 birds/dose	Triclopyr acid, 215, 464, 1000, 2150, and 4640 mg/kg bw. 14-day observation period.	LD_{50} = 1698 mg/kg NOAEC (mortality): 464 mg/kg bw Signs of toxicity prior to death: incoordination and lethargy. An NOAEC for signs of toxicity is not reported.	Wildlife International 1976a, MRID 40346401
Mallard duck (*Anas platyrhynchos*), 14 days old, average Day 0 bw ≅ 26 to 30 g/bird, 50 birds/dose	Triclopry TEA (64.7% a.i.), 14-day observation period.	LD_{50} = 2055 mg a.i./kg The a.i. value is from 3176 mg formulation/kg x 64.7% a.i./formulation LD_{50} = 1418 mg a.e./kg	MRID 40346501, U.S. EPA/OPP 1998a and 2009a, and cited as Fink 1978 Also summarized in Mayes 1990h
Mallard duck (*Anas platyrhynchos*), age, bw, and number/dose not specified in EPA summary.	Triclopry TEA, 8-day observation period	LD_{50} = 1417.6 mg a.e./kg Note: This is virtually identical to the above MRID.	MRID 00134178, U.S. EPA/OPP 2009a
Northern bobwhite quail (*Colinus virginianus*), additional details not available.	Garlon 4, Triclopry BEE (62.9% a.i.)	LD_{50} = 849 mg a.i./kg (611 mg a.e./kg bw) This a.i. value is from 1350 mg formulation /kg x 62.9% a.i./formulation	Campbell and Lynn 1991b, MRID 41902003
Northern bobwhite quail (*Colinus virginianus*), 30 weeks, average Day 0 bw ≅ 194 to 205 g/bird, 10 birds/dose	Triclopyr BEE, 96.1%, 21-day observation period. Doses: 175, 292, 486,810, 1350, and 2250 mg a.i./kg of body weight.	LD_{50} = 735 mg a.i./kg bw (529 mg a.e./kg bw) LOEC: 486 mg a.i./kg bw (≈350 mg a.e./kg bw), incoordination, reduced response to stimuli, lethargy, coma. NOEC (mortality): 292 mg a.i./kg bw (≈210 mg a.e./kg bw) NOEC (toxicity): 175 mg a.i./kg bw (≈126 mg a.e./kg bw)	Campbell and Lynn 1991a, MRID 41902002
Northern bobwhite quail (*Colinus virginianus*), 18 weeks, average Day 0 bw 175 to 198 g/bird, 5 per sex/dose	TCP (99.9%), 14 day observation period. Doses: 62.5, 125,250,500, 1000 and 2000 mg/kg bw.	LD_{50} = >2000 mg a.i./kg bw. No mortality at 2000 mg/kg bw/day. NOAEC: 125 mg/kg bw LOAEC: 250 mg/kg bw (reduced body weight)	Campbell et al. 1990

Appendix 3: Toxicity to Birds *(continued)*

A3 Table 2: Acute Dietary Toxicity to Birds

Species	Exposure	Response	Reference[1]
Acid			
Mallard duck (*Anas platyrhynchos*), additional details not available	Triclopyr acid, (99.0% a.i.)	LC_{50} = 5620 ppm	Beavers et al. 1979a, MRID 0031249
Japanese quail (*Coturnix japonica*), age 10 to 15 day, Day 0 body weight 97 to 136 g/bird, 15 birds/test dose with 75 birds in control group.	Triclopyr acid, 5-day dietary with 3 day recovery at 0, 500, 1000, 2000, 3980, and 5000 ppm. Used Day-4 food consumption. Food consumption on other days impacted by wastage or wet food. Food consumption: ≈ 18 g/bird/day BW: ≈33 g/bird Food consumption rate: ≈0.55.	LC_{50} = 3272 ppm NOAEC: 1000 ppm, no signs of toxicity. (≈550 mg a.e./kg bw) LOAEC: 2000 ppm, lethargy (≈1100 mg a.e./kg bw).	Norris 1973, MRID 00049638
Northern bobwhite quail (*Colinus virginianus*), 14 days old, Day 0 bw 32 to 35 g/bird, 10 birds/dose	Triclopyr acid, 5-day dietary (with 3 day recovery period) at concentrations of 464, 1000. 2150, 4640. and 10.000. Food consumption and BW on p. 6 of study. 1000 ppm: BW=40g/bird, FC=42.5 g/bird, factor≈1.06. 2150 ppm: BW=38g/bird, FC=33.0 g/bird, factor≈0.87.	LC_{50} = 2934 ppm (≈2553 mg a.e./kg bw) NOEC (mortality): 1000 ppm (≈1000 mg a.e./kg bw)	Wildlife International 1976b, MRID 40346403
TEA Salt			
Mallard duck (*Anas platyrhynchos*), no additional details available.	Triclopyr TEA (64.7% a.i.)	LC_{50} >10,000 ppm formulation or >4464.8 ppm a.e.	MRID 40346502, U.S. EPA/OPP 1998a and 2009a, Fink 1977
Northern bobwhite quail (*Colinus virginianus*)	Triclopyr TEA (64.7% a.i.) at 0, 464, 1000, 2150, 4640, and 10,000 ppm, 5-day exposure with 3-day recovery. Food consumption and BW on p. 8 of study. 2150 ppm: BW=31.5g/bird, FC=42.5 g/bird, factor≈1.35. 10,000 ppm: BW=29.5g/bird, FC=17.3 g/bird, factor≈0.58.	LC_{50} = 11,622 ppm formulation or 5,189 ppm a.e. (≈3000 mg a.e./kg bw) NOAEC (mortality): 2150 ppm formulation (995 mg a.e./kg bw)	Wildlife International 1977, MRID 40346503 Also summarized in Mayes 1990g.

Appendix 3: Toxicity to Birds *(continued)*

A3 Table 2: Acute Dietary Toxicity to Birds			
Species	**Exposure**	**Response**	**Reference[1]**
BEE			
Mallard duck (*Anas platyrhynchos*), 10 animals per dose group	Triclopyr BEE (93.% a.i.) 8-day dietary at 464, 1000, 2150, 4640 and 10,000 ppm a.i. ≤2150 ppm: No effect on food consumption or bw. ≈0.243 g food/g bw 4640 ppm: Significant decrease in food consumption (≈7.9% fd/bw-d) and body weight (≈71% of controls. 10,000 ppm: Significant decrease in food consumption (≈3% fd/bw-day) and body weight (≈62% of controls.	LC_{50} >10,000 ppm a.i. (> 6689 ppm a.e.) No mortality at any dose. NOAEC: 2150 ppm (≈350 mg a.e./kg bw correcting for compound purity). LOAEC: 4640 ppm, reduced food consumption and bw gain. FEL: 10,000 ppm, lethargy, depression and reduced response to stimuli.	Fink et al. 1977, MRID 00134179
Mallard duck (*Anas platyrhynchos*)	Triclopyr BEE (96.1.% a.i.) 5-day dietary with 3 day recovery at 304, 540, 961, 1711, 3037, and 5401 ppm a.i. Detailed bw and food consumption in Tables 3 and 4 of study. Approximate averages during 5-day exposure for key doses below: 961 ppm: bw=222 g, fd= 82 g, prop. = 0.37. 1711 ppm: bw=192 g, fd=54 g, prop.=0.28.	LC_{50} >5401 ppm a.i. (>3885 ppm a.e. or ≈>1087.8 mg a.e./kg bw) No mortality. NOEC: 961 ppm a.i. (≈246 mg a.e./kg bw/day) LOEC: 1711 ppm a.i., reduced body weight gain. (≈313 mg a.e./kg bw/day)	Lynn et al. 1991b , MRID 41905502 Wildlife International Study ID: 103-354

Appendix 3: Toxicity to Birds *(continued)*

A3 Table 2: Acute Dietary Toxicity to Birds

Species	Exposure	Response	Reference[1]
Northern bobwhite quail (*Colinus virginianus*)	Triclopyr BEE (93% a.i.), 8-day dietary at 464, 1000, 2150, 4640 and 10,000 ppm a.i. Decreased bw and food consumption at 464 and 10,000 ppm but not at other doses. At 1000 ppm, 0.263 g food/g bw.	Study: LC_{50}: 9020 (6791-11,996) ppm (≈6495 ppm a.e. or 1708 mg/kg bw) Mortality: 3/10 at 464 ppm and 6/10 at 10,000 ppm. ≥1,000 ppm: Dose-response increase in lethargy and related signs of toxicity. Mortality in low dose group attributed to cannibalism and not used in calculation of LC_{50}. U.S. EPA/OPP 1996c: LC_{50} = 9026 ppm a.i. (6038 ppm a.e.). LOEC: 1000 ppm (≈173 mg a.e./kg bw correcting for compound purity) NOEC: 464 ppm might be viewed as an NOEC. A conversion to mg/kg bw cannot be reliably made due to the mortality and the manner in which the food consumption and bw data are reported. This could be viewed as a failed study.	Fink et al. 1978, MRID 00134180 U.S. EPA/OPP 1996c: Accepted as Core.
Northern bobwhite quail (*Colinus virginianus*)	Triclopyr BEE (96.1% a.i.), 5-day dietary with 3 day recovery at 304, 540, 961, 1711, 3037, and 5401 ppm a.i. Available summary does not provide information on food consumption or body weights.	LC_{50} = 5401ppm a.i. (3885 ppm a.e.) NOEC (toxicity): 961 ppm a.i. (≈691 ppm a.e.) LOEC: 1711 ppm a.i., reduced weight gain. No mortality at 3037 ppm a.i. Working Note: Using a food consumption factor of 0.263 from Fink et al., 1978, the NOEC is ≈182 mg a.e./kg bw.	Lynn et al. 1991a , MRID 41905501 Wildlife International Study ID: 103-353

continued on next page

A3 Table 2: Acute Dietary Toxicity to Birds			
Species	**Exposure**	**Response**	**Reference[1]**
Other feeding studies (excepting reproduction studies)			
Zebra finches (*Poephila guttata*), bw ≈13.5 g (study, Table2, p. 322)	Triclopyr BEE. All concentrations appear to be expressed as a.i. 50 to 4050 ppm. Exposures for 8 or 29 days. Food consumption values not reported. Based on U.S. EPA/ORD (1993, p. 3-4), food consumption in passerines in g/day can be estimated at 0.398 $W^{0.85}_{(g)}$. Taking 13.5 g as a typical weight, food consumption would be about 3.64 g or a factor of 0.27 relative to bw. For a 12 g bird (weight loss in Table 2), the food consumption factor would be about the same but food consumption was probably less due to toxicity.	LC_{50} =1923 (1627-2277) ppm a.i. or 1383 ppm a.e. (LD_{50}: ≈318 mg a.e./kg bw based on food consumption factor of 0.23). See Section 4.1.2.2.1.2 for the discussion of the food consumption factor. 8-Day Assay: Decreased body weight at 800 ppm a.i. or 585 ppm a.i. (≈155 mg/kg bw). Longer-term NOAEC: 50 ppm (≈9.7 mg a.e./kg bw [50 mg a.e./kg food x 0.27 x 0.719])	Holmes et al. 1994
TCP			
Mallard duck (*Anas platyrhynchos*), 10 days old at start, Average Day 0 bw of 160 to 177 g. 10 birds/dose except that 30 birds used in control.	TCP (99.9%). Dietary concentrations of 562, 1000, 1780, 3160 and 5620 ppm. 5 days with a 3 day post-exposure observation period. Food consumption rate at lowest concentration based on Day 5 weight: 62 g food/301 g bw ≅ 0.206 g food/g bw.	LC_{50}: >5620 ppm LOAEC: 562 ppm based on reduced body weight gain. Based on food consumption, the LOAEC corresponds to a dose of about 116 mg/kg bw. NOAEC: not determined.	Long et al. 1990

Appendix 3: Toxicity to Birds *(continued)*

A3 Table 3: Reproductive and Subchronic Toxicity to Birds			
Species	**Exposure**	**Response**	**Reference**[1]
Reproduction			
Mallard duck (*Anas platyrhynchos*), males and females, 6 months old	DOWCO 233 (98.9% a.i.), dietary concentrations of 100, 200, or 500 ppm. Food consumption was about 10% of body weight [Table 4 of study]. Thus, doses were about 10, 20, and 50 mg/kg bw/day. Note: U.S. EPA/OPP 1998a (p. 38) identifies test compound a triclopyr acid.	100 ppm: No symptoms of toxicity or behavioral effects at any dose level; no treatment-related mortality; slight, statistically significant ($p<0.01$) decrease in food consumption at 100 ppm dose 200 ppm: Reduction in number of 14-day-old survivors as percentage of eggs was reduced and the reduction approached statistical significance. No statistically significant reproductive effects 500 ppm: Statistically significant decrease in body weight; statistically significant ($p<0.01$) reduction in number of 14-day-old survivors as percentage of eggs set. U.S. EPA/OPP 1998a (RED) and U.S. EPA/OPP 2009a: NOAEL: 100 ppm (10 mg/kg bw/day) LOAEL: 200 ppm (20 mg/kg bw/day)	Beavers et. al. 1980 MRID 00031250 Also summarized in Mayes 1991a.
Northern bobwhite quail (*Colinus virginianus*) Note: Study abstract gives high dose as 300 ppm. This is apparently a typo.	Triclopyr acid (98.9% a.i.) DOWCO 233, dietary concentrations of 0,100, 200, or 500 ppm. Food consumption was 7.5 to 10% of bw [Table 4, p. 18]. No concentration related differences in bw or food consumption. Take 0.075 kg fd/kg bw for dose conversion.	No statistically significant reproductive impairment at any dose level; statistically significant reduction in eggshell thickness at 200 ppm, but this effect was not observed at 100 or 500 ppm. NOEC = 100 ppm (≈7.5 mg a.e/kg bw) LOEC = 200 ppm (≈15 mg a.e/kg bw) U.S. EPA/OPP 2009a, Appendix A, p. 4 classifies 500 ppm [≅37.5 mg/kg bw/day] as a NOAEC but also cites 200 ppm as an LOAEC. This is repeated on p. 24 of Appendix A. U.S. EPA/OPP 1998a (RED) cites 500 ppm as NOEC.	Beavers et al. 1979b, MRID 00031251
Mallard duck (*Anas platyrhynchos*)	Triclopyr, 21 weeks, 0, 400, 800 ppm a.i. Mid-point food consumption: ≈ 160 g/bird/day. Body weight: ≈1152 g. Food Consumption Rate: ≈0.14. Doses from study (p. 23): 54.7 mg/kg bw at 400 ppm and 117.8 mg/kg bw at 800 ppm	No overt signs of toxicity at any dose. LOAEL: 800 ppm (117.8 mg/kg bw): Reduction in adult female body weight, a decrease in egg production at the end of the egg laying period and an increase in number of females with regressed ovary that were considered treatment related . NOAEL: 400 ppm (56 mg/kg bw). Note clear if this study has been submitted to or reviewed by U.S. EPA/OPP.	Temple et al. 2007

Appendix 3: Toxicity to Birds *(continued)*

A3 Table 4: Field Studies

Application	Observations	Reference
Triclopyr (not otherwise specified) at 2.2 kg a.i./ha applied in 1983 with and without prescribed burning in 1985, 1986, and 1987. Area: Cross Timbers Experimental Range (CTER) near Stillwater, Oklahoma, 648 ha area composed of blackjack oak, post oak, red cedar, savannas, and prairies.	Herbaceous forage (forbs and grasses) increased after herbicide application. No effect on nutritional status of bobwhite quail.	Boren et al. 1993
Treatment described in Boggs et al. 1991a. The following is from the entry for Boggs et al. 1991a in Appendix 2, Table 10. Triclopyr (not otherwise specified) at 2.2 kg a.i./ha applied in 1983 with and without prescribed burning in 1985, 1986, and 1987. Area: Cross Timbers Experimental Range (CTER) near Stillwater, Oklahoma, 648 ha area composed of blackjack oak, post oak, red cedar, savannas, and prairies.	No treatment related effects on bird density. Types of birds varied from control based on habitat preference.	Schulz et al. 1992a
	Greater bird density and species richness in autumn and winter on herbicide plots.	Schulz et al. 1992b

Appendix 4: Toxicity to Terrestrial Plants

A4 Table 1: Vegetative Vigor

Form	Exposure	Response	Reference [1]
Triclopyr BEE	0.002, 0.009, 0.03, 0.14, or 0.56 kg/ha applied at 3 weeks after planting	Monocots: at 0.56 kg/ha, phytotoxic to all monocots: causing growth inhibition and adventitious root growth in corn; growth inhibition, some twisting of lower stems, and adventitious root growth in oats; some leaf rolling and adventitious root formation in wheat; under-developed roots with adventitious root formation in grain sorghum; and death, swollen stem bases, and adventitious and inhibited root development in Kleingrass. Dicots: at 0.56 kg/ha, extensive damage to peanuts, including growth inhibition, callus growth, and shortened and twisted stems; no new growth occurred in cotton treated with 0.14 or 0.56 kg/ha; extensive damage to cucumbers at ≥0.009 kg/ha; extensive damage to soybeans at all treatment levels.	Bovey and Meyer 1981
Triclopyr TEA	14 day exposure period, 45.2% triclopyr.	Shoot length Species / NOEC (lb a.e./ac) / EC_{25} (lb a.e./ac) **Dicots** Sunflower: 0.0028 / 0.005 Sugar beet: 0.11 Tomato: 0.018 Oilseed rape: 0.064 Radish: 0.132 Soybean: 0.028 **Monocots** Wheat: >0.69 Corn: 0.32 Onion: 0.24	MRID 43129801 in U.S. EPA/OPP 2009a, Schwab 1993

A4 Table 1: Vegetative Vigor

Form	Exposure	Response	Reference [1]
Triclopyr BEE	0, 4.4, 8.8, 17.5, 35, 70, 140, 280, 561, 1121, or 2242 g a.i./ha.	**Results given in study.** See U.S. EPA/OPP 2990a values on the following page.	Schwab 1995 MRID 43650001

Shoot length (Summary Table D in Study)

Species	NOEC (g a.i./ha)	EC_{25} (g a.i./ha)
Alfalfa	70	87
Carrots	17.5	50
Corn	140	763
Oats	>2242	>2242
Onions	280	506
Radishes	35	127
Soybeans	35	104
Sunflowers	4.4	11
Tomatoes	35	48
Wheat	1121	>2242

Shoot weight (Summary Table E in Study)

Species	NOEC (g a.i./ha)	EC_{25} (g a.i./ha)
Alfalfa	70	42*
Carrots	4.4	26
Corn	140	522
Oats	>2242	>2242
Onions	280	99*
Radishes	35	121
Soybeans	35	43
Sunflowers	4.4	10
Tomatoes	17.5	41
Wheat	561	901

* Different methods are used to estimate the NOEC and EC_{25}. In some cases, this leads to reported NOECs that exceed the EC_{25}.

** This is not a typo.

Note: Some entries in the SERA (2003) RA had erroneously entered EC_{50}s rather than EC_{25}s in the column for the EC_{25}s.

A4 Table 1: Vegetative Vigor

Form	Exposure	Response	Reference [1]
Triclopyr BEE	0, 4.4, 8.8, 17.5, 35, 70, 140, 280, 561, 1121, or 2242 g a.i./ha.	Results as reported in U.S. EPA/OPP 2009a. **Shoot weight** Species: Onions; NOEC (lb a.e./ac): **<0.063**; EC_{25} (lb a.e./ac): 0.063 Species: Sunflowers; NOEC (lb a.e./ac): ***0.028 (0.0028)***; EC_{25} (lb a.e./ac): 0.006 Cells marked in bold are not consistent with study data. This may reflect are reanalysis by U.S. EPA/OPP (2009a). Cells marked in ***bold/italics*** in the above two sub-tables appear to be typographical errors. The correct value is given in parentheses. The error in the shoot weight of sunflowers is particularly important because this is the most sensitive endpoint identified by U.S. EPA/OPP (2009a) for triclopyr BEE in this study.	Schwab 1995 MRID 43650001 *(continued from previous page)*

A4 Table 2: Seedling Emergence

Form	Exposure	Response	Reference [1]
Garlon 4	Soil from a mixed wood clear cut. Triclopyr, as Garlon 4) added at levels of 10, 50, 100, 500, 1000, and 5000 ppm (dry weight).	Emergence of seedlings naturally occurring in the soil was monitored. Substantial inhibition of *Rubus* spp, other dicots and monocots at all concentrations of 50 ppm and above. No substantial inhibition at 10 ppm. At levels of 500 ppm and above, no germination. The concentration of 10 ppm is essentially a NOEL and 50 ppm a FEL.	Morash and Freedman 1989
Triclopyr TEA	14-day observation period	Shoot length	MRID 43129801 in U.S. EPA/OPP 2009a, Schwab 1993

Species	NOEC (lb a.e./ac)	EC_{25} (lb a.e./ac)
Dicots		
Sunflower		0.69
Sugar beet		>0.69
Tomato		>0.69
Oilseed rape		>0.69
Radish		>0.69
Soybean	0.0028	>0.28
Monocots		
Wheat		>0.69
Corn		>0.23
Barley	0.23	>0.23
Onion		>0.69

Triclopyr TEA	21-day observation period	EC_{25}s reported as <9 lb a.e./acre for several species of dicots (sunflower, sugar beet, tomato, oilseed rape, radish and soybean) and monocots (wheat, corn, barley and onion). No additional details provided. Note: This study is cited as a Tier I study in the RED (U.S. EPA/OPP 1998a) but is not otherwise summarized.	MRID 41734301 in U.S. EPA/OPP 2009a, Weseloh and Stockdale 1990
Triclopyr BEE	21-day observation period	EC_{25}s reported as <8 lb a.e./acre for several species of dicots (sunflower, sugar beet, tomato, oilseed rape, radish and soybean) and monocots (wheat, corn, barley and onion). No additional details provided. Note: This study is cited as a Tier I study in the RED (U.S. EPA/OPP 1998a) but is not otherwise summarized.	MRID 41734301 in U.S. EPA/OPP 2009a, Weseloh and Stockdale 1990

A4 Table 2: Seedling Emergence

<table>
<tr><th>Form</th><th>Exposure</th><th>Response</th><th>Reference [1]</th></tr>
<tr><td>Triclopyr BEE</td><td>4.4, 8.8, 17.5, 35, 70, 140, 280, 561, 1121, or 2242 g a.i./ha.</td><td>Results reported in study. See U.S. EPA/OPP 2990a values on the following page.
Percent emergence
<table>
<tr><th>Species</th><th>NOEC (g a.i./ha)</th><th>EC₂₅ (g a.i./ha)</th></tr>
<tr><td>Alfalfa</td><td>280</td><td>40*</td></tr>
<tr><td>Carrots</td><td>561</td><td>147*</td></tr>
<tr><td>Soybeans</td><td>280</td><td>445</td></tr>
<tr><td>Corn, Oats, Onions, Radishes, Sunflowers, Tomato, Wheat</td><td>>2242</td><td>>2242</td></tr>
</table>
Shoot length
<table>
<tr><th>Species</th><th>NOEC (g a.i./ha)</th><th>EC25 (g a.i./ha)</th></tr>
<tr><td>Alfalfa</td><td>280</td><td>95*</td></tr>
<tr><td>Carrots</td><td>70</td><td>100</td></tr>
<tr><td>Corn</td><td>>2242</td><td>>2242</td></tr>
<tr><td>Oats</td><td>>2242</td><td>>2242</td></tr>
<tr><td>Onions</td><td>280</td><td>477</td></tr>
<tr><td>Radishes</td><td>>2242</td><td>1523</td></tr>
<tr><td>Soybeans</td><td>70</td><td>187</td></tr>
<tr><td>Sunflowers</td><td>>2242</td><td>>2242</td></tr>
<tr><td>Tomatoes</td><td>1121</td><td>1709</td></tr>
<tr><td>Wheat</td><td>>2242</td><td>>2242</td></tr>
</table>
Shoot weight
<table>
<tr><th>Species</th><th>NOEC (g a.i./ha)</th><th>EC₂₅ (g a.i./ha)</th></tr>
<tr><td>Alfalfa</td><td>280</td><td>183*</td></tr>
<tr><td>Carrots</td><td>20</td><td>138</td></tr>
<tr><td>Corn</td><td>>2242</td><td>>2242</td></tr>
<tr><td>Oats</td><td>>2242</td><td>>2242</td></tr>
<tr><td>Onions</td><td>70</td><td>62*</td></tr>
<tr><td>Radishes</td><td>1121</td><td>967</td></tr>
<tr><td>Soybeans</td><td>35</td><td>222</td></tr>
<tr><td>Sunflowers</td><td>>2242</td><td>>2242</td></tr>
<tr><td>Tomatoes</td><td>140</td><td>332</td></tr>
<tr><td>Wheat</td><td>>2242</td><td>>2242</td></tr>
</table>
* Different methods are used to estimate the NOEC and EC₂₅. In some cases, this leads to reported NOECs that exceed the EC₂₅.
Note: Some entries in the SERA (2003) RA had erroneously entered EC₅₀s rather than EC₂₅s in the column for the EC₂₅s.</td><td>Schwab 1995, MRID 43650001</td></tr>
</table>

A4 Table 2: Seedling Emergence

Form	Exposure	Response	Reference [1]
Triclopyr BEE	4.4, 8.8, 17.5, 35, 70, 140, 280, 561, 1121, or 2242 g a.i./ha.	**Results reported in study.** See U.S. EPA/OPP 2990a values on the following page. Shoot weight **Species** / **NOEC (lb a.e./ac)** / **EC_{25} (lb a.e./ac)** Onions / **0.0021** / **0.053** * Different methods are used to estimate the NOEC and EC_{25}. In some cases, this leads to reported NOECs that exceed the EC_{25}. **Values in bold** are not consistent with results reported in study. May reflect a reanalysis of the raw data by U.S. EPA/OPP (2009a).	Schwab 1995, MRID 43650001 as summarized in U.S. EPA/OPP 2009a

A4 Table 3: Other Toxicity Studies

Species	Exposure	Response	Reference
Three native grass species (buffalograss, blue grama, and sideoats grama)	Triclopyr BEE: application rates of 0.2, 0.6, 1.1, 2.2, 4.5, and 9 kg/ha	Significant inhibition of germination at 2.2 kg/ha and above. No significant effect at 1.1 kg/ha or below. Units of application rate not clear but appear to be in a.i.	Huffman and Jacoby 1984
Tomatoes	Triclopyr (NOS) with adjuvant (Boost, not further described). Direct spary.	NOEC (visual damage): 0.006 kg/ha. EC5 (dry weight): 0.007 kg/ha.	Ray et al. 1996

A4 Table 4: Field Studies

Application	Observations	Reference
Triclopyr (commercial formulation of 480 g/L, consistent with Garlon 4) applied to soil (Elkton silt loam - plowed, disced, and harrowed) at rates of 3.4, 6.7, and 10.1 kg/ha by ground sprayer. Treated in May 1988. Site in Prince George's County, MD. Different types of vegetation planted at varying periods after application.	Wheat tolerated all applications by day 8 after application (8 DAA) in terms of visual assessment of injury but yield from untreated plots was about twice that of treated plots. Kidney beans tolerated 3.4 and 6.7 kg/ha applications 82 DAA and no effect on yield was noted. Corn tolerated 3.4 6.7 and 10.1 kg/ha by 8, 47, and 82 DAA. At 3.4 kg/ha, yield was reduced to about 80% of control level. By 82 DAA, squash emerged and grew normally at 3.4 kg/ha. Earlier plantings often resulted in emergence and plant death. At 3.4 kg/ha, the yield of okra sowed 8 DAA was not effected. Potato plant fresh weights from 436 DAA of triclopyr at 3.4 kg/ha were only moderately less (6%) than untreated controls. Bananas evidence signs of injury at all application rates. After 2 years, all cites were covered by indigenous species with no apparent differences between treated and untreated cites. By this time, all crops except bananas tolerated triclopyr residues in soil.	Coffman et al. 1993
Apple and peach trees	Soil applications of up to 1.12 kg a.e./ha (1 lb a.e./acre) applied to soil have no adverse effect. Foliar applications at efficacious rates did damage tree limbs.	Derr 1993
Pastures treated with triclopyr at 2.2 kg/ha in June of 1983 and burned in late spring of 1985, 1986, and 1987. Stillwater, Oklahoma.	Frequency of horseweed, rosette panicgrass, and little bluestem increased with treatment due to reduction in woody overstory. Pronounced increase in the production of forbs and browse which would likely be beneficial for wildlife habitat.	Engle et al. 1991

A4 Table 4: Field Studies

Application	Observations	Reference
Garlon 4 helicopter application at 1.68 kg a.e./ha in diesel oil (winter: late dormant period) or Garlon 4 helicopter application at 1.40 kg a.e./ha in water (spring: early foliar period) to 2- or 3-year-old plantations of Douglas fir. Principal woody plants on the sites included shrubs (thimbleberry, salmonberry, vine maple, and trailing blackberry) and hard wood trees (red alder, big-leaf maple, and bittercherry). Principal herbaceous plants included sword-fern, pearly-everlasting, fireweed, foxglove, and bracken fern.	Response of competing vegetation and planted Douglas fir were studied for 10 years after six herbicide and manual release treatments in Washington and Oregon Coast Ranges. Treatment caused visual symptoms of injury to Douglas fir (45% of trees); 2-years after triclopyr treatment, Douglas fir growth was less than that of untreated check, suggesting the prolonged effects of herbicide injury.	Harrington et al. 1995
Triclopyr BEE (probably Garlon 4 or equivalent) at rates of 0.28, 0.56, and 1.12 kg ai/ha on a pasture by backpack sprayer.	Efficacy study on the control of southern wax myrtle. The highest application rate, substantial defoliation and mortality.	Kalmbacher et al. 1993
Triclopyr (not otherwise specified) at a rate of 4.5 kg ai/ha on pine stands by backpack sprayer at monthly intervals from April to October of 1981. Location: Sierra Nevada Mountains, elev. 1300 m.	Assayed effects on various conifer species. Jeffery Pine: Severe (>60%) damage on all dates of application, and no difference in herbicide tolerance between application dates. A slight tendency for less severe effects with applications in April and may, before new leaves began the rapid phase of growth. Sugar Pine: Maximum damage after June and October applications. Minimum damage after September application. Damage highly correlated with xylem pressure potential. Red Fir: Less injury with applications in spring and most damage from applications in summer. White Fir: Most injury during summer applications with less in May and September. Douglas Fir: Most injury with applications in May and June (period of leader growth) and least injury after applications during a time of maximum water stress. High tolerance after annual growth ceased and when water stress was high.	King and Radosevich 1985
Combination of Garlon/Tordon (picloram) at 11.7 L/ha and 18.7 L/ha. Formulation of Garlon not specified. Applied along a power-line corridor in Ohio in late June of 1990.	After one year, less plant coverage relative to control. A lesser but still noticeable effect after two years. Treatment favored germination of annuals rather than perennial herbs and vines. Relatively rapid recovery of trees.	Luken et al. 1993

A4 Table 4: Field Studies

Application	Observations	Reference
Hand sprayer application of triclopyr BEE at rates of 0.56, 1.12, and 2.24 kg/ha. [Whether these are acid equivalents is not specified. Assume not for risk assessment.] Area: Washington, Texas, huisache plants about 1-2 meters tall (about 800/ha) on a Bleiblerville clay.	Triclopyr BEE caused no mortality in target plant (huisache) but caused a modest reduction in canopy at the two high application rates. Grasses were favored over broadleaf plants at the middle dose but no effect on either was seen at the low dose.	Meyer and Bovey 1990
Garlon 3A, 2.2 and 4.4 kg/ha by aerial application.	Vegetative hardwood and shrub cover over 1.5 meters in height virtually eliminated. Differences in height and cover were apparent at 9 years after application.	Newton et al. 1992a [NJAF 9:126]
Garlon 3A, 2.2 and 4.4 kg/ha by aerial application.	Conifers dominated over hardwoods. Some injury to conifers at the higher application rate.	Newton et al. 1992b [NJAF, 9:130]
Triclopyr at 0.4 and 0.8 kg ai/ha by backpack sprayer to 3 cultivars of rice.	Moderate injury (primarily leaf necrosis, chlorosis, and stunting) to all three cultivars at both rates of application with a dose/dependent decrease in yield.	Pantone and Baker 1992
Triclopyr (RELEASE/TBEE) at nominal rates of 0.4, 1.26, 2.12, 2.98, and 3.84 kg a.e./ha by backpack sprayers (VMD=1089 µm) in early fall to clear-cuts in New Brunswick.	Plots assayed two growing seasons after application evidenced shallow dose/response patterns in terms of decreased crown area.	Pitt et al. 1993
Triclopyr rates of 0.03 and 0.06 kg/ha on cotton to simulate drift. Fine sandy loam soil in Mississippi.	Higher application rate decrease height of cotton when applied to pin-head square but not early-bloom. Effects not seen at lower application rate. Both application rates delayed crop maturity and lowered yield.	Snipes et al. 1991
Triclopyr at 0.3, 0.4, or 0.6 kg/ha plus X-77, a surfactant, applied to cotton.	When applied to early booting stage, there was a dose/related decrease in yields. When applied to three- to four-leaf rice, hyponasty was observed.	Street et al. 1992
Treatment described in Boggs et al. 1991a. The following is from the entry for Boggs et al. 1991a in Appendix 2, Table 10. Triclopyr (not otherwise specified) at 2.2 kg a.i./ha applied in 1983 with and without prescribed burning in 1985, 1986, and 1987. Area: Cross Timbers Experimental Range (CTER) near Stillwater, Oklahoma, 648 ha area composed of blackjack oak, post oak, red cedar, savannas, and prairies.	Effective control of dominant overstory brush species, blackjack oak and post oak. Less effective against American elm, gum burnelia, hackberry, roughleaf dogwood, buckbrush, and eastern redcedar.	Stritzke et al. 1991

Appendix 5: Toxicity to Fish.

Most sensitive toxicity values are highlighted in working copy of this appendix.

A5 Table 1: Triclopyr Acid, Acute Toxicity

Species	Exposure	Response	Reference
Rainbow trout (*Oncorhynchus mykiss*)	96 hours	LC_{50}: 117 mg a.e./L NOEC not reported in study.	Batchelder 1973, MRID 00049637
Bluegill sunfish (*Lepomis macrochirus*)	96 hours	LC_{50}: 148 mg a.e./L NOEC not reported in study.	Batchelder 1973, MRID 00049637
Coho salmon	99.2%, 96 hours, static	LC_{50}: 9.6 mg a.e./L	Wan et al. 1997
Chum salmon	99.2%, 96 hours, static	LC_{50}: 7.5 mg a.e./L	Wan et al. 1997
Sockeye salmon	99.2%, 96 hours, static	LC_{50}: 7.5 mg a.e./L	Wan et al. 1997
Rainbow trout	99.2%, 96 hours, static	LC_{50}: 7.5 mg a.e./L	Wan et al. 1997
Chinook salmon	99.2%, 96 hours, static	LC_{50}: 9.7 mg a.e./L	Wan et al. 1997
Pink salmon	99.2%, 96 hours, static	LC_{50}: 6.3 mg a.e./L	Wan et al. 1997

A5 Table 2: Triclopyr TEA, Acute Toxicity

Species	Exposure	Response	Reference
Channel catfish (*Ictalurus punctatus*), juveniles, 2-3" long	96 hours, Garlon 3A, static renewal	Formulation 48-h LC_{50} = 384.3 ± 22.0 mg/L 96-h LC_{50} = 344.3 ± 20.6 mg/L a.e. 48-h LC_{50} = 122.6 ± 7.0 mg/L 96-h LC_{50} = 109.5 ± 6.6 mg/L	Abdelghani 1995, Table 1
Bluegill sunfish (*Lepomis macrochirus*)	96 hours, Garlon 3A, static renewal	Formulation 48-h LC_{50} = 295.6 ± 7.6 mg/L 96-h LC_{50} = 286.1 ± 25 mg/L a.i. 48-h LC_{50} = 94.0 ± 2.4 mg/L 96-h LC_{50} = 91.0 ± 7.9 mg/L	Abdelghani 1995, Table 2
Channel catfish (*Ictalurus punctatus*)	96 hours, Garlon 3A	LC_{50} = 447 mg/L as Garlon 3A LC_{50} = 142 mg a.e./L NOAEC: 103 mg a.e./L LOAEC (lethargy): 141 mg a.e./L	Barron and Ball 1989 MRID 41714301 Not listed in U.S. EPA/OPP 1998a or 2009a.

Appendix 5: Toxicity to Fish *(continued)*

A5 Table 2: Triclopyr TEA, Acute Toxicity			
Species	**Exposure**	**Response**	**Reference**
Coho salmon (*Oncorhynchus kisutch*), juvenile	96 hours, Garlon 3A (assume 31.8% a.e.), static	LC_{50} = 400 ppm (apparently as formulation) LC_{50} = 127.2 mg a.e./L	Janz et al. 1991
Fathead minnow (*Pimephales promelas*)	96 hours, static	LC_{50} = 245 mg a.i./L (≈175 mg a.e./L)	Mayes et al. 1984
Fathead minnow (*Pimephales promelas*)	96 hours, flow-through	LC_{50} = 120 mg a.i./L (≈85.8 mg a.e./L)	Mayes et al. 1984
Fathead minnow (*Pimephales promelas*)	**192 hours** (8 days), flow-through	LC_{50} = 101 mg a.i./L (≈72.2 mg a.e./L)	Mayes et al. 1984
Rainbow trout (*Oncorhynchus mykiss*)	96 hours, Garlon 3A, static	LC_{50} = 400 mg form./L (≈127 mg a.e./L)	Morgan et al. 1991[2]
Rainbow trout (*Oncorhynchus mykiss*)	0.5 hours, Garlon 3A	Threshold for behavioral changes = 200 mg form./L (≈63.6 mg a.e./L) Threshold for avoidance response = 800 mg form./L (254 mg a.e./L)	Morgan et al. 1991[2]
Rainbow trout (*Oncorhynchus mykiss*)	96 hours, 47.8% a.i., M3724, flow-through	LC_{50} = 79.2 mg a.e./L	Batchelder 1973, MRID 00049637
Bluegill sunfish (*Lepomis macrochirus*)	96 hours, 47.8% a.i., M3724, flow-through	LC_{50} = 155.4 mg a.e./L	Batchelder 1973, MRID 00049637
Rainbow trout (*Oncorhynchus mykiss*)	96 hours, 64.7% a.i. , flow-through	LC_{50} = 273.7 mg a.e./L	McCarty and Alexander 1978, MRID 00151956
Bluegill sunfish (*Lepomis macrochirus*)	96 hours, 64.7% a.i. , flow-through	LC_{50} = 233.1 mg a.e./L	McCarty and Alexander 1978, MRID 00151956
Fathead minnow (*Pimephales promelas*)	96 hours, 64.7% a.i., flow-through	LC_{50} = 422.8 mg a.e./L	McCarty and Alexander 1978, MRID 00151956
Fathead minnow (*Pimephales promelas*)	96 hours, 44.9% a.i., static	LC_{50} = 168.5 mg a.e./L	Mayes 1990c, MRID 00151958
Fathead minnow (*Pimephales promelas*)	96 hours, 44.9% a.i., flow-through	LC_{50} = 86.4 mg a.e./L Working Note: Note difference between static (above) and flow-through. See also Mayes 1984.	Mayes 1990c, MRID 00151958

Appendix 5: Toxicity to Fish *(continued)*

A5 Table 2: Triclopyr TEA, Acute Toxicity			
Species	**Exposure**	**Response**	**Reference**
Tidewater silverside (*Menidia beryllina*), Marine species	96 hours, 44.7% a.i. (not clear if this is a formulation), 32.07% a.e. 0, 26, 42, 66, 94, and 160 mg a.i./L.	Study and U.S. EPA/OPP 1989a LC_{50}: 130 mg a.i./L (≈93 mg a.e./L) NOEC: 61 mg/L (44 mg a.e./L) U.S. EPA/OPP 2009a LC_{50}: 40.1 mg a.e./L U.S. EPA/OPP 2009a appears to assume that the LC50 in the study is expressed in units of formulation. This does not appear to be the case.	Ward and Boeri 1989, MRID 41633703 Not cited in U.S. EPA/OPP 2009a
Coho salmon	Garlon 3A (36% a.e.), 96 hours, static	LC_{50} (formulation): 463 mg/L LC_{50} (a.e.): 167 mg a.e./L	Wan et al. 1997
Chum salmon	Garlon 3A (36% a.e.), 96 hours, static	LC_{50} (formulation): 267 mg/L LC_{50} (a.e.): 96.1 mg a.e./L	Wan et al. 1997
Sockeye salmon	Garlon 3A (36% a.e.), 96 hours, static	LC_{50} (formulation): 311 mg/L LC_{50} (a.e.): 112 mg a.e./L	Wan et al. 1997
Rainbow trout	Garlon 3A (36% a.e.), 96 hours, static	LC_{50} (formulation): 420 mg/L LC_{50} (a.e.): 151 mg a.e./L	Wan et al. 1997
Chinook salmon	Garlon 3A (36% a.e.), 96 hours, static	LC_{50} (formulation): 275 mg/L LC_{50} (a.e.): 99 mg a.e./L	Wan et al. 1997

A5 Table 3: Triclopyr BEE (and other esters), Acute Toxicity

Species	Exposure	Response	Reference
Bluegill sunfish (*Lepomis macrochirus*)	96 hours, Garlon 4, 62.9% a.i. (≈45.2% a.e.)	Study 96 h LC_{50} = 1.2 mg/L (≈0.54 mg a.e./L) NOEC = 0.73 mg/L (≈0.33 mg a.e./L) U.S. EPA/OPP 2009aa 24 h LC_{50} = 0.59 mg a.e./L U.S. EPA/OPP 1998a: LC_{50} = 0.77 to 1.2 mg /L	Gorzinski et al. 1991a, MRID 41971603 (Full study) Gorzinski et al. 1991b, MRID 41971604 (Study summary) Note: Only MRID 41971604 is cited in U.S. EPA/OPP 2009a.
Bluegill sunfish (*Lepomis macrochirus*)	Triclopyr BEE, 93% a.i. , 96 hour exposure	Study LC_{50} = 0.87 mg a.i./L (0058 mg a.e./L) Note: Cannot read statistical analyses sheets in full study. LC_{50} = 1.46 ppm formulation? (U.S. EPA/OPP 1998a) LC_{50} = 1.46 ppm propylene glycol butyl ether ? (U.S. EPA/OPP 2009a)	McCarty and Alexander 1973, MRID 00134181
Bluegill sunfish (*Lepomis macrochirus*)	Garlon 4 (TSN 100516), 62.2% a.i., 96 hours, flow-through	Study LC_{50} = 0.44 mg Garlon 4/L (≈0.20 mg a.e./L) NOEC = 0.21 mg Garlon 4/L (≈0.093 mg a.e./L) U.S. EPA/OPP 2009a: LC_{50} = 0.31 mg a.e./L Note: U.S. EPA/OPP 2009a appears to assume that the study reports the LC_{50} in units of a.i. The study explicitly states the units as Garlon 4. A value of 0.32 mg a.e./L is given by OPP on p. 22 of Appendix A, U.S. EPA/OPP 2009a.	Weinberg et al. 1994a, MRID 43442601
Bluegill sunfish (*Lepomis macrochirus*)	Triclopyr BEE, 96.98% a.i., 96 hours	Study: 96-h LC_{50} = 0.36 mg a.i./L (≈0.25 mg a.e./L) 96-h EC_{50} = 0.29 mg/L (sublethal effects) NOEC: 0.13 mg a.i./L (≈0.091 mg a.e./L) U.S. EPA/OPP 2009a, Appendix A: 96-h LC_{50} = 0.25 mg a.e./L	Woodburn et al. 1993c, MRID 42917901 **Note: Little different from Garlon 4. Note in discussion of inerts.**
Chinook salmon	Garlon 4, 24 hour, flow-through	Duration / LC_{50} (mg a.e./L): 1 hour — 34.6 6 hours — 4.7 24 hours — 1.76 Note: Paper clearly specifies that results are expressed in units of a.e.	Kreutzweiser et al. 1994

A5 Table 3: Triclopyr BEE (and other esters), Acute Toxicity

Species	Exposure	Response	Reference
Coho salmon	Triclopyr-BEE (NOS)	<table><tr><th rowspan="2">Stage</th><th colspan="2">96h-LC_{50}</th></tr><tr><th>mg a.i./L*</th><th>mg a.e./L</th></tr><tr><td>alevin</td><td>0.26</td><td>0.19</td></tr><tr><td>juvenile</td><td>1.3</td><td>0.93</td></tr></table> Alevin (fry) excreted ester more slowly than juvenile fish. *Abstract does not clearly specify units as a.i. or a.e. Above, the assumption is made that units are in a.i. and the a.e. conversion is given.	Mayes et al. 1986
Coho salmon (*Oncorhynchus kisutch*), juvenile	96 hours, Garlon 4, static	LC_{50} = 2.4 ppm (apparently as formulation) LC_{50} ≈ 1.0 mg a.e./L	Janz et al. 1991
Coho salmon (*Oncorhynchus kisutch*), juvenile, yolk-sac fry	BEE, 99% a.i.	Study Fry LC_{50} = 0.47 mg a.i./L (≈0.33 mg a.e./L) Juv. LC_{50} = 1.7 mg a.i./L (≈1.2 mg a.e./L) U.S. EPA/OPP 1998a Fry LC_{50} = 0.45 – 0.47 mg a.i./L Juv. LC_{50} = 1.4 mg a.i./L U.S. EPA/OPP 2009a Fry LC_{50} = 0.32 – 0.33 mg a.e./L Juv. LC_{50} = 1.0 mg a.e./L	Barron et al. 1989b MRID 41736304 Also in open literature as Barron et al. 1990
Coho salmon, fry	Garlon 4, 44.3% a.e., 96 hour, static,	LC_{50} = 2.2 ppm (apparently as formulation) LC_{50} ≈ 0.97 mg a.e./L	Servizi et al. 1987
Coho salmon, juvenile	Garlon 4, 96 hour, flow-through	LC_{50} = 0.84 ppm Lethargy occurred at concentrations >0.56 mg/L then regressed to highly distressed condition characterized by elevated oxygen uptake and death. At 0.32-0.43 mg/L fish were lethargic with reduced oxygen uptake. At concentrations ≤0.10 mg/L fish were hypersensitive to stimuli and activity levels and oxygen uptake were increased during photoperiod transitions.	Johansen and Geen 1990
Coho salmon, juvenile	Garlon 4, 96 hour, static	LC_{50} = 2.7 mg a.i./L (1.9 mg a.e./L)	Wan et al. 1991[1]
Fathead minnow (*Pimephales promelas*)	Triclopyr BEE, 93% a.i. , 96 hour exposure	Study LC_{50} = 0.75 mg a.i./L (0.50 mg a.e./L) Note: Cannot read statistical analyses sheets in full study. Values not summarized in U.S. EPA/OPP 1998a or 2009a.	McCarty and Alexander 1973, MRID 00134181
Fathead minnow (*Pimephales promelas*)	96 hours, BEE, 96% a.i.	Study 96-h LC_{50} = 2.2 mg a.i./L (≈1.5 mg a.e./L) NOAEC (toxicity): 1.4 mg/L (≈0.97 mg a.e./L) U.S. EPA/OPP 2009a 24-h LC_{50} = 1.7 mg a.e./L U.S. EPA/OPP 1998a 24 h-LC_{50} = 2.31 mg a.i./L	Milazzo and Batchelder 1981a, MRID 00151965

A5 Table 3: Triclopyr BEE (and other esters), Acute Toxicity

Species	Exposure	Response	Reference
Fathead minnow (*Pimephales promelas*)	96 hours, Garlon 4, static	Study and 96-h LC_{50} = 2.3 mg formulation/L? U.S. EPA/OPP 1998a 24-h LC_{50} = 2.3 mg/L? Note: Study units are not clear.	Milazzo and Batchelder 1981b, MRID 00151963
Pink salmon, juvenile	Garlon 4, 96 hour, static	LC_{50} = 1.3 mg a.i./L (0.93 mg a.e./L)	Wan et al. 1991[1]
Rainbow trout	Garlon 4, 24 hour, flow-through	Duration / LC_{50} (mg a.e./L): 1 hour: 22.5 6 hours: 1.95 23 hours: 0.79 Note: Paper clearly specifies that results are expressed in units of a.e.	Kreutzweiser et al. 1994
Rainbow trout (*Oncorhynchus mykiss*)	Triclopyr **ethylene glycol butyl ether ester**, 93% a.i. , 96 hour exposure	Study LC_{50} = 0.74 mg a.i./L Note: Cannot read statistical analyses sheets in full study. LC_{50} = 1.29 ppm formulation? (U.S. EPA/OPP 1998a) LC_{50} = 1.29 ppm propylene glycol butyl ether ? (U.S. EPA/OPP 2009a)	McCarty and Alexander 1973, MRID 00134181
Rainbow trout (*Oncorhynchus mykiss*)	96 hours, Garlon 4, static	LC_{50} = 2.4 mg form./L (1.0 mg a.e./L)	Morgan et al. 1991[2]
Rainbow trout (*Oncorhynchus mykiss*)	0.5 hours, Garlon 4, flow-through	Threshold for behavioral changes = 0.6 ppm formulation (0.26 mg a.e./L) Threshold for avoidance response = 19.2 ppm formulation (8.3 mg a.e./L)	Morgan et al. 1991[2]
Rainbow trout (*Oncorhynchus mykiss*, a.k.a. *Salmo gairdneri*)	96 hours, Garlon 4, flow-through. Nominal concentrations: 0.10, 0.18, 0.32, 0.56 and 1.0 mg/L.	Study: Concentrations appear to be in units of formulation. Assume 0.433 for conversion to a.e. LC_{50} = 0.8 (0.6-1.0) mg Garlon 4/L LC_{50} ≈ 0.34 mg a.e./L No mortality at 0.32 mg Garlon 4/L (≈0.14 mg a.e./L). Only 8 fish/dose and partial mortality only at two highest concentrations.	Ross and Pell 1981, MRID 00151962 Not cited in U.S. EPA/OPP 1998a or 2009a
Rainbow trout (*Oncorhynchus mykiss*)	96 hours, flow-through, Garlon 4 (TSN 100516), 62.2% a.i. Test concentrations of 0.15, 0.24, 0.43, 0.76, 1.2 and 2.0 mg/L as Garlon 4.	Study LC_{50} = 0.98 (0.824-1.18) mg Garlon 4/L (≈0.47 mg a.e./L) NOEC = 0.24 mg Garlon 5/L (≈0.1 mg a.e./L). U.S. EPA/OPP 1998a: cited but not summarized. U.S. EPA/OPP 2009a: LC50 = 0.70 mg a.e./L Note: U.S. EPA/OPP 2009a appears to assume that the study reports the LC_{50} in units of a.i. The study explicitly states the units as Garlon 4.	Weinberg et al. 1994b, MRID 43442602

A5 Table 3: Triclopyr BEE (and other esters), Acute Toxicity			
Species	**Exposure**	**Response**	**Reference**
Rainbow trout (*Oncorhynchus mykiss*)	96 hours, triclopyr BEE, 96.98% a.i.	Study LC_{50} = 0.65 ppm a.i. (≈0.47 mg a.e./L) EC_{50} (sublethal toxicity) = 0.48 ppm a.i. NOEC = 0.28 ppm a.i. (≈ 0.20 mg a.e./L) U.S. EPA/OPP 2009aa LC_{50} = 0.47 mg a.e./L	Woodburn et al. 1993d, MRID 42884501
Rainbow trout, fry	Garlon 4, 44.3% a.e., 96 hour, static	LC_{50} = 2.2 ppm (apparently as formulation) LC_{50} ≈ 0.97 mg a.e./L	Servizi et al. 1987
Rainbow trout, juvenile	Garlon 4, 96 hour, static	LC_{50} = 1.8 mg a.i./L (1.3 mg a.e./L)	Wan et al. 1991[1]
Sockeye salmon, fingerlings	Garlon 4, 44.3% a.e., 96 hour, static	LC_{50} = 1.4 ppm (apparently as formulation) LC_{50} ≈ 0.62 mg a.e./L	Servizi et al. 1987
Sockeye salmon, fry	Garlon 4, 44.3% a.e., 96 hour, static	LC_{50} = 1.2 ppm (apparently as formulation) LC_{50} ≈ 0.53 mg a.e./L	Servizi et al. 1987
Tidewater silverside (*Menidia beryllina*)	BEE, 96.1% a.i., 96 hours, Conc: 0, 0.30, 0.57, 0.90, 1.4 and 2.7 mg a.i./L	Study LC_{50} = 0.45 mg a.i./L (≈0.32 mg a.e./L) NOEC = 0.30 mg a.i./L (≈0.22 mg a.e./L) U.S. EPA/OPP 2009a: LC_{50} = 0.32 mg a.e./L	Ward and Boeri 1991d , MRID 42053901
Tidewater silverside (*Menidia beryllina*)	Garlon 4, 62.9% a.i., 96 hours, flow-through	Study LC_{50} = 0.77 mg Garlon 4/L (≈0.35 mg a.e./L) NOEC = 0.56 mg Garlon 4/L (≈0.25 mg a.e./L) U.S. EPA/OPP 2009a: LC_{50} = 0.34 mg a.e./L	Ward and Boeri 1991a, MRID 41969901
Coho salmon	Garlon 4 (48% a.e.), 96 hours, static	LC_{50} (formulation): 2.1 mg/L LC_{50} (a.e.): 1.0 mg a.e./L	Wan et al. 1997
Chum salmon	Garlon 4 (48% a.e.), 96 hours, static	LC_{50} (formulation): 1.7 mg/L LC_{50} (a.e.): 0.81 mg a.e./L	Wan et al. 1997
Sockeye salmon	Garlon 4 (48% a.e.), 96 hours, static	LC_{50} (formulation): 1.4 mg/L LC_{50} (a.e.): 0.67 mg a.e./L	Wan et al. 1997
Rainbow trout	Garlon 4 (48% a.e.), 96 hours, static	LC_{50} (formulation): 2.7 mg/L LC_{50} (a.e.): 1.30 mg a.e./L	Wan et al. 1997
Chinook salmon	Garlon 4 (48% a.e.), 96 hours, static	LC_{50} (formulation): 2.7 mg/L LC_{50} (a.e.): 1.30 mg a.e./L	Wan et al. 1997
Pink salmon	Garlon 4 (48% a.e.), 96 hours, static	LC_{50} (formulation): 1.2 mg/L LC_{50} (a.e.): 0.58 mg a.e./L	Wan et al. 1997

[1] All results in Wan et al. 1991 are reported as mg a.i./L.

[2] Morgan et al. (1991) appear to express toxicity values in units of formulation but this is not explicitly stated. In the above table, the units of the toxicity values are assumed to be in units of formulation an are converted to a.e. using factors of 0.318 for Garlon 3A and 0.433 for Garlon 4.

A5 Table 4: TCP, Acute Toxicity			
Species	**Exposure**	**Response**	**Reference**
Bluegill sunfish	TCP, 99.9%	LC_{50} = 12.5 ppm	MRID 41829003 [1]
Rainbow trout	TCP, 99.9%	LC_{50} = 12.6 ppm	MRID 41829004[1]
Rainbow trout	TCP, 99.7%, 96 hours	LC_{50} = 1.5 ppm	Wan et al. 1987[2]
Coho salmon	TCP, 99.7%, 96 hours	LC_{50} = 1.8 ppm	Wan et al. 1987[2]
Chum salmon	TCP, 99.7%, 96 hours	LC_{50} = 1.8 ppm	Wan et al. 1987[2]
Sockeye salmon	TCP, 99.7%, 96 hours	LC_{50} = 2.5 ppm	Wan et al. 1987[2]
Chinook salmon	TCP, 99.7%, 96 hours	LC_{50} = 2.1 ppm	Wan et al. 1987[2]
Pink salmon	TCP, 99.7%, 96 hours	LC_{50} = 2.7 ppm	Wan et al. 1987[2]

[2] Taken from U.S. EPA/OPP (2009a), Appendix A, p. 6. Values given by EPA in units of triclopyr a.e. are divided by the conversion factor of 1.291 (Table 1 of current risk assessment) to provide units of mg TCP/L.

[2] Data from Table 5, p. 725 in Wan et al. 1987. No differences between 24, 48, 72, and 96 hour LC_{50} values for any species.

A5 Table 5: Chronic toxicity			
Species	**Exposure**	**Response**	**Reference**
TEA			
Fathead minnow (*Pimephales promelas*)	Triclopyr TEA, 28 days, egg-to-fry, flow-through, Concentrations of 26, 43, 65, 104, 162, and 253 mg a.i./L.	U.S. EPA/OPP 2009a summary: NOEC: 32.2 mg a.e./L LOEC (length): 50.2 mg a.e./L Study Summary: Larval survival reduced at 253 mg/L. A slight decrease in larval growth at 162 mg/L. No effects at concentrations of 104 mg/L or less.	Mayes 1983, MRID 00151958 Mayes 1990c MRID 92189012
BEE			
Rainbow Trout (*Oncorhynchus mykiss*), Early Life Stages	Triclopyr-BEE: 0, 26.3, 48.6, 99.3, 184,369 and 741µg/L.	Study NOEC: 23.6 µg a.i./L (17.0 µg a.e./L) LOEC: 48.6 µg a.i./L (34.9 µg a.e./L based on larval weight and length). No larvae survived at concentrations ≥184 µg a.i./L. Only 33% survival at 99.3 µg a.i./L. [Table 8, p. 32 of study.] Working Note: Cannot interpret Table 9 of study giving stats of day-to-mean hatch. U.S. EPA/OPP 2009a NOEC: 0.019 mg a.e./L LOEC: 0.034 mg a.e./L (based on larval weight and length).	Weinberg et al. 1994d, MRID 43230201 Note: Cited but not summarized in U.S. EPA/OPP 1998a.
continued on next page			

A5 Table 5: Chronic toxicity

Species	Exposure	Response	Reference
TCP			
Rainbow trout, 200 embryos, approximately 48 hours post fertilization	**TCP metabolite** Mean measured concentrations of 0, solvent control [81.5 µg acetone/L], 0.0808, 0.134, 0.273, 0.519, 0.989, or 2.01 mg TCP/L in flow-through system with acetone as solvent. Observations to 31 days post-hatch of water control embryos.. Note: Adverse effects and extreme variability were seen in the acetone control groups. Data from these groups were not used in the statistical analysis. This approach is conservative but may have biased the analysis. Acetone in the low dose group was 2.6 µg/L. Thus, in the high dose group the acetone concentration was ≈64.6 µg/L [2.6 µg/L x 2.01 ÷ 0.0808]	Statistically significant (α=0.05) effects on several endpoints (see below). Decrease in overall survival were seen at ≥0.273 mg TCP/L; days to mean hatch and growth reduction (weight and length indices) were significant for larvae at 0.134 mg TCP/L. Endpoint / Conc. (mg/L) NOEC / LOEC Weight 0.0808 / 0.134 Length 0.0808 / 0.134 Pre-thinning Survival 0.989 / 2.01 Post-thinning Survival 0.134 / 0.273 # Emb Hatched 0.134 / 0.273 Mean Days to Hatch 0.0808 / 0.134 # Larvae at hatch 0.134 / 0.273 Overall survival 0.134 / 0.273	Marino et al. 1999, MRID 44997301 Note: Not cited or summarized in U.S. EPA/OPP 2009a. **The DER for this study is available on the peer review CD and is cited as Mossler et al. 2000. The study is classified as INVALID.**
Rainbow trout, 200 embryos (4 replicates of 50 each), approximately 48 hours post fertilization	**TCP metabolite** Mean measured concentrations of 0, solvent control [81.5 µg dimethylformamide/L], 58.6, 106, 178, 278, 479, and 825 µg TCP/L in flow-through system. Observations to 33 days post-hatch of water control embryos..	Note: This is a repeat of Marino et al. 1999 using a different solvent. Statistically significant (α=0.05) effects on several endpoints (see below for most sensitive endpoints). Endpoint / Conc. (mg/L) NOEC / LOEC Length 0.178 / 0.278 Weight 0.178 / 0.278 Day to mean swim-up 0.479 / 0.825 All other endpoints 0.825 / N.D. Note: Responses in solvent control are comparable to water control. See Table 7 of study.	Marino et al. 2003, MRID 46033201

A5 Table 6: Field Studies		
Exposure	**Response**	**Reference**
Aerial application of triclopyr BEE at nominal rate of 8 L Garlon 4/ha (3.84 kg a.e./ha) to approximately 100 ha of forestry land in northern Ontario in August of 1987. About 3.8 km of Dora Creek containing four species of caged aquatic organism were directly oversprayed.	Yellow perch and fathead minnows, caged in stream. During application, the largest dose of triclopyr BEE was at the downstream site. The maximum concentration in the stream was 0.35 ppm, which decreased to <0.15 ppm within 15 minutes. The TWA concentration during the 12 hours of greatest exposure was 0.11 ppm. No statistically significant (p=0.05) differences were observed in the mortality of caged fish. At 96 hours, a statistically significant difference in the mortalities between control and treated sites was observed but not considered treatment related.	Fontaine 1990 MRID 41445001
Garlon 3A tank mixture [6% formulated product by volume, 0.5% LI 700 (nonionic surfactant), and 93.5% water] was applied at 5L/ha, using a hand-held backpack sprayer, to the water side of two wetland areas in late stages of purple loosestrife invasion in the State of Washington to determine the nontarget effects of treatment.	No statistically significant decreases in the survival or growth of the bioassay organisms (duckweed, *Daphnia*, or rainbow trout), and no significant decreases in the abundance of free-living aquatic invertebrates as a result of Garlon 3A application.	Gardner and Grue 1996
Subsurface application (via spray boom operated from an airboat) of triclopyr TEA (formulated as Garlon 3A) to plot A (Phelps Bay) and surface application (via boomless low-volume device) of triclopyr TEA (formulated as Garlon 3A) to plot B (Carsons Bay) of Lake Minnetonka MI in summer of 1994 to control watermilfoil. Garlon 3A was applied at a rate of 2.5 mg/L, the maximum rate indicated on the label.	Triclopyr rapidly degraded to its metabolites TCP and TMP. All three compounds dissipated rapidly from sample matrices: water, sediment, fin-fish, invertebrates, and non-target plants. There were no deaths observed in any of species of fish that were tested.	Houtman et al. 1997a MRID 44456101
Field evaluation of triclopyr ester (TBEE) toxicity to trout. Lake enclosures treated by backpack application at level of 0.25 to 7.6 mg a.e./L.	Cages Rainbow Trout: All rainbow trout died by day 3 at initial concentrations of 0.69-7.6 mg/L and partial mortality at 0.45 mg/L. No mortality at 0.25 mg/L. At both 0.25 and 0.45 mg/L, significant adverse effects on growth rate of surviving fish. Native un-caged Brook Trout: No indication of mortality or changes in population density. Some indication, however, that growth of may have been inhibited.	Kreutzweiser et al. 1995

Appendix 6: Toxicity to Amphibians.

A6 Table 1: Triclopyr TEA Acute Toxicity

Species	Exposure	Response	Reference
African clawed frog (*Xenopus laevis*), embryos	96-hours, Garlon 3A	LC_{50}: 750 mg a.e./L LC_5: 84 mg a.e./L Ratio: 8.9 Slope: 1.7 NOAEC (growth): 125 mg a.e./L	Perkins 1997

A6 Table 2: Triclopyr BEE Acute Toxicity

Species	Exposure	Response	Reference
Rana pipiens tadpoles (Gosner stage 25)	Release (TBEE 480 g a.e./L with kerosene), 10 day exposure to either 0.25 or 0.5 mg a.e./L at pH 5.5 or 7.5 with either low **or** high food availability.	Clear concentration-related decrease in survival. An NOEC was not established. See Figure 4 in paper.	Chen et al. 2008 Cited in U.S. EPA/OPP 2009a but not clear that the study is used.
Bufo americanus (stages in column 2)	Release (TBEE 480 g a.e./L with kerosene) Embryo: GS 8-10 through GS 25 Larvae: GS 25 for 96 hours	Stage / pH / 96-h LCx (mg a.e./L): EC_{10}, EC_{50} Embryo 5.5: 7.4, 12.0 Embryo 7: 9.5, 15.1 Larvae 5.5: 0.60, 0.88 Larvae 7: 1.1, 2.1 No significant malformations noted in embryo assay. Significant growth inhibition in embryo assay.	Edington et al. 2005
Rana pipiens (stages in column 2)	Release (TBEE 480 g a.e./L with kerosene) Embryo: GS 8-10 through GS 25 Larvae: GS 25 for 96 hours	Stage / pH / 96-h LCx (mg a.e./L): EC_{10}, EC_{50} Embryo 5.5: 9.2, 16.2 Embryo 7: 14.1, 23.3 Larvae 5.5: 0.66, 0.79 Larvae 7: 0.68, 0.87 Significant growth inhibition in embryo assays. Significant increase in mal-formations, primarily abnormal gut coiling. EC_{50} for malformations could not be determined due to mortality.	Edington et al. 2005

A6 Table 2: Triclopyr BEE Acute Toxicity

Species	Exposure	Response	Reference
Rana clamitans (stages in column 2)	Release (TBEE 480 g a.e./L with kerosene) Embryo: GS 8-10 through GS 25 Larvae: GS 25 for 96 hours	<table><tr><th rowspan="2">Stage</th><th rowspan="2">pH</th><th colspan="2">96-h LCx (mg a.e./L)</th></tr><tr><th>EC_{10}</th><th>EC_{50}</th></tr><tr><td>Embryo</td><td>5.5</td><td>5.9</td><td>19</td></tr><tr><td></td><td>7</td><td>11.6</td><td>24.6</td></tr><tr><td>Larvae</td><td>5.5</td><td>6.9</td><td>11.5</td></tr><tr><td></td><td>7</td><td>10.8</td><td>18.2</td></tr></table>Significant growth inhibition in embryo assays. No significant malformations noted in embryo assay.	Edington et al. 2005
Xenopus laevis (stages in column 2)	Release (TBEE 480 g a.e./L with kerosene) Embryo: GS 8-10 through GS 25 Larvae: GS 25 for 96 hours	<table><tr><th rowspan="2">Stage</th><th rowspan="2">pH</th><th colspan="2">96-h LCx (mg a.e./L)</th></tr><tr><th>EC_{10}</th><th>EC_{50}</th></tr><tr><td>Embryo</td><td>5.5</td><td>4.8</td><td>8.3</td></tr><tr><td></td><td>7</td><td>6.7</td><td>13.7</td></tr><tr><td>Larvae</td><td>5.5</td><td>0.34</td><td>1.0</td></tr><tr><td></td><td>7</td><td>0.59</td><td>1.7</td></tr></table>Significant growth inhibition in embryo assays. Significant increase in mal-formations, primarily abnormal gut coiling. EC_{50}s for malformations were 13.2 mg a.e./L at pH 5.5 and 14.8 mg a.e./L at pH 7.	Edington et al. 2005
African clawed frog (*Xenopus laevis*), embryos	96-hours, Garlon 4	LC_{50}: 15 mg a.e./L LC_5: 6 mg a.e./L Ratio: 2.5 Slope: 4.3 Reduced growth at concentrations below the LC_{50}. NOAEC (Growth): 2.5 mg a.e./L	Perkins 1997

A6 Table 3: Field or Field Simulation Studies

<table>
<tr><th>Exposure</th><th>Response</th><th>Reference</th></tr>
<tr><td>Garlon 4 thin-line individual stem (basal) application to 2 ha plot in low elevation, southern Appalachian hardwood forest in southwest VA. Treatment with herbicide intended to remove non-desirable understory woody vegetation.</td><td>No significant difference in the relative abundance of salamanders before and after harvest on the control (p=0.788) and triclopyr (p=0.862) treatment.</td><td>Harpole and Haas 1999</td></tr>
<tr><td>In situ enclosures at two sites in forest wetlands (Ontario) at triclopyr (Release, T-BEE at 480 g a.e./L) initial nominal concentrations of 0, 0.26, 0.64, 1.28, 2.56, and 7.69 mg a.e./L. Exposures to larvae of Rana clamitans and Rana pipiens (both at Gosner stage 25). Observation period up to 77 days.</td><td>Dissipation (DT_{50}) from water:
T-BEE: 0.6 day (Site A) and 1 day (Site B).
Triclopyr: 9 days (Site A) and 27 days (Site B).
96-hour lethality (mg a.e./L) based on BEE concentrations at 3 h:
<table>
<tr><th>Site</th><th>Species</th><th>LC_{10}</th><th>LC_{50}</th></tr>
<tr><td>A</td><td>R. clamitans</td><td>NS</td><td>NS</td></tr>
<tr><td></td><td>R. pipiens</td><td>0.65</td><td>2.79</td></tr>
<tr><td>B</td><td>R. clamitans</td><td>1.41</td><td>3.01</td></tr>
<tr><td></td><td>R. pipiens</td><td>1.24</td><td>3.29</td></tr>
</table>
Concentrations (mg a.e./L) for abnormal avoidance response based on BEE concentrations at 3 h:
<table>
<tr><th>Site</th><th>Species</th><th>EC_{10}</th><th>EC_{50}</th></tr>
<tr><td>A</td><td>R. Clamitans</td><td>0.68</td><td>3.84</td></tr>
<tr><td></td><td>R. Pipiens</td><td>0.32</td><td>1.86</td></tr>
<tr><td>B</td><td>R. Clamitans</td><td>0.10</td><td>1.90</td></tr>
<tr><td></td><td>R. Pipiens</td><td>0.36</td><td>1.67</td></tr>
</table>
No adverse effect on growth rate at either site relative to site-specific controls.</td><td>Wojtaszek et al. 2005</td></tr>
</table>

Appendix 7: Toxicity to Aquatic Invertebrates

A7 Table 1: Triclopyr Acid, Acute Toxicity

Species	Exposure	Response	Reference
Daphnia magna	Triclopyr acid, 99.5%	LC_{50} = 132.9 mg a.e./L NOEC not reported.	Batchelder and McCarty, 1977, MRID 40346504
European ambersnail (*Succinea putris*)	Triclopyr acid, 100%, 96 hours, static	No mortality at concentrations of up to 400 mg a.e./L	Neuderfer 2009
Tadpole physa (*Physella gyrina*) [freshwater snail]	Triclopyr acid, 100%, 96 hours, static	LC_{50} = 293 (284 to 302) mg a.e./L	Neuderfer 2009

A7 Table 2: Triclopyr TEA, Acute Toxicity

Species	Exposure	Response	Reference
Crawfish (*Procambarus* spp)	Garlon 3A, 31.8% a.e., 96 hour, static	96-h LC_{50} = 20,117.9 ± 1073.0 mg Garlon 3A/L, (6397.5 ± 341.2 mg a.e./L)	Abdelghani et al. 1995 and 1997
Red swamp crayfish (*Procambarus clarki*)	Garlon 3A (31.4% a.e. of TEA), 96 hours	Mortality Controls: 1/10 103 mg a.e./L: 8/30 Mortality in exposed group is not significantly greater than in control group (p=0.27 using Fisher Exact test).	Barron et al. 1989a, MRID 41736301 Not listed in U.S. EPA/OPP 1989a or 2009a
Daphnia magna	Triclopyr TEA, 44.9% a.i., 32.15% a.e.	Study: LC_{50}: 1170 mg formulation/L (≈ 376 mg a.e./L) NOEC (mortality): <336 mg formulation/L (≈<108 mg a.e./L) U.S. EPA/OPP 1992a: LC_{50}: 1496 mg formulation/L (≈ 480 mg a.e./L) Difference between study and EPA values is relatively minor and probably reflects a reanalysis by EPA.	Gersich et al. 1982, MRID 00151959 Also summarized in Mayes 1990d, MRID 92189013.

Appendix 7: Toxicity to Aquatic Invertebrates *(continued)*

A7 Table 2: Triclopyr TEA, Acute Toxicity

Species	Exposure	Response	Reference
Daphnia magna	Triclopyr TEA salt (not formulation), 48 hours, 0, 366, 480, 686, 980, 1400, and 2000 mg a.i./L.	LC50 = 1170 (1030-1340(mg a.i./L) ≈837 mg a.e./L Partial mortality at lowest concentration tested (≈260 mg a.e./L).	Gersich et al. 1984
Daphnia magna	Triclopyr TEA (44.9% a.i., 32.16% a.e.), 48 hours, flow-through	Study: LC_{50} = 1110 formulation/L (≈357 mg a.e./L). Geometric mean of 3 assays.	Gersich et al. 1985a, MRID 00151960
Daphnia magna	Triclopyr TEA, 64.7% a.i.	LC_{50} = 346 mg a.e./L	McCarty and Alexander 1978, MRID 00151956
Fiddler crab (*Uca pugilator*)	M-3724 Herbicide, Triclopyr TEA, 43.8% a.i.	U.S. EPA/OPP 2009a EC_{50}: > 302.2 mg a.e./L Study: No effect on equilibrium at 1000 ppm product (313 mg a.e./L)	Heitmuller 1975, MRID 0062623 Also summarized in Mayes 1990a,b, MRIDs 92189010/11
Eastern oyster (*Crassostrea virginica*), embryo larvae	M-3724 Herbicide, Triclopyr TEA, 43.8% a.i. Reported test concentrations: 8.7, 18, 32, 56, and 87 ppm. Calculated: 2.7, 5.6, 10, 17.5, and 27 mg a.e./L.	U.S. EPA/OPP 2009a Abnormal development EC_{50} >16.9 mg a.e./L and <26.3 mg a.e./L (geometric mean =21.1 mg a.e./L) Study Concentration (ppm) / % Abnormal Development 0 / 3 8.7 / 3 18 / 5 32 / 5 56 / 40 87 / 100	Heitmuller 1975, MRID 0062623 Also summarized in Mayes 1990a,b, MRIDs 92189010/11
Pink shrimp (*Penaeus duorarum*)	M-3724 Herbicide, Triclopyr TEA, 43.8% a.i.	U.S. EPA/OPP 2009a EC_{50}: 270.5 mg a.e./L Study EC_{50}: 895 mg product/L (eq. to 280 mg a.e./L)	Heitmuller 1975, MRID 0062623 Also summarized in Mayes 1990a,b, MRIDs 92189010/11
Eastern Oyster (*Crassostrea virginica*)	Triclopyr TEA, 46.09%, 96 hour exposures	Shell deposition EC_{50} = 18.4 mg a.e./L	MRID 42646101 in U.S. EPA/OPP 1998a and 2009a
Eastern Oyster (*Crassostrea virginica*)	Triclopyr TEA, 43.8%, 96 hour exposures	Embryo-larvae EC_{50} >56 ppm 100% abnormal development at 87 ppm	MRID 42646101 in U.S. EPA/OPP 1998a
Grass shrimp (*Palaemonetes pugio*)	Triclopyr TEA, 46.09%	LC_{50} = 326 ppm as product LC_{50} = 103.7 mg a.e./L	MRID 42646102 in U.S. EPA/OPP 1998a and 2009a

A7 Table 3: Triclopyr BEE, Acute Toxicity			
Species	**Exposure**	**Response**	**Reference**
Red swamp crayfish (*Procambarus clarki*)	Garlon 4 (62.4% a.i.), 96 hours 0, 1.6,2.6,4.2,6.5, 10.5 and 17.0 mg formulation/L.	LC_{50} = 6.9 mg/L (≈3.1 mg a.e./L) NOEC: 2.6 mg/L (≈1.2 mg a.e./L)	Gorzinski and Barron 1996. Not listed in U.S. EPA/OPP 1989a or 2009a
Daphnia magna Note: U.S. EPA/OPP 2009a appears to have converted from U.S. EPA/OPP 1998a without adjusting for compound purity. The reason for discrepancies between the study and EPA summaries is not apparent.	Triclopyr BEE, 96.4% a.i. (U.S. EPA/OPP 1998a)	Study (two assays reported) LC_{50} = 18.8 mg a.i./L (≈ 13.0 mg a.e./L) LC_{50} = 15.9 mg a.i./L (≈11. 0 mg a.e./L) Geometric Mean LC_{50}: 12.0 mg a.e./L LOEC: 0.3 mg a.i./L (≈0.21 mg a.e./L) NOEC: no determined U.S. EPA/OPP 2009a LC_{50} = 8.63 mg a.e./L U.S. EPA/OPP 1998a LC_{50} = 12 mg a.i./L (≈8.3 mg a.e./L)	Milazzo and Batchelder 1981a, MRID 00151965
Daphnia magna	Triclopyr BEE (96.4% a.i.), 48 hours, static	Study (two assays reported) LC_{50} = 2.8 mg a.i./L (≈1.94 mg a.e./L) LC_{50} = 1.7 mg a.i./L (≈1.18 mg a.e./L) NOEC: 0.7 mg a.i./L (≈0.49 mg a.e./L) U.S. EPA/OPP 2009a LC_{50} = 1.2 mg a.e./L	Milazzo and Batchelder 1981b, MRID 00151963
Caddisfly (*Brachycentrus americanus*)	Garlon 4, 61.1% a.i., 96 hours	LC_{50} = 11.3 (9.1-13.4) mg/L LC50 ≈ 5.0 mg a.e./L	Peterson et al. 2001[1]
Caddisfly (*Psychoglypha* sp.), early instar (10 mm)	Garlon 4, 61.1% a.i., 96 hours	LC_{50} = 28.34 (24.6-31.9) mg/L LC_{50} ≈ 12.5 mg a.e./L	Peterson et al. 2001[1]
Caddisfly (*Lepidostoma unicolor*)	Garlon 4, 61.1% a.i., 96 hours	LC_{50} = 45 (42.0-49.7) mg/L LC_{50} ≈ 20.0 mg a.e./L	Peterson et al. 2001[1]
Mayfly (*Ameletus* sp.)	Garlon 4, 61.1% a.i., 96 hours	LC_{50} = 8.55 (3.4-13.0) mg/L LC_{50} ≈ 3.8 mg a.e./L	Peterson et al. 2001[1]
Mayfly (*Cinygma* sp.)	Garlon 4, 61.1% a.i., 96 hours	LC_{50} = 20.21 (13.5-27.33) mg/L LC_{50} ≈ 8.95 mg a.e./L	Peterson et al. 2001[1]
Stonefly (*Calineuria californica*)	Garlon 4, 61.1% a.i., 96 hours	LC_{50} = 8.1 (7.01-9.06) mg/L LC_{50} ≈ 3.6 mg a.e./L	Peterson et al. 2001[1]
Daphnia pulex	Garlon 4, 44.3% a.e., 96 hour, static,	EC_{50} = 1.2 ppm (apparently as formulation) LC_{50} ≈ 0.54 mg a.e./L	Servizi et al. 1987
Eastern Oyster (*Crassostrea virginica*)	Triclopyr-BEE, 96 hour exposures	Shell deposition EC_{50} = 0.33 mg a.e./L Not cited in U.S. EPA/OPP 1998a. Full reference not given in U.S. EPA/OPP 2009a.	U.S. EPA/OPP 2009a, MRID 41971602

A7 Table 3: Triclopyr BEE, Acute Toxicity			
Species	**Exposure**	**Response**	**Reference**
Grass shrimp (*Palaemonetes pugio*)	Garlon 4, 62.9 % a.i., 96-hours, 0, 1.0, 1.3, 1.9,2.4 and 4.6 mg Garlon 4/L	Study: 96-h EC_{50} = 1.8 mg Garlon 4/L (0.81 mg a.e./L) NOEC (sublethal): 1.0 mg Garlon 4/L (0.45 mg a.e./L) U.S. EPA/OPP 2009a 96-h EC_{50} = 0.77 mg a.e./L	Ward and Boeri 1991b, MRID 41969902
Eastern Oyster (*Crassostrea virginica*)	Garlon 4, 62.9% a.i., flow-through, , 96 hour exposures	Study: Shell Deposition EC_{50} = 0.30 mg Garlon 4/L (≈0.14 mg a.e./L) NOEC: 0.11 mg Garlon 4/L (≈0.05 mg a.e./L) U.S. EPA/OPP 2009a Shell Deposition EC_{50} = 0.23 mg a.e./L)	Ward and Boeri 1991c, MRID 41969903
Grass shrimp (*Palaemonetes pugio*)	Triclopyr BEE, 96.1% a.i., 96 hours	Study: 96-h EC_{50} = 2.4 mg a.i./L (≈1.72 mg a.e./L) NOEC: 0.27 mg a.i./L (0.19 mg a.e./L) U.S. EPA/OPP 2009a 96-h EC_{50} = 1.8 mg a.e./L	Ward and Boeri 1991e, MRID 41971601
Daphnia magna	Garlon 4, 48 hours, flow-through. % a.i. not specified in study (assume 62.9% for a.e. conversion). The EC_{50} appears to be for immobility.	Study: LC_{50} = 0.43 mg Garlon 4/L (0.19 mg a.e./L) EC_{50} = 0.35 mg Garlon 4/L (0.16 mg a.e./L) NOEC = 0.27 mg Garlon 4/L (0.12 mg a.e./L) U.S. EPA/OPP 2009a: LC_{50} = 0.25 mg a.e./L It is not clear why the EPA number differ from those given in the study.	Weinberg et al. 1994c, MRID 43442603 Not cited in U.S. EPA/OPP 1998a

[1] Cannot determine how Peterson et al. 2001 report the results – i.e., as a.e., a.i., or formulation. The assumption is made that the doses are expressed in units of mg formulation/L and the a.e. conversion is made using a factor of 0.443.

A7 Table 4: TCP, Acute Toxicity			
Species	**Exposure**	**Response**	**Reference**
Daphnia magna	48-hours	LC_{50} = 10.9 mg/L	U.S. EPA/OPP 2009a, MRID 41829003

A7 Table 5: Chronic toxicity			
Species	**Exposure**	**Response**	**Reference**
TEA			
Daphnia magna	Triclopyr TEA (32.16% a.e. or 44.9% a.i.) 21 days Mean measured concentrations of 80.7, 149, 290, 574, and 1177 mg a.e. /L. Static renewal, 3 times/week.	U.S. EPA/OPP 2009a NOEC = 25 mg a.e./L LOEC = 46.2 mg a.e./L based on total number of young and mean brood size. Study Results appear to be expressed as formulation. Result summarized in Table 3, p. 11 of study. NOEC = 80.7 mg/L (≈25.95 mg a.e./L) LOEC = 149 mg /L (≈47.9 mg a.e./L) based on a significant decrease in mean young/brood.	Gersich et al. 1982, MRID 00151959 Summarized in Gersich et al. 1985b publication. The publication suggests that results are expressed in a.i. rather than formulation but this is not consistent with the full study.
Daphnia magna	Triclopyr TEA (32.16% a.e. or 44.9% a.i.) 21 days Mean measured concentrations of 60.3, 79.5, 120, 194, 281 mg/L. Static renewal, 3 times/week.	Study Results (Study Table 6) appear to be expressed as a.i. but this is not clear. NOEC = 79.5 mg a.i./L ? LOEC = 123 mg a.i./L? based on a significant decrease in mean young/adult and mean brood size/adult.	Gersich et al. 1985a MRID 00151960 Not cited or summarized in the U.S. EPA/OPP 1998a or 2009a.
BEE			
*Simocephalus vetulus (*Cladoceran*)*	Release (**BEE** 480 g a.e./L with kerosene), 8 day exposure to either 0.25 or 0.5 mg a.e./L at pH 5.5 or 7.5 with either low or high food availability.	0.5 mg/L: Clear increase in mortality but no clear differences between responses at pH 5.5 and 7.5 (see Fig. 1 in paper). 0.25 mg/L: Less pronounced increase in mortality at pH 5.5 with low food and pH 7.5 with high food. Reproduction: Concentration-related decrease in reproduction. An NOEC not established (see Fig. 2 of publication)	Chen et al. 2008 Cited in U.S. EPA/OPP 2009a. Not clear that this study is used in the EPA analysis.
TCP			
Daphnia magna	**TCP**, mean measured concentrations of 0.029, 0.058, 0.13, 0.31, , 0.66, and 1.5 mg TCP/L.	Study NOEC: 0.058 mg TCP/L LOEC: 0.13 mg TCP/L based on significant decrease in mean number of young/adult. No impact on adult survival at any concentration.	Machado 2003, MRID 45861301 Not cited in U.S. EPA/OPP 2009a.

A7 Table 6: Field and Field Simulation Studies

Exposure	Response	Reference
Aerial application of triclopyr BEE at nominal rate of 8 L Garlon 4/ha (3.84 kg a.e./ha) to approximately 100 ha of forestry land in northern Ontario in August of 1987. About 3.8 km of Dora Creek containing four species of caged aquatic organism were directly oversprayed.	During application, the largest dose of triclopyr BEE was at the downstream site. The maximum concentration in the stream was 0.35 ppm, which decreased to <0.15 ppm within 15 minutes. The TWA concentration during the 12 hours of greatest exposure was 0.11 ppm. No statistically significant (p=0.05) differences were observed in the mortality of caged caddisflies. **At 96 hours, a statistically significant difference in the mortalities between control and treated sites was observed but not considered treatment related.**	Fontaine 1990 MRID 41445001
Garlon 3A tank mixture [6% formulated product by volume, 0.5% LI 700 (nonionic surfactant), and 93.5% water] was applied at 5L/ha, using a hand-held backpack sprayer, to the water side of two wetland areas in late stages of purple loosestrife invasion in the State of Washington to determine the nontarget effects of treatment.	No statistically significant decreases in the survival or growth of the bioassay organisms (duckweed, *Daphnia*, or rainbow trout), and no significant decreases in the abundance of free-living aquatic invertebrates as a result of Garlon 3A application.	Gardner and Grue 1996
Subsurface application (via spray boom operated from an airboat) of triclopyr TEA (formulated as Garlon 3A) to plot A (Phelps Bay) and surface application (via boomless low-volume device) of triclopyr TEA (formulated as Garlon 3A) to plot B (Carsons Bay) of Lake Minnetonka MI in summer of 1994 to control watermilfoil. Garlon 3A was applied at a rate of 2.5 mg/L, the maximum rate indicated on the label.	Triclopyr rapidly degraded to its metabolites TCP and TMP. All three compounds dissipated rapidly from sample matrices: water, sediment, fin-fish, invertebrates, and non-target plants. There were no deaths observed in any of species of aquatic invertebrates that were tested.	Houtman et al. 1997a MRID 44456101
Artificial streams with triclopyr concentrations of 3.2, 32, or 320 mg/L. Formulation and form of triclopyr not specified.	No significant impact on survival of *Isogenoides* sp. or *Hydropsyche* sp. at 3.2 mg/L. Increase in mortality at 320 mg/L. Drift of *Epeorus* sp. was markedly increased at 320 mg/L but only slightly increased at 32 mg/L.	Kreutzweiser and Capell 1992
Field evaluation of triclopyr ester (TBEE) toxicity to trout. Lake enclosures treated by backpack application at level of 0.25 to 7.6 mg a.e./L.	Native Invertebrates: Only transient increase in drift. At a stream collection station 15 m downstream from the lake, the maximum measured concentration of TBEE was 0.61 mg/L, which declined to <0.05 mg/L within 40 minutes.	Kreutzweiser et al. 1995

A7 Table 6: Field and Field Simulation Studies

Exposure	Response	Reference
Garlon 4 mixed in river water and applied (using applicators designed to deliver exponentially declining concentrations over a 6-hour period) to lower portion of outdoor stream channels. One channel was treated at an initial concentration of 2.7 mg/L (EEC) and the other channel was treated at an initial concentration of 27 mg/L (10 times the EEC).	Accumulated triclopyr BEE in leaf material from stream channels was calculated from nominal aqueous concentrations and ranged from 55.8 to 274.4, which was clearly less than in laboratory experiments described above. The application of triclopyr BEE to the stream channels die not affect the survival of two caddisfly species, perhaps due to the rapid absorption to organic material, which mitigated the toxicity of triclopyr BEE to the detritivores.	Kreutzweiser et al. 1998
Garlon 4 was added to semi-static microcosms designed to simulate lentic environments. In experiments to test effects of aqueous and adsorbed triclopyr BEE, detritivores were added to the microcosm 24 hours before the pesticide applications; in experiments to test effects of adsorbed triclopyr BEE alone, the invertebrates were added 24 hours after application, when the the aqueous triclopyr BEE concentrations had dissipated by >90%.	Accumulations of triclopyr BEE in leaf packs were up to 80 times aqueous concentrations and residues persisted for 4 to 5 days. In experiments to determine the effects of both aqueous and accumulated triclopyr BEE, there was no significant mortality among three species of invertebrates: stonefly (*Pteronarcys dorsata*), cranefly (*Tipula* sp.) or caddisfly (*Pycnopsyche guttifer*) in microcosms treated at or near the EEC of 2.7 mg/L In experiments to determine effects of accumulated triclopyr BEE only (insects added after aqueous concentrations declined by more than 90% and accumulated concentrations were high) there was no significant mortality of either test species: stonefly or caddisfly, even at test concentrations near 10 times the EEC.	Kreutzweiser et al. 1998.
Stream (New Zealand) in area sprayed with Grazon (triclopyr BEE at 600 g a.e./L). Application rate of 194.5 L/61.5 ha [1.9 kg/ha or ≈1.7 lb a.e./acre]	Triclopyr concentrations in stream of about 1 to 3.4 µg/L immediately after spraying but not detectable levels thereafter. Fluctuations of invertebrate populations between control and treated sites could not be associated with exposures to triclopyr. Working Note: This study seems marginal in terms of hazard identification.	Maloney 1995
Aerial application of Garlon 4 at the rate of 3 quarts/acre to an experimental site located near Kosciusko, Mississippi to determine the impact of a conifer release treatment on a forest environment.	The decline in the number of organisms per samples from the benthic invertebrates was thought to be related to natural population dynamics. No residues of triclopyr or its metabolite TCP were found in any of the water samples, sediment, or fish samples.	Nugent and Schotts 1990 MRID 41353201

A7 Table 6: Field and Field Simulation Studies

Exposure	Response	Reference
Outdoor pond mesocosms of mixed rotifers, copepods, and cladocerans. Triclopyr (Grandstand formulation) at application rate of 0.4 kg a.i./ha to a 500 L mesocosm 0.7 meters deep. Corresponds to 40 mg/m^2 per 0.7 m^3 or 57 mg/ m^3 or 0.057 mg a.i./L.	No measurable effects reported at 24 or 48 hours after application. The paper provides very few details on applications of triclopyr or other pesticides that reportedly had no adverse effect..	Perschbacher et al. 2002
Garlon 4 directly applied to stream as a point source to yield initial concentrations in water of 0.8 and 2.7 mg/L. This was intended to mimic bodies of water 50 and 15 cm deep inadvertently sprayed with TBEE at a rate of 4 kg/ha.	Maximum concentrations of TBEE in stream water of 0.848 and 0.949 mg/L. TBEE rapidly converted to triclopyr. Periods of exposure to concentrations in excess of 0.001 mg/L were less than or equal to 120 minutes, depending on the speed of the stream flow. Invertebrate drift was increased by 3-4 fold but invertebrate abundance was not affected. Species monitored included *Plecoptera*, *Trichoptera*, *Chironemidae, Ceratopagonidae*, and *Tipulidae*.	Thompson et al. 1995

Appendix 8: Toxicity to Aquatic Plants

The following macrophytes are cited in Tables 2 and 3 of this appendix.

Scientific Name	Common Name
Dicot	
M. spicatum× M. sibiricum	Milfoil Hybrid
Myriophyllum sibiricum	Eurasian watermilfoil
Nuphar lutea	Yellow water-lily
Nymphaea odorata	Waterlily
Trapa natans	Water Chestnut
Monocot	
Zizania palustris	Wild Rice
Hydrilla verticillata	Hydrilla
Lemna gibba	Duckweed
Lemna minor	Duckweed
Potamogeton pectinatus	Sago Pondweed

A8 Table 1: Algae

Species	Exposure	Response[1]	Reference
Triclopyr Acid			
Chlorella vulgaris	Analytical grade (NOS)	EC_{50} = 11 ppm a.e.	Baarschers et al. 1988
Chlorella pyrenoidosa	Analytical grade (NOS)	EC_{50} = 80 ppm a.e.	Baarschers et al. 1988
Selenastrum capricornutum(*Kirchneria subcapitata*)	Triclopyr acid, 98.8%, 5 day exposures. Nominal concentrations of 7.8, 12.96, 21.6, 36, 60, and 100 mg a.e./L.	Study: EC_{50} = 50 mg a.e./L NOEC = 22 mg a.e./L Ratio: 0.44 U.S. EPA/OPP 2009a: EC_{50} = 32.5 ppm a.e. NOEC = 7.0 ppm a.e. Note: The discrepancy between the study and the EPA EC_{50}s probably reflect a reanalysis by EPA. Based on Table 2 of study, the EPA NOEC seems reasonable for Day 5 reduction in total cell number.	Cowgill and Milazzo 1989a, MRID 41736303,
Triclopyr TEA			
Chlorella vulgaris	Analytical grade (NOS)	EC_{50} = 8 ppm a.e.	Baarschers et al. 1988
Chlorella pyrenoidosa	Analytical grade (NOS)	EC_{50} = 54 ppm a.e.	Baarschers et al. 1988

Appendix 8: Toxicity to Aquatic Plants *(continued)*

A8 Table 1: Algae			
Species	**Exposure**	**Response[1]**	**Reference**
Ankistrodesmus spp. (NOS)	Garlon 3A	96 h EC_{50}: 0.692 mg a.i./L (≈0.49 mg a.e./L) NOAEC: 0.320 mg a.i./L (≈0.23 mg a.e./L) Ratio: 0.46 Units (a.e., a.i., formulation) for exposures are not explicitly noted but appear to be in units of a.i. Will assume reported units of a.i. for conversion to a.e.	Gardner et al. 1997
Kirchneria subcapitata	TEA, 5 days	EC_{50} = 12.1 mg a.e./L	MRID 41736305, U.S. EPA/OPP 2009a, Cowgill 1987
Kirchneria subcapitata (*Selenastrum capricornutum*)	96 hours, TEA, 45.0% a.i.	EC_{50} = 7.60 ppm a.i. (5.4 mg a.e./L) NOEC = 11.3 ppm a.i. (8.1 mg a.e./L) Ratio: 1.48 **Special Note: The above EC_{50} and NOEC are as reported in U.S. EPA/OPP 1998a.**	U.S. EPA/OPP 1998a, MRID 41633705 Not cited in U.S. EPA/OPP 2009a.
Anabaena flos-aquae	7 days, TEA, 45.0% a.i.	EC_{50} = 5.90 ppm a.i. (4.1 mg a.e./L) NOEC = 2.0 ppm a.i. Ratio: 0.33	MRID 41633706, U.S. EPA/OPP 1998a and 2009a, Cowgill 1987
Skeletonema costatum	96 hours, TEA, 45.1% a.i. Conc: 0, 13, 21.6, 36, and 100 mg/L.	EC_{50} = 6.70 ppm a.i. (4.6 mg a.e./L) NOEC = 0.40 ppm a.i. (≈0.39 mg a.e./L) Ratio: 0.060 Working Note: This ratio is very low. The raw data in Mayes (1991d) are consistent with a very low (if any) NOAEC. The EPA NOEC appears to be credible.	MRID 41633707, U.S. EPA/OPP 1998a and 2009a, Cowgill 1987 Also summarized in Mayes 1991d
Navicula pelliculosa	96 hours, TEA, 45.0% a.i.	EC_{50} = 15.30 ppm a.i. (10.6 mg a.e./L) NOEC = 8.0 ppm a.i. Ratio: 0.52	MRID 41633708, U.S. EPA/OPP 1998a and 2009a, Cowgill 1987

Appendix 8: Toxicity to Aquatic Plants *(continued)*

A8 Table 1: Algae			
Species	**Exposure**	**Response[1]**	**Reference**
Triclopyr BEE			
Anabaena flos-aquae	96 hours, BEE, 96.98% a.i., 5 days	Study EC_{50} = 2.27 mg a.i./L (≈1.63 mg a.e./L) NOEC = 1.04 mg a.i./L (≈0.75 mg a.e./L) U.S. EPA/OPP 1998a, 2009a EC_{50} = 1.97 ppm a.i. (≈1.42 mg a.e./L) NOEC =0.52 ppm a.i. (≈0.37 mg a.e./L)	Hughes and Alexander 1993b, MRID 42721101
Navicula pelliculosa	96 hours, BEE, 96.98% a.i., 5 days	Study EC_{50} = 0.193 mg a.i./L (≈0.139 mg a.e./L) NOEC = 0.104 mg a.i./L (≈0.075 mg a.e./L) U.S. EPA/OPP 1998a EC_{50} = 0.1 mg a.i./L (≈0.07 mg a.e./L) NOEC = 0.002 mg a.i./L (0.0014 mg a.e./L) U.S. EPA/OPP 2009a EC_{50} = 0.073 mg a.e./L NOEC = 0.0014 mg a.e./L The study designation of 0.104 mg a.i./L as the NOAEC is based on statistical significance with respect to controls. The stated NOAEC is associated with 11.8% inhibition (Study Table 5, p. 22). The EPA/OPP designation of 0.002 mg a.i./L seems more reasonable.	Hughes and Alexander 1993c, MRID 42721102

Appendix 8: Toxicity to Aquatic Plants *(continued)*

A8 Table 1: Algae			
Species	**Exposure**	**Response[1]**	**Reference**
Skeletonema costatum	Garlon 4, exposure period of 5 days	Study: Cell Count (Day 5) EC_{50} = 8.2 mg a.i./L (≈5.9 mg a.e./L) NOEC = 1.4 mg a.i./L (≈1.0 mg a.e./L. Cell Volume EC_{50} = 10.3 mg a.i./L (≈7.4 mg a.e./L) NOEC = 1.4 mg a.i./L (≈1.0 mg a.e./L. U.S. EPA/OPP 1989a: EC_{50} = 3.4 mg a.i./L (2.43 mg a.e./L) NOEC = 2.3 mg a.i./L (≈1.65 mg a.e./L) The NOEC but not the EC_{50} is consistent with the study data. U.S. EPA/OPP 2009a: EC_{50} = 2.5 mg a.e./L The above EC_{50} is not consistent with the study data.	Cowgill et al. 1989b, MRID 41633704. Also summarized in Mayes 1991e.
Skeletonema costatum	96 hours, BEE, 96.98% a.i., 5 days	Study, U.S. EPA/OPP 1998a and 2009a EC_{50} = 1.17 mg a.i./L (≈0.84 mg a.e./L) NOEC = 0.209 mg a.i./L (≈0.15 mg a.e./L)	Hughes and Alexander 1993a, MRID 42721103
Kirchneria subcapitata (*Selenastrum capricornutum*)	5 days, 61.3% a.i.	U.S. EPA/OPP 1998a EC_{50} = 3.40 ppm a.i. NOEC = 2.3 ppm a.i. U.S. EPA/OPP 2009a EC_{50} = 2.50 mg a.e./L	MRID 42090422 (Mayes 1991e) and MRID 41633704
TCP			
Kirchneria subcapitata (*Selenastrum capricornutum*)	5 days	EC_{50}: 2.3 mg a.e./L (1.8 mg TCP/L) NOAEC: 0.84 mg a.e./L (0.65 mg TCP/L)	MRID 45312001, U.S. EPA/OPP 2009a, Appendix A [2]
Anabaena flos-aquae	5 days	EC_{50}: 2.3 mg a.e./L (1.8 mg TCP/L) NOAEC: 0.46 mg a.e./L (0.36 mg TCP/L)	MRID 45312003, U.S. EPA/OPP 2009a, Appendix A [2]

[1] Unless otherwise specified, the term *Ratio* refers to the ratio of the NOAEC to the EC_{50}.

[2] U.S. EPA/OPP 2009a, Appendix A, reports toxicity values for TCP as triclopyr acid equivalents. 1.292 a.e./TCP based on ratios of molecular weights of triclopyr acid and TCP.

A8 Table 2: Macrophytes

Species	Exposure	Response	Reference
Triclopyr Acid			
Common Watermilfoil (*Myriophyllum sibiricum*)	14 days, acid (99.6%)	IC_{50}: (shoot growth): 4.57 mg a.i./L (similar to BEE, see below). IC_{50}: (root length): 0.56 mg a.i./L (most sensitive endpoint).	Roshon et al. 1999 (also in Roshon 1997, full thesis)
Watermilfoil (*Myriophyllum sibiricum*)	14 days, triclopyr acid NOS	Most sensitive EC_{50}s Carotenoid content: 0.04 mg a.e./L Overt Toxicity Dry weight: 4.12 mg a.e./L No information on NOAECs.	Perkins 1997
Triclopyr TEA			
Duckweed, (*Lemna gibba*)	Garlon 3A (32.3% a.e.) Nominal conc.: 0, 4.7, 7.8, 13, 21.6, 36, 60, and 100 mg a.e./L. 7-day and 14-day exposures.	**Endpoint** / **14-day EC_{50}** (**mg form./L**, **mg a.e./L**): Number of plants: 24, 7.7 Frond number: 30, 9.7 Biomass: 26, 8.4 Units in study appear to be reported in mg formulation/L. U.S. EPA/OPP 1998a: EC50: 11 mg a.i./L (≈7.8 mg a.e./L) EC05/NOEC: 3.5 mg a.i./L (≈2.5 mg a.e./L) EPA values are consistent with study values (within rounding errors) assuming that EPA selected the most sensitive endpoint.	Cowgill et al. 1988, MRID 41736302. Also in open lit. as Cowgill et al. 1989a This study is not cited in U.S. EPA/OPP 2009a.
Lemna gibba	14 days, TEA	Most sensitive EC_{50} Frond count: 13.58 mg a.e./L	Perkins 1997

A8 Table 2: Macrophytes

Species	Exposure	Response	Reference
Duckweed, (*Lemna minor*), 4 clones from 4 States	Garlon 3A (32.3% a.e.) Nominal conc.: 0, 4.7, 7.8, 13, 21.6, 36, 60, and 100 mg a.e./L. 7-day and 14-day exposures. Only most sensitive clone for each endpoint summarized in the next column.	**Endpoint** / **14-day EC_{50}** (**14-day EC_{50} mg/L**; **mg a.e./L**): Number of plants 55 17.8; Frond number 49 15.8; Biomass 67 21.6. NOAEC (based on study tables) as well as Table 6 in Cowgill et al. 19891 appears to be 7.8 mg a.i./L or about 5.6 mg a.e./L.	Cowgill et al. 1988, MRID 41736302. Also in open lit. as Cowgill et al. 1989a
Eurasian watermilfoil	4 week exposures at 0.5 to 1 µg/L.	0.5 µg/L: decrease in photosynthesis and chlorophyll. 1 µg/L: reduction in stem length and abnormal root development.	Lembi and Chand-Goyal 1994
Hydrilia verticillata	4 week exposures at 50 to 500 µg/L.	50 µg/L: slight but not significant stimulation of growth. 100 µg/L: Reduction in chlorophyll. 250 µg/L: Significant reduction in main stem length. 500 µg/L: Reduction in photosynthesis.	Lembi and Chand-Goyal 1994
Nymphaea odorata (waterlily)	Renovate 3 at concentrations of 0.25, 0.50, 1.00 and 2.00 mg a.i./L.	Shoot Biomass: Slight stimulation at lowest concentrations and slight reduction at higher concentrations. Not statistically significant or concentration-related. Root Biomass: Slight stimulation at lowest concentration and significant and concentration related decreases at higher concentrations.	Glomski and Nelson 2008
Nuphar lutea (spatterdock)	Renovate 3 at concentrations of 0.25, 0.50, 1.00 and 2.00 mg a.i./L.	Shoot Biomass: No effect at 0.25 mg/L. Concentration-related decrease at higher concentration. Root Biomass: No effect at 0.25 mg/L. Decreases at higher concentrations.	Glomski and Nelson 2008
Zizania palustris (wild rice)	Renovate 3 at 0, 0.75, 1.5, and 2.5 mg/L for 4 weeks	NOEC: 0.75 mg/L LOEC: 1.5 mg/L based in decrease in mass of seedling stage rice.	Madsen et al. 2008

A8 Table 2: Macrophytes

Species	Exposure	Response	Reference
Lemna gibba	14 days, TEA, 45.1% a.i.	EC_{50} = 8.80 ppm a.i. (6.06 mg a.e./L) NOEC = 3.5 ppm a.i. (≈2.5 mg a.e./L)	MRID 41633709, U.S. EPA/OPP 1998a and 2009a, Cowgill 1987 Also summarized in Mayes 1991c.
Lemna gibba	14 days, TEA, 45.0% a.i.	EC_{50} = 11 ppm a.i. (7.6 mg a.e./L) NOEC = 3.5 ppm a.i. (≈2.5 mg a.e./L)	MRID 41736302, U.S. EPA/OPP 1998a and 2009a, Cowgill 1987
Watermilfoil	0.25-2.5 mg a.e./L (as Garlon 3A) over time periods of 2-84 hrs.	Very little effect at any concentration for exposure periods less than 6 hours. At 0.25 mg/L, effective control was associated with exposure periods of 24 (partially effective) to 72 (very effective) hours.	Netherland and Getsinger 1992, 1993
Water Chestnut (*Trapa natans*)	Renovate 3 at 0, 0.5, 1.0, and 2.0 mg a.e./L for 24 and 48 hours with pos-exposure observations for 56 days.	Concentration related decrease in mean shoot biomass at 56 DAT. No difference between the 24 and 48 hour exposure periods.	Poovey and Getsinger 2007
Eurasian Watermilfoil (*Myriophyllum spicatum*)	Renovate 3 at 0.01, 0.03, 0.09, 0.27, 0.81, 2.43 mg a.e./L for 24 to 28 hours with pos-exposure observations at 5 weeks.	Significant concentration related decrease in shoot biomass at all concentrations. See Figure 1 of paper. EC_{50} for decrease in shoot length of 0.04 mg a.e./L. See Figure 2 of paper. Visual estimate of NOAEC: 0.01 mg a.e./L	Poovey et al. 2007
Milfoil Hybrid (*M. spicatum*× *M. sibiricum*)	Renovate 3 at 0.01, 0.03, 0.09, 0.27, 0.81, 2.43 mg a.e./L for 24 to 28 hours with pos-exposure observations at 5 weeks.	No significant decrease in shoot biomass at the two lower concentrations. NOEC=0.03 mg/L. Higher concentrations resulted in significant and substantial decreases. See Figure 1 of paper. EC_{50} for decrease in shoot length of 0.08 mg a.e./L. See Figure 2 of paper.	Poovey et al. 2007
Sago Pondweed (*Potamogeton pectinatus*)	Garlon 3A at 1, 1.5, and 2.0 mg a.e./L for 24 hours with observations at 35 days after treatment.	No significant effect on biomass at 1.0 mg/L. Significant (≈33%) decrease in biomass at two higher concentrations.	Sprecher et al. 1998

A8 Table 2: Macrophytes

Species	Exposure	Response	Reference
Triclopyr BEE			
Lemna gibba	14 days, BEE, 96.98% a.i.	Study EC_{50} (Frond count): 2.4 mg a.i./L (≈1.7 mg a.e./L) NOEC (Frond count): 0.2 mg a.i./L (≈0.14 mg a.e./L) U.S. EPA/OPP 2009a EC_{50}: 0.86 mg a.e./L NOAEC: <0.111 mg a.e./L The reason for the discrepancy in the EC_{50}s is not apparent. EPA may have reanalyzed the dose/response data.	Milazzo et al. 1993, MRID 42719101
Common Watermilfoil (*Myriophyllum sibiricum*)	14 days, Garlon 4	IC_{50}: (shoot growth): 6.42 mg a.i./L (4.62 mg a.e./L)	Roshon et al. 1999 (also in Roshon 1997, full thesis)
Watermilfoil (*Myriophyllum sibiricum*)	14 days	Most sensitive EC_{50} Chlorophyll B: 0.09 mg a.e./L Overt EC_{50} Total plant area: 1.49 mg a.e./L	Perkins 1997
Lemna gibba	14 days	Most sensitive EC_{50} Frond count: 6.25 mg a.e./L	Perkins 1997

A8 Table 3: Field or Mesocosm Studies

Exposure	Response	Reference
Renovate (triclopyr amine) with non-ionic surfactant (0.25%). Rates of low (4.8 L/ha), medium (9.6 L/ha), and high (14.4 L/ha). These rates correspond to about 1.54, 3.1, and 4.6 lb a.e./acre. Alabama marsh, 5x5 meter plots, for control of alligatorweed (aquatic invasive), applications in April and July.	Adequate control of target species with an increase in biomass of native species.	Allen et al. 2007
Applications to wetlands of 4, 8, and 12 kg/ha for the control of purple loosestrife. Water depth of 50-60 cm.	Good control of loosestrife at all application rates. No impact on nontarget grasses but decline in sedge (*Carex* spp.) at two higher application rates.	Gabor et al. 1995 Gabor et al. 1996

A8 Table 3: Field or Mesocosm Studies

Exposure	Response	Reference
Garlon 3A tank mixture [6% formulated product by volume, 0.5% LI 700 (nonionic surfactant), and 93.5% water] was applied at 5L/ha, using a hand-held backpack sprayer, to the water side of two wetland areas in late stages of purple loosestrife invasion in the State of Washington to determine the nontarget effects of treatment.	No statistically significant decreases in the survival or growth of the bioassay organisms (duckweed, *Daphnia*, or rainbow trout), and no significant decreases in the abundance of free-living aquatic invertebrates as a result of Garlon 3A application.	Gardner and Grue 1996
Garlon 3A (31.8% a.e.) at nominal concentration of 1 or 2.5 mg/L to 6-ha river plot at Pend Oreille River in Washington for the control of Eurasian water milfoil.	Monitored concentrations of 4.59 ± 1.46 mg/L. Decrease in total plant biomass at 4 weeks after application but no effect on biomass at 1 or 2 years after application. Reduction in milfoil biomass persisted for 2 years after application due to acute and severe damage to rootcrowns. Substantial increase in native plant biomass at 1 and 2 years post-treatment. Little effect on native monocots or dicots.	Getsinger et al. 1996
Garlon 3A (31.8% a.e.) was applied at 2.5 mg/L to a 6-ha river plot and at 1.75 mg/L to a 4-ha cover plot using a conventional submersed application technique to control Eurasian water milfoil.	Within the river treatment plot, triclopyr concentrations (<0.01-0.41 mg/L) were less than the proposed potable water tolerance level of 0.5 mg/L 3 days after treatment and 675 m downstream of the plot, triclopyr concentrations were <0.01-0.47 mg/L within 1 day after treatment. In the cove plot, triclopyr concentrations ranged from 0.12 to 0.29 mg/L by 7 days after treatment and from <0.01 to 0.06 mg/L at 150 m downstream. Treatment reduced milfoil biomass by 99% within 4 weeks; nontarget native plant biomass increased 500-1000% by 1 year post-treatment and remained significantly higher in the cover plot at 2 years post-treatment.	Getsinger et al. 1997 Working Note: This may be the same study summarized in Getsinger et al. 1996 with different reporting details. Many similarities.
Subsurface application (via spray boom operated from an airboat) of triclopyr TEA (formulated as Garlon 3A) to plot A (Phelps Bay) and surface application (via boomless low-volume device) of triclopyr TEA (formulated as Garlon 3A) to plot B (Carsons Bay) of Lake Minnetonka MI in summer of 1994 to control watermilfoil. Garlon 3A was applied at a rate of 2.5 mg/L, the maximum rate indicated on the label.	Triclopyr rapidly degraded to its metabolites TCP and TMP. All three compounds dissipated rapidly from sample matrices: water, sediment, fin-fish, invertebrates, and non-target plants. Treatment with Garlon 3A at the maximum label rate resulted in complete control of Eurasian watermilfoil at both treated sites. Native plant biomass, cover, and diversity remained higher after triclopyr treatment, compared with the untreated reference plot. Triclopyr treatments did not adversely affect water quality. After the eradication of the target species (Eurasian watermilfoil), water quality conditions generally improved, especially with respect to pH and dissolved oxygen levels.	Houtman et al. 1997a MRID 44456101

A8 Table 3: Field or Mesocosm Studies

Exposure	Response	Reference
Limnobium spongia (American Frogbit), monocot treated with Renovate (TEA) at rates equivalent to 1.69, 3.38, and 7.72 kg/ha with 0.25% X-77. Observation period of 12 weeks.	A clear concentration-related decrease in plant biomass. No monitoring data on concentrations of triclopyr in water.	Madsen et al. 1998
Pool in upper Mississippi. Garlon 3A are rates of 0, 3.41 kg/ha, or 4.54 kg/ha with 0.25% X-77 surfactant.	Adequate control of purple loosestrife at both rates. Also effects on nontarget dicots but no substantial direct impact on monocots. Longer-term decreases in monocots were associated with a flood event.	Nelson et al. 1996
Channel mesocosms with watermilfoil, rates of 0.25, 0.5, 1.0 and 2.5 mg a.e./L (Garlon 3A) with exposure periods of 2 to 96 hours.	Effective control at rates as low as 0.25 mg/L over a 96 hour period. At 2.5 mg/L, effective control in only 8 hours.	Netherland and Getsinger 1993

Appendix 9: Triclopyr BEE Following Application of Triclopyr BEE

BEE (Garlon 4)

Table A09-1: Effective Offsite Application Rate (lb/acre)

Site	Clay	Loam	Sand
Dry and Warm Location	0 (0 - 1.25E-05)	0 (0 - 0)	0 (0 - 0)
Dry and Temperate Location	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)
Dry and Cold Location	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)
Average Rainfall and Warm Location	0 (0 - 0.0046)	0 (0 - 0.00096)	0 (0 - 7.80E-06)
Average Rainfall and Temperate Location	0 (0 - 0.0062)	0 (0 - 0.00046)	0 (0 - 5.30E-10)
Average Rainfall and Cool Location	0 (0 - 0.00118)	0 (0 - 0)	0 (0 - 0)
Wet and Warm Location	0 (0 - 0.00062)	0 (0 - 1.51E-08)	0 (0 - 0)
Wet and Temperate Location	0 (0 - 0.00042)	0 (0 - 0)	0 (0 - 0)
Wet and Cool Location	0.0131 (0.00235 - 0.046)	0.0032 (0.000036 - 0.0213)	1.70E-07 (0 - 0.005)
		Average of Central Values:	0.000604
		25th Percentile of Lower Bounds:	0
		Maximum Value:	0.046
		Summary of Values:	0.0006 (0 - 0.046)

BEE (Garlon 4)

Table A09-2: Concentration in Top 12 Inches of Soil (ppm)

Site	Clay	Loam	Sand
Dry and Warm Location	0.131 (0.131 - 0.131)	0.116 (0.116 - 0.116)	0.116 (0.116 - 0.116)
Dry and Temperate Location	0.131 (0.131 - 0.131)	0.116 (0.116 - 0.116)	0.116 (0.116 - 0.116)
Dry and Cold Location	0.131 (0.131 - 0.131)	0.116 (0.116 - 0.116)	0.116 (0.116 - 0.116)
Average Rainfall and Warm Location	0.131 (0.131 - 0.131)	0.116 (0.116 - 0.116)	0.116 (0.116 - 0.116)
Average Rainfall and Temperate Location	0.131 (0.131 - 0.131)	0.116 (0.116 - 0.116)	0.116 (0.116 - 0.116)
Average Rainfall and Cool Location	0.131 (0.131 - 0.131)	0.116 (0.116 - 0.116)	0.116 (0.116 - 0.116)
Wet and Warm Location	0.131 (0.131 - 0.131)	0.116 (0.116 - 0.116)	0.116 (0.116 - 0.116)
Wet and Temperate Location	0.131 (0.131 - 0.131)	0.116 (0.116 - 0.116)	0.116 (0.116 - 0.116)
Wet and Cool Location	0.13 (0.127 - 0.131)	0.116 (0.115 - 0.116)	0.116 (0.116 - 0.116)
		Average of Central Values:	0.121
		25th Percentile of Lower Bounds:	0.116
		Maximum Value:	0.131
		Summary of Values:	0.121 (0.116 - 0.131)

BEE (Garlon 4)

Table A09-3: Concentration in Top 36 Inches of Soil (ppm)

Site	Clay	Loam	Sand
Dry and Warm Location	0.044 (0.044 - 0.044)	0.039 (0.039 - 0.039)	0.039 (0.039 - 0.039)
Dry and Temperate Location	0.044 (0.044 - 0.044)	0.039 (0.039 - 0.039)	0.039 (0.039 - 0.039)
Dry and Cold Location	0.044 (0.044 - 0.044)	0.039 (0.039 - 0.039)	0.039 (0.039 - 0.039)
Average Rainfall and Warm Location	0.044 (0.044 - 0.044)	0.039 (0.039 - 0.039)	0.039 (0.039 - 0.039)
Average Rainfall and Temperate Location	0.044 (0.044 - 0.044)	0.039 (0.039 - 0.039)	0.039 (0.039 - 0.039)
Average Rainfall and Cool Location	0.044 (0.044 - 0.044)	0.039 (0.039 - 0.039)	0.039 (0.039 - 0.039)
Wet and Warm Location	0.044 (0.044 - 0.044)	0.039 (0.039 - 0.039)	0.039 (0.039 - 0.039)
Wet and Temperate Location	0.044 (0.044 - 0.044)	0.039 (0.039 - 0.039)	0.039 (0.039 - 0.039)
Wet and Cool Location	0.043 (0.042 - 0.044)	0.039 (0.038 - 0.039)	0.039 (0.039 - 0.039)
		Average of Central Values:	0.0406
		25th Percentile of Lower Bounds:	0.039
		Maximum Value:	0.044
		Summary of Values:	0.041 (0.039 - 0.044)

BEE (Garlon 4)

Table A09-4: Maximum Penetration into Soil Column (inches)

Site	Clay	Loam	Sand
Dry and Warm Location	4 (0.39 - 8)	4 (0.39 - 8)	4 (0.39 - 8)
Dry and Temperate Location	4 (0.39 - 4)	4 (0.39 - 4)	4 (0.39 - 4)
Dry and Cold Location	4 (4 - 8)	4 (4 - 8)	4 (4 - 8)
Average Rainfall and Warm Location	8 (4 - 12)	8 (4 - 12)	8 (4 - 18)
Average Rainfall and Temperate Location	8 (4 - 12)	8 (4 - 12)	8 (4 - 18)
Average Rainfall and Cool Location	8 (4 - 12)	4 (4 - 12)	4 (4 - 12)
Wet and Warm Location	8 (4 - 8)	4 (4 - 12)	8 (4 - 12)
Wet and Temperate Location	8 (4 - 8)	4 (4 - 12)	8 (4 - 12)
Wet and Cool Location	12 (12 - 12)	12 (12 - 18)	18 (12 - 24)
		Average of Central Values:	6.74
		25th Percentile of Lower Bounds:	4
		Maximum Value:	24
		Summary of Values:	6.74 (4 - 24)

BEE (Garlon 4)

Table A09-5: Stream, Maximum Peak Concentration in Surface Water (ug/L or ppb)

Site	Clay	Loam	Sand
Dry and Warm Location	0	0	0
	(0 - 0.022)	(0 - 0)	(0 - 0)
Dry and Temperate	0	0	0
Location	(0 - 0)	(0 - 0)	(0 - 0)
Dry and Cold Location	0	0	0
	(0 - 0)	(0 - 0)	(0 - 0)
Average Rainfall and	0	0	0
Warm Location	(0 - 7)	(0 - 1.4)	(0 - 0.05)
Average Rainfall and	0	0	0
Temperate Location	(0 - 3.5)	(0 - 0.7)	(0 - 0.000008)
Average Rainfall and Cool	0	0	0
Location	(0 - 2.2)	(0 - 0)	(0 - 0)
Wet and Warm Location	0	0	0
	(0 - 1.16)	(0 - 0.0004)	(0 - 0)
Wet and Temperate	0	0	0
Location	(0 - 0.6)	(0 - 0)	(0 - 0)
Wet and Cool Location	9	2.18	0.0011
	(3.04 - 17.1)	(0.06 - 8)	(0 - 1.86)
		Average of Central Values:	0.414
		25th Percentile of Lower Bounds:	0
		Maximum Value:	17.1
		Summary of Values:	0.41 (0 - 17.1)

BEE (Garlon 4)

Table A09-6: Stream, Annual Average Concentration in Surface Water (ug/L or ppb)

Site	Clay	Loam	Sand
Dry and Warm Location	0 (0 - 0.00007)	0 (0 - 0)	0 (0 - 0)
Dry and Temperate Location	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)
Dry and Cold Location	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)
Average Rainfall and Warm Location	0 (0 - 0.023)	0 (0 - 0.005)	0 (0 - 0.00016)
Average Rainfall and Temperate Location	0 (0 - 0.01)	0 (0 - 0.002)	0 (0 - 2.4E-08)
Average Rainfall and Cool Location	0 (0 - 0.006)	0 (0 - 0)	0 (0 - 0)
Wet and Warm Location	0 (0 - 0.003)	0 (0 - 0.000001)	0 (0 - 0)
Wet and Temperate Location	0 (0 - 0.002)	0 (0 - 0)	0 (0 - 0)
Wet and Cool Location	0.04 (0.012 - 0.07)	0.009 (0.00028 - 0.03)	0.000003 (0 - 0.007)
		Average of Central Values:	0.001815
		25th Percentile of Lower Bounds:	0
		Maximum Value:	0.07
		Summary of Values:	0.00181 (0 - 0.07)

BEE (Garlon 4)

Table A09-7: Pond, Maximum Peak Concentration in Surface Water (ug/L or ppb)

Site	Clay	Loam	Sand
Dry and Warm Location	0 (0 - 0.004)	0 (0 - 0)	0 (0 - 0)
Dry and Temperate Location	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)
Dry and Cold Location	0 (0 - 0)	0 (0 - 0)	0 (0 - 0)
Average Rainfall and Warm Location	0 (0 - 1.81)	0 (0 - 0.31)	0 (0 - 0.017)
Average Rainfall and Temperate Location	0 (0 - 1.06)	0 (0 - 0.11)	0 (0 - 1.9E-06)
Average Rainfall and Cool Location	0 (0 - 0.3)	0 (0 - 0)	0 (0 - 0)
Wet and Warm Location	0 (0 - 0.16)	0 (0 - 0.00005)	0 (0 - 0)
Wet and Temperate Location	0 (0 - 0.1)	0 (0 - 0)	0 (0 - 0)
Wet and Cool Location	1.02 (0.22 - 2.94)	0.24 (0.006 - 1.37)	0.00015 (0 - 0.3)
		Average of Central Values:	0.0467
		25th Percentile of Lower Bounds:	0
		Maximum Value:	2.94
		Summary of Values:	0.047 (0 - 2.94)

BEE (Garlon 4)

Table A09-8: Pond, Annual Average Concentration in Surface Water (ug/L or ppb)

Site	Clay	Loam	Sand
Dry and Warm Location	0	0	0
	(0 - 0.000016)	(0 - 0)	(0 - 0)
Dry and Temperate	0	0	0
Location	(0 - 0)	(0 - 0)	(0 - 0)
Dry and Cold Location	0	0	0
	(0 - 0)	(0 - 0)	(0 - 0)
Average Rainfall and	0	0	0
Warm Location	(0 - 0.007)	(0 - 0.0012)	(0 - 0.00007)
Average Rainfall and	0	0	0
Temperate Location	(0 - 0.004)	(0 - 0.0004)	(0 - 7.0E-09)
Average Rainfall and Cool	0	0	0
Location	(0 - 0.0011)	(0 - 0)	(0 - 0)
Wet and Warm Location	0	0	0
	(0 - 0.0006)	(0 - 1.8E-07)	(0 - 0)
Wet and Temperate	0	0	0
Location	(0 - 0.0004)	(0 - 0)	(0 - 0)
Wet and Cool Location	0.005	0.0012	5.0E-07
	(0.0011 - 0.012)	(0.00003 - 0.005)	(0 - 0.0012)
		Average of Central Values:	0.0002296
		25th Percentile of Lower Bounds:	0
		Maximum Value:	0.012
		Summary of Values:	0.00023 (0 - 0.012)

Appendix 10: Triclopyr Acid Following Application of Triclopyr BEE

Triclopyr (Garlon 4)

Table A10-1: Effective Offsite Application Rate (lb/acre)

Site	Clay	Loam	Sand
Dry and Warm Location	0	0	0
	(0 - 0.00046)	(0 - 3.20E-06)	(0 - 0)
Dry and Temperate	0	0	0
Location	(0 - 3.70E-07)	(0 - 0)	(0 - 0)
Dry and Cold Location	0	0	0
	(0 - 0.000264)	(0 - 0)	(0 - 0)
Average Rainfall and	0.00114	1.87E-07	0
Warm Location	(4.30E-07 - 0.0233)	(0 - 0.00224)	(0 - 2.08E-06)
Average Rainfall and	0.00068	1.69E-09	0
Temperate Location	(2.34E-07 - 0.0157)	(0 - 0.00141)	(0 - 9.50E-07)
Average Rainfall and Cool	0.000032	0	0
Location	(0 - 0.007)	(0 - 0.00001)	(0 - 1.68E-09)
Wet and Warm Location	0.0005	9.90E-07	0
	(1.82E-06 - 0.0149)	(0 - 0.0004)	(0 - 9.50E-08)
Wet and Temperate	0.000036	0	0
Location	(0 - 0.0043)	(0 - 1.84E-05)	(0 - 0)
Wet and Cool Location	0.047	0.0045	8.40E-08
	(0.0207 - 0.091)	(0.0004 - 0.0161)	(0 - 0.000128)
		Average of Central Values:	0.001996
		25th Percentile of Lower Bounds:	0
		Maximum Value:	0.091
		Summary of Values:	0.002 (0 - 0.091)

Triclopyr (Garlon 4)

Table A10-2: Concentration in Top 12 Inches of Soil (ppm)

Site	Clay	Loam	Sand
Dry and Warm Location	0.116 (0.11 - 0.184)	0.103 (0.098 - 0.156)	0.103 (0.098 - 0.171)
Dry and Temperate Location	0.117 (0.11 - 0.18)	0.103 (0.098 - 0.174)	0.104 (0.098 - 0.171)
Dry and Cold Location	0.119 (0.112 - 0.194)	0.107 (0.099 - 0.181)	0.108 (0.099 - 0.18)
Average Rainfall and Warm Location	0.168 (0.115 - 0.196)	0.158 (0.102 - 0.182)	0.157 (0.102 - 0.18)
Average Rainfall and Temperate Location	0.161 (0.111 - 0.19)	0.149 (0.098 - 0.177)	0.15 (0.098 - 0.177)
Average Rainfall and Cool Location	0.165 (0.114 - 0.19)	0.154 (0.101 - 0.176)	0.154 (0.101 - 0.177)
Wet and Warm Location	0.18 (0.118 - 0.196)	0.168 (0.108 - 0.182)	0.169 (0.108 - 0.182)
Wet and Temperate Location	0.161 (0.113 - 0.193)	0.149 (0.1 - 0.179)	0.15 (0.1 - 0.18)
Wet and Cool Location	0.182 (0.159 - 0.194)	0.175 (0.154 - 0.182)	0.171 (0.152 - 0.182)
		Average of Central Values:	0.1445
		25th Percentile of Lower Bounds:	0.099
		Maximum Value:	0.196
		Summary of Values:	0.144 (0.099 - 0.196)

Triclopyr (Garlon 4)

Table A10-3: Out_Site01_SOIL36

Site	Clay	Loam	Sand
Dry and Warm Location	0.039 (0.037 - 0.061)	0.034 (0.033 - 0.052)	0.034 (0.033 - 0.057)
Dry and Temperate Location	0.039 (0.037 - 0.06)	0.034 (0.033 - 0.058)	0.035 (0.033 - 0.057)
Dry and Cold Location	0.04 (0.037 - 0.065)	0.036 (0.033 - 0.06)	0.036 (0.033 - 0.06)
Average Rainfall and Warm Location	0.056 (0.038 - 0.065)	0.053 (0.034 - 0.061)	0.053 (0.034 - 0.061)
Average Rainfall and Temperate Location	0.054 (0.037 - 0.063)	0.05 (0.033 - 0.059)	0.05 (0.033 - 0.059)
Average Rainfall and Cool Location	0.055 (0.038 - 0.063)	0.051 (0.034 - 0.059)	0.052 (0.034 - 0.059)
Wet and Warm Location	0.06 (0.039 - 0.065)	0.056 (0.036 - 0.061)	0.056 (0.036 - 0.061)
Wet and Temperate Location	0.054 (0.038 - 0.064)	0.05 (0.033 - 0.06)	0.05 (0.033 - 0.06)
Wet and Cool Location	0.061 (0.053 - 0.065)	0.059 (0.052 - 0.061)	0.059 (0.052 - 0.061)
		Average of Central Values:	0.0484
		25th Percentile of Lower Bounds:	0.033
		Maximum Value:	0.065
		Summary of Values:	0.048 (0.033 - 0.065)

Triclopyr (Garlon 4)

Table A10-4: Maximum Penetration into Soil Column (inches)

Site	Clay	Loam	Sand
Dry and Warm Location	8	8	8
	(4 - 18)	(4 - 18)	(4 - 24)
Dry and Temperate	4	4	4
Location	(4 - 12)	(4 - 12)	(4 - 12)
Dry and Cold Location	8	8	8
	(4 - 18)	(4 - 18)	(4 - 24)
Average Rainfall and	24	24	30
Warm Location	(12 - 36)	(12 - 36)	(18 - 36)
Average Rainfall and	18	18	18
Temperate Location	(12 - 30)	(12 - 30)	(12 - 36)
Average Rainfall and Cool	18	12	18
Location	(8 - 24)	(8 - 24)	(12 - 30)
Wet and Warm Location	30	30	36
	(18 - 36)	(18 - 36)	(24 - 36)
Wet and Temperate	18	18	24
Location	(12 - 30)	(12 - 36)	(12 - 36)
Wet and Cool Location	36	36	36
	(36 - 36)	(36 - 36)	(36 - 36)
		Average of Central Values:	18.7
		25th Percentile of Lower Bounds:	4
		Maximum Value:	36
		Summary of Values:	18.7 (4 - 36)

Triclopyr (Garlon 4)

Table A10-5: Stream, Maximum Peak Concentration in Surface Water (ug/L or ppb)

Site	Clay	Loam	Sand
Dry and Warm Location	0 (0 - 1.56)	0 (0 - 0.008)	0 (0 - 0)
Dry and Temperate Location	0 (0 - 0.0015)	0 (0 - 0)	0 (0 - 0)
Dry and Cold Location	0 (0 - 1.32)	0 (0 - 0)	0 (0 - 0)
Average Rainfall and Warm Location	3.07 (0.0012 - 34)	0.0005 (0 - 3.5)	0 (0 - 1.31)
Average Rainfall and Temperate Location	1.88 (0.0009 - 26.1)	0.000006 (0 - 3.1)	0 (0 - 0.028)
Average Rainfall and Cool Location	0.12 (0 - 19.8)	0 (0 - 0.016)	0 (0 - 0.00004)
Wet and Warm Location	1.33 (0.008 - 30.5)	0.004 (0 - 0.9)	0.0017 (0 - 2.09)
Wet and Temperate Location	0.12 (0 - 10.3)	2.8E-06 (0 - 0.06)	0 (0 - 0.09)
Wet and Cool Location	41 (22.5 - 62)	5.5 (1.62 - 15)	22.7 (3.8 - 62)
		Average of Central Values:	2.8
		25th Percentile of Lower Bounds:	0
		Maximum Value:	62
		Summary of Values:	2.8 (0 - 62)

Triclopyr (Garlon 4)

Table A10-6: Stream, Annual Average Concentration in Surface Water (ug/L or ppb)

Site	Clay	Loam	Sand
Dry and Warm Location	0 (0 - 0.004)	0 (0 - 0.000025)	0 (0 - 0)
Dry and Temperate Location	0 (0 - 0.000004)	0 (0 - 0)	0 (0 - 0)
Dry and Cold Location	0 (0 - 0.004)	0 (0 - 0)	0 (0 - 0)
Average Rainfall and Warm Location	0.01 (0.000005 - 0.14)	2.4E-06 (0 - 0.013)	0 (0 - 0.009)
Average Rainfall and Temperate Location	0.006 (2.5E-06 - 0.09)	1.6E-08 (0 - 0.009)	0 (0 - 0.00008)
Average Rainfall and Cool Location	0.0003 (0 - 0.06)	0 (0 - 0.00005)	0 (0 - 1.2E-07)
Wet and Warm Location	0.005 (0.000024 - 0.09)	0.000011 (0 - 0.004)	0.000005 (0 - 0.017)
Wet and Temperate Location	0.0004 (0 - 0.04)	9.0E-09 (0 - 0.00016)	0 (0 - 0.0009)
Wet and Cool Location	0.23 (0.13 - 0.4)	0.06 (0.022 - 0.5)	0.7 (0.08 - 1.94)
		Average of Central Values:	0.0375
		25th Percentile of Lower Bounds:	0
		Maximum Value:	1.94
		Summary of Values:	0.037 (0 - 1.94)

Triclopyr (Garlon 4)

Table A10-7: Pond, Maximum Peak Concentration in Surface Water (ug/L or ppb)

Site	Clay	Loam	Sand
Dry and Warm Location	0 (0 - 0.5)	0 (0 - 0.004)	0 (0 - 0)
Dry and Temperate Location	0 (0 - 0.0005)	0 (0 - 0)	0 (0 - 0)
Dry and Cold Location	0 (0 - 0.29)	0 (0 - 0)	0 (0 - 0)
Average Rainfall and Warm Location	1.33 (0.0006 - 27.9)	0.0004 (0 - 2.12)	0 (0 - 1.82)
Average Rainfall and Temperate Location	0.8 (0.00028 - 19)	0.000002 (0 - 1.56)	0 (0 - 0.019)
Average Rainfall and Cool Location	0.04 (0 - 7.8)	0 (0 - 0.012)	0 (0 - 0.000024)
Wet and Warm Location	0.7 (0.0028 - 16.4)	0.0026 (0 - 0.7)	0.0026 (0 - 4.6)
Wet and Temperate Location	0.04 (0 - 4.7)	1.2E-06 (0 - 0.022)	0 (0 - 0.12)
Wet and Cool Location	16.9 (7.4 - 37)	5.3 (1.4 - 38)	65 (9.8 - 142)
		Average of Central Values:	3.34
		25th Percentile of Lower Bounds:	0
		Maximum Value:	142
		Summary of Values:	3.34 (0 - 142)

Triclopyr (Garlon 4)

Table A10-8: Pond, Annual Average Concentration in Surface Water (ug/L or ppb)

Site	Clay	Loam	Sand
Dry and Warm Location	0 (0 - 0.25)	0 (0 - 0.0013)	0 (0 - 0)
Dry and Temperate Location	0 (0 - 0.00021)	0 (0 - 0)	0 (0 - 0)
Dry and Cold Location	0 (0 - 0.14)	0 (0 - 0)	0 (0 - 0)
Average Rainfall and Warm Location	0.8 (0.00027 - 15.4)	0.00014 (0 - 1.12)	0 (0 - 0.6)
Average Rainfall and Temperate Location	0.4 (0.00012 - 10)	6.0E-07 (0 - 0.7)	0 (0 - 0.009)
Average Rainfall and Cool Location	0.02 (0 - 3.6)	0 (0 - 0.004)	0 (0 - 0.000018)
Wet and Warm Location	0.31 (0.0015 - 12.3)	0.0013 (0 - 0.5)	0.0006 (0 - 2.59)
Wet and Temperate Location	0.012 (0 - 1.82)	4.0E-07 (0 - 0.009)	0 (0 - 0.021)
Wet and Cool Location	9.3 (1.72 - 25.1)	2.71 (0.5 - 18.7)	23.4 (5.3 - 62)
		Average of Central Values:	1.37
		25th Percentile of Lower Bounds:	0
		Maximum Value:	62
		Summary of Values:	1.37 (0 - 62)

Appendix 11: TCP Following Application of Triclopyr BEE

TCP from Garlon 4 Application

Table A11-1: Effective Offsite Application Rate (lb/acre)

Site	Clay	Loam	Sand
Dry and Warm Location	1.02E-05 (0 - 0.00298)	0 (0 - 0.00049)	0 (0 - 0)
Dry and Temperate Location	8.10E-06 (0 - 0.00087)	0 (0 - 0.00009)	0 (0 - 1.29E-07)
Dry and Cold Location	0 (0 - 0.00025)	0 (0 - 0)	0 (0 - 0)
Average Rainfall and Warm Location	0.00132 (0.000076 - 0.0088)	0.000039 (1.53E-07 - 0.00182)	1.02E-07 (0 - 3.16E-05)
Average Rainfall and Temperate Location	0.00094 (0.00005 - 0.0082)	9.60E-06 (0 - 0.00144)	0 (0 - 1.67E-05)
Average Rainfall and Cool Location	0.000244 (1.72E-06 - 0.00306)	2.10E-07 (0 - 0.00033)	0 (0 - 6.70E-07)
Wet and Warm Location	0.00178 (0.000097 - 0.0133)	0.000086 (4.20E-06 - 0.00227)	9.50E-08 (0 - 0.000035)
Wet and Temperate Location	0.00052 (0.000032 - 0.0037)	1.14E-05 (8.80E-07 - 0.00034)	0 (0 - 5.90E-07)
Wet and Cool Location	0.0032 (0.00133 - 0.0144)	0.00043 (0.000124 - 0.0027)	4.80E-07 (0 - 0.000056)
		Average of Central Values:	0.000318
		25th Percentile of Lower Bounds:	0
		Maximum Value:	0.0144
		Summary of Values:	0.00032 (0 - 0.0144)

TCP from Garlon 4 Application

Table A11-2: Concentration in Top 12 Inches of Soil (ppm)

Site	Clay	Loam	Sand
Dry and Warm Location	0.089 (0.072 - 0.134)	0.078 (0.063 - 0.124)	0.079 (0.063 - 0.126)
Dry and Temperate Location	0.09 (0.072 - 0.135)	0.079 (0.063 - 0.124)	0.079 (0.063 - 0.124)
Dry and Cold Location	0.102 (0.073 - 0.144)	0.094 (0.064 - 0.133)	0.098 (0.066 - 0.133)
Average Rainfall and Warm Location	0.121 (0.081 - 0.146)	0.113 (0.072 - 0.136)	0.111 (0.072 - 0.134)
Average Rainfall and Temperate Location	0.123 (0.089 - 0.143)	0.113 (0.081 - 0.132)	0.112 (0.081 - 0.132)
Average Rainfall and Cool Location	0.123 (0.083 - 0.151)	0.113 (0.075 - 0.14)	0.113 (0.077 - 0.139)
Wet and Warm Location	0.129 (0.103 - 0.151)	0.119 (0.095 - 0.142)	0.118 (0.095 - 0.14)
Wet and Temperate Location	0.119 (0.087 - 0.146)	0.109 (0.078 - 0.135)	0.11 (0.079 - 0.134)
Wet and Cool Location	0.116 (0.086 - 0.138)	0.109 (0.071 - 0.131)	0.083 (0.031 - 0.125)
		Average of Central Values:	0.1053
		25th Percentile of Lower Bounds:	0.0685
		Maximum Value:	0.151
		Summary of Values:	0.105 (0.0685 - 0.151)

TCP from Garlon 4 Application

Table A11-3: Out_Site01_SOIL36

Site	Clay	Loam	Sand
Dry and Warm Location	0.0295 (0.0239 - 0.045)	0.026 (0.0211 - 0.041)	0.0262 (0.0211 - 0.042)
Dry and Temperate Location	0.0299 (0.0239 - 0.045)	0.0264 (0.0211 - 0.041)	0.0265 (0.0212 - 0.041)
Dry and Cold Location	0.034 (0.0242 - 0.048)	0.0312 (0.0214 - 0.044)	0.033 (0.022 - 0.044)
Average Rainfall and Warm Location	0.04 (0.0269 - 0.049)	0.038 (0.0241 - 0.045)	0.037 (0.0241 - 0.046)
Average Rainfall and Temperate Location	0.041 (0.0297 - 0.048)	0.038 (0.027 - 0.044)	0.038 (0.0271 - 0.044)
Average Rainfall and Cool Location	0.041 (0.0278 - 0.05)	0.038 (0.0249 - 0.047)	0.038 (0.0255 - 0.047)
Wet and Warm Location	0.043 (0.034 - 0.051)	0.04 (0.0315 - 0.047)	0.04 (0.0316 - 0.047)
Wet and Temperate Location	0.04 (0.0291 - 0.049)	0.037 (0.0261 - 0.045)	0.037 (0.0262 - 0.045)
Wet and Cool Location	0.041 (0.032 - 0.048)	0.041 (0.031 - 0.048)	0.039 (0.0281 - 0.046)
		Average of Central Values:	0.0359
		25th Percentile of Lower Bounds:	0.0239
		Maximum Value:	0.051
		Summary of Values:	0.036 (0.0239 - 0.051)

Appendix 11: TCP Following Application of Triclopyr BEE *(continued)*

TCP from Garlon 4 Application

Table A11-4: Maximum Penetration into Soil Column (inches)

Site	Clay	Loam	Sand
Dry and Warm Location	12 (4 - 18)	8 (4 - 18)	12 (4 - 24)
Dry and Temperate Location	12 (8 - 24)	12 (8 - 24)	18 (8 - 30)
Dry and Cold Location	12 (8 - 18)	12 (8 - 18)	18 (12 - 24)
Average Rainfall and Warm Location	24 (18 - 30)	24 (18 - 36)	36 (18 - 36)
Average Rainfall and Temperate Location	24 (18 - 30)	24 (18 - 30)	30 (18 - 36)
Average Rainfall and Cool Location	24 (18 - 30)	24 (18 - 30)	36 (30 - 36)
Wet and Warm Location	30 (24 - 36)	36 (30 - 36)	36 (36 - 36)
Wet and Temperate Location	36 (24 - 36)	36 (30 - 36)	36 (36 - 36)
Wet and Cool Location	36 (36 - 36)	36 (36 - 36)	36 (36 - 36)
		Average of Central Values:	25.2
		25th Percentile of Lower Bounds:	8
		Maximum Value:	36
		Summary of Values:	25.2 (8 - 36)

TCP from Garlon 4 Application

Table A11-5: Stream, Maximum Peak Concentration in Surface Water (ug/L or ppb)

Site	Clay	Loam	Sand
Dry and Warm Location	0.04 (0 - 6.5)	0 (0 - 0.6)	0 (0 - 0)
Dry and Temperate Location	0.021 (0 - 1.23)	0 (0 - 0.17)	0 (0 - 0.0011)
Dry and Cold Location	0 (0 - 0.8)	0 (0 - 0)	0 (0 - 0)
Average Rainfall and Warm Location	2.5 (0.14 - 11.8)	0.05 (0.0004 - 1.7)	0.0007 (0 - 0.4)
Average Rainfall and Temperate Location	2.16 (0.14 - 11.9)	0.022 (0 - 2.18)	2.5E-06 (0 - 0.06)
Average Rainfall and Cool Location	0.7 (0.0029 - 5.6)	0.0004 (0 - 0.4)	0.0011 (0.000004 - 0.04)
Wet and Warm Location	2.62 (0.19 - 12.3)	0.15 (0.005 - 2.8)	0.4 (0.021 - 2.9)
Wet and Temperate Location	1.07 (0.08 - 6.6)	0.026 (0.0021 - 0.7)	1 (0.12 - 4)
Wet and Cool Location	1.59 (0.8 - 9.5)	0.8 (0.17 - 4.6)	10.5 (2.73 - 26.5)
		Average of Central Values:	0.876
		25th Percentile of Lower Bounds:	0
		Maximum Value:	26.5
		Summary of Values:	0.88 (0 - 26.5)

Appendix 11: TCP Following Application of Triclopyr BEE *(continued)*

TCP from Garlon 4 Application

Table A11-6: Stream, Annual Average Concentration in Surface Water (ug/L or ppb)

Site	Clay	Loam	Sand
Dry and Warm Location	0.00011 (0 - 0.022)	0 (0 - 0.0023)	0 (0 - 0)
Dry and Temperate Location	0.00009 (0 - 0.008)	0 (0 - 0.0007)	0 (0 - 0.000005)
Dry and Cold Location	0 (0 - 0.0028)	0 (0 - 0)	0 (0 - 0)
Average Rainfall and Warm Location	0.013 (0.0011 - 0.07)	0.00028 (1.4E-06 - 0.007)	2.8E-06 (0 - 0.004)
Average Rainfall and Temperate Location	0.01 (0.0005 - 0.05)	0.00008 (0 - 0.008)	9.0E-09 (0 - 0.00029)
Average Rainfall and Cool Location	0.0026 (0.000018 - 0.025)	1.5E-06 (0 - 0.0018)	0.000008 (4.0E-08 - 0.0003)
Wet and Warm Location	0.014 (0.0019 - 0.06)	0.0007 (0.00005 - 0.011)	0.008 (0.00013 - 0.09)
Wet and Temperate Location	0.006 (0.0004 - 0.04)	0.00029 (0.000018 - 0.022)	0.09 (0.003 - 0.4)
Wet and Cool Location	0.021 (0.009 - 0.07)	0.03 (0.0023 - 0.24)	0.6 (0.14 - 1.53)
		Average of Central Values:	0.02949
		25th Percentile of Lower Bounds:	0
		Maximum Value:	1.53
		Summary of Values:	0.0295 (0 - 1.53)

TCP from Garlon 4 Application

Table A11-7: Pond, Maximum Peak Concentration in Surface Water (ug/L or ppb)

Site	Clay	Loam	Sand
Dry and Warm Location	0.009 (0 - 2.6)	0 (0 - 0.4)	0 (0 - 0)
Dry and Temperate Location	0.007 (0 - 0.6)	0 (0 - 0.07)	0 (0 - 0.0006)
Dry and Cold Location	0 (0 - 0.22)	0 (0 - 0)	0 (0 - 0)
Average Rainfall and Warm Location	1.03 (0.06 - 6.4)	0.029 (0.00013 - 1)	0.0003 (0 - 0.16)
Average Rainfall and Temperate Location	0.8 (0.05 - 6.3)	0.008 (0 - 1.2)	7.0E-07 (0 - 0.031)
Average Rainfall and Cool Location	0.2 (0.0013 - 2.57)	0.00018 (0 - 0.25)	0.0007 (0.000004 - 0.024)
Wet and Warm Location	1.18 (0.07 - 8.3)	0.07 (0.0024 - 1.67)	0.2 (0.01 - 1.47)
Wet and Temperate Location	0.4 (0.026 - 2.75)	0.01 (0.001 - 0.3)	0.5 (0.06 - 2.32)
Wet and Cool Location	0.6 (0.27 - 3.8)	0.4 (0.07 - 2.77)	6 (1.34 - 19.4)
		Average of Central Values:	0.424
		25th Percentile of Lower Bounds:	0
		Maximum Value:	19.4
		Summary of Values:	0.42 (0 - 19.4)

TCP from Garlon 4 Application

Table A11-8: Pond, Annual Average Concentration in Surface Water (ug/L or ppb)

Site	Clay	Loam	Sand
Dry and Warm Location	0.00024 (0 - 0.07)	0 (0 - 0.011)	0 (0 - 0)
Dry and Temperate Location	0.00018 (0 - 0.017)	0 (0 - 0.002)	0 (0 - 0.000023)
Dry and Cold Location	0 (0 - 0.006)	0 (0 - 0)	0 (0 - 0)
Average Rainfall and Warm Location	0.03 (0.0026 - 0.22)	0.0009 (0.000004 - 0.026)	0.00001 (0 - 0.012)
Average Rainfall and Temperate Location	0.027 (0.0013 - 0.19)	0.00022 (0 - 0.03)	4.0E-09 (0 - 0.0008)
Average Rainfall and Cool Location	0.007 (0.00004 - 0.08)	0.000004 (0 - 0.007)	0.000024 (1.3E-07 - 0.0011)
Wet and Warm Location	0.04 (0.004 - 0.27)	0.0021 (0.00016 - 0.05)	0.015 (0.0005 - 0.16)
Wet and Temperate Location	0.014 (0.0008 - 0.09)	0.0006 (0.00004 - 0.03)	0.09 (0.0031 - 0.3)
Wet and Cool Location	0.026 (0.01 - 0.13)	0.05 (0.003 - 0.31)	0.8 (0.2 - 1.85)
		Average of Central Values:	0.0409
		25th Percentile of Lower Bounds:	0
		Maximum Value:	1.85
		Summary of Values:	0.041 (0 - 1.85)

Appendix 12: Triclopyr Following Application of Triclopyr TEA

Triclopyr TEA

Table A12-1: Effective Offsite Application Rate (lb/acre)

Site	Clay	Loam	Sand
Dry and Warm Location	3.40E-06 (0 - 0.00165)	0 (0 - 0.000097)	0 (0 - 0)
Dry and Temperate Location	8.00E-07 (0 - 0.000243)	0 (0 - 3.90E-06)	0 (0 - 8.60E-10)
Dry and Cold Location	0 (0 - 0.00049)	0 (0 - 0)	0 (0 - 0)
Average Rainfall and Warm Location	0.0017 (1.36E-05 - 0.047)	3.05E-06 (0 - 0.0073)	0 (0 - 6.90E-06)
Average Rainfall and Temperate Location	0.0011 (1.35E-05 - 0.0235)	5.60E-07 (0 - 0.00125)	0 (0 - 2.25E-07)
Average Rainfall and Cool Location	0.00012 (3.03E-08 - 0.0077)	0 (0 - 0.000055)	0 (0 - 1.70E-09)
Wet and Warm Location	0.00103 (1.25E-05 - 0.0143)	3.90E-06 (4.20E-09 - 0.00048)	0 (0 - 7.60E-08)
Wet and Temperate Location	0.000143 (1.56E-06 - 0.0059)	2.11E-07 (0 - 0.000077)	0 (0 - 2.35E-08)
Wet and Cool Location	0.061 (0.0259 - 0.108)	0.0068 (0.00101 - 0.0203)	3.90E-07 (0 - 0.00013)
		Average of Central Values:	0.002663
		25th Percentile of Lower Bounds:	0
		Maximum Value:	0.108
		Summary of Values:	0.00266 (0 - 0.108)

Triclopyr TEA

Table A12-2: Concentration in Top 12 Inches of Soil (ppm)

Site	Clay	Loam	Sand
Dry and Warm Location	0.131 (0.131 - 0.23)	0.116 (0.116 - 0.205)	0.116 (0.116 - 0.217)
Dry and Temperate Location	0.131 (0.131 - 0.229)	0.116 (0.116 - 0.215)	0.116 (0.116 - 0.215)
Dry and Cold Location	0.149 (0.131 - 0.235)	0.137 (0.116 - 0.22)	0.15 (0.116 - 0.221)
Average Rainfall and Warm Location	0.216 (0.152 - 0.237)	0.202 (0.141 - 0.222)	0.202 (0.138 - 0.222)
Average Rainfall and Temperate Location	0.206 (0.131 - 0.237)	0.194 (0.116 - 0.222)	0.193 (0.116 - 0.222)
Average Rainfall and Cool Location	0.211 (0.148 - 0.237)	0.197 (0.136 - 0.222)	0.197 (0.134 - 0.222)
Wet and Warm Location	0.228 (0.181 - 0.238)	0.214 (0.168 - 0.223)	0.214 (0.167 - 0.223)
Wet and Temperate Location	0.205 (0.131 - 0.237)	0.192 (0.116 - 0.222)	0.192 (0.116 - 0.222)
Wet and Cool Location	0.224 (0.205 - 0.236)	0.217 (0.201 - 0.223)	0.213 (0.187 - 0.222)
		Average of Central Values:	0.1807
		25th Percentile of Lower Bounds:	0.116
		Maximum Value:	0.238
		Summary of Values:	0.181 (0.116 - 0.238)

Triclopyr TEA

Table A12-3: Concentration in Top 36 Inches of Soil (ppm)

Site	Clay	Loam	Sand
Dry and Warm Location	0.044 (0.044 - 0.077)	0.039 (0.039 - 0.068)	0.039 (0.039 - 0.072)
Dry and Temperate Location	0.044 (0.044 - 0.076)	0.039 (0.039 - 0.072)	0.039 (0.039 - 0.072)
Dry and Cold Location	0.05 (0.044 - 0.078)	0.046 (0.039 - 0.073)	0.05 (0.039 - 0.074)
Average Rainfall and Warm Location	0.072 (0.051 - 0.079)	0.067 (0.047 - 0.074)	0.067 (0.047 - 0.074)
Average Rainfall and Temperate Location	0.069 (0.044 - 0.079)	0.065 (0.039 - 0.074)	0.064 (0.039 - 0.074)
Average Rainfall and Cool Location	0.07 (0.049 - 0.079)	0.066 (0.045 - 0.074)	0.066 (0.045 - 0.074)
Wet and Warm Location	0.076 (0.06 - 0.079)	0.071 (0.056 - 0.074)	0.071 (0.056 - 0.074)
Wet and Temperate Location	0.068 (0.044 - 0.079)	0.064 (0.039 - 0.074)	0.064 (0.039 - 0.074)
Wet and Cool Location	0.075 (0.068 - 0.079)	0.073 (0.068 - 0.074)	0.073 (0.068 - 0.074)
		Average of Central Values:	0.0604
		25th Percentile of Lower Bounds:	0.039
		Maximum Value:	0.079
		Summary of Values:	0.06 (0.039 - 0.079)

Triclopyr TEA

Table A12-4: Maximum Penetration into Soil Column (inches)

Site	Clay	Loam	Sand
Dry and Warm Location	12 (4 - 18)	8 (4 - 24)	12 (4 - 24)
Dry and Temperate Location	12 (8 - 24)	12 (4 - 24)	12 (8 - 30)
Dry and Cold Location	8 (4 - 24)	8 (4 - 18)	8 (4 - 24)
Average Rainfall and Warm Location	24 (18 - 36)	24 (18 - 36)	36 (18 - 36)
Average Rainfall and Temperate Location	24 (18 - 36)	24 (12 - 36)	24 (18 - 36)
Average Rainfall and Cool Location	18 (12 - 30)	18 (12 - 30)	24 (12 - 36)
Wet and Warm Location	30 (24 - 36)	36 (24 - 36)	36 (36 - 36)
Wet and Temperate Location	30 (18 - 36)	36 (18 - 36)	36 (30 - 36)
Wet and Cool Location	36 (36 - 36)	36 (36 - 36)	36 (36 - 36)
		Average of Central Values:	23
		25th Percentile of Lower Bounds:	6
		Maximum Value:	36
		Summary of Values:	23 (6 - 36)

Triclopyr TEA

Table A12-5: Stream, Maximum Peak Concentration in Surface Water (ug/L or ppb)

Site	Clay	Loam	Sand
Dry and Warm Location	0.014	0	0
	(0 - 4.7)	(0 - 0.22)	(0 - 0)
Dry and Temperate	0.004	0	0
Location	(0 - 0.4)	(0 - 0.008)	(0 - 0.000014)
Dry and Cold Location	0	0	0
	(0 - 2)	(0 - 0)	(0 - 0)
Average Rainfall and	4.6	0.007	0.000009
Warm Location	(0.028 - 45)	(0 - 6.8)	(0 - 5.4)
Average Rainfall and	3.2	0.0019	0
Temperate Location	(0.05 - 43)	(0 - 2.67)	(0 - 0.13)
Average Rainfall and Cool	0.4	0	0
Location	(0.00012 - 22.8)	(0 - 0.15)	(0 - 0.011)
Wet and Warm Location	2.31	0.016	0.26
	(0.04 - 33)	(0.000013 - 1.23)	(0.00002 - 7)
Wet and Temperate	0.5	0.0016	0.07
Location	(0.004 - 14.3)	(0.000001 - 0.21)	(0.00004 - 1.69)
Wet and Cool Location	55	8.3	31.3
	(25.8 - 84)	(1.62 - 20.7)	(7.3 - 76)
		Average of Central Values:	3.93
		25th Percentile of Lower Bounds:	0
		Maximum Value:	84
		Summary of Values:	3.93 (0 - 84)

Triclopyr TEA

Table A12-6: Stream, Annual Average Concentration in Surface Water (ug/L or ppb)

Site	Clay	Loam	Sand
Dry and Warm Location	0.00005 (0 - 0.013)	0 (0 - 0.0006)	0 (0 - 0)
Dry and Temperate Location	0.000012 (0 - 0.0024)	0 (0 - 0.000023)	0 (0 - 4.0E-08)
Dry and Cold Location	0 (0 - 0.007)	0 (0 - 0)	0 (0 - 0)
Average Rainfall and Warm Location	0.017 (0.00015 - 0.15)	0.00003 (0 - 0.02)	2.5E-08 (0 - 0.016)
Average Rainfall and Temperate Location	0.013 (0.00014 - 0.14)	0.000006 (0 - 0.007)	0 (0 - 0.0006)
Average Rainfall and Cool Location	0.0012 (3.0E-07 - 0.07)	0 (0 - 0.0004)	0 (0 - 0.00003)
Wet and Warm Location	0.009 (0.00016 - 0.11)	0.00007 (4.0E-08 - 0.003)	0.0024 (6.0E-08 - 0.05)
Wet and Temperate Location	0.0016 (0.00002 - 0.06)	0.00001 (4.0E-09 - 0.0022)	0.0009 (1.7E-07 - 0.09)
Wet and Cool Location	0.31 (0.19 - 0.4)	0.09 (0.024 - 0.5)	1.07 (0.13 - 2.45)
		Average of Central Values:	0.0561
		25th Percentile of Lower Bounds:	0
		Maximum Value:	2.45
		Summary of Values:	0.056 (0 - 2.45)

Triclopyr TEA

Table A12-7: Pond, Maximum Peak Concentration in Surface Water (ug/L or ppb)

Site	Clay	Loam	Sand
Dry and Warm Location	0.005 (0 - 1.94)	0 (0 - 0.11)	0 (0 - 0)
Dry and Temperate Location	0.0013 (0 - 0.29)	0 (0 - 0.005)	0 (0 - 0.000007)
Dry and Cold Location	0 (0 - 0.6)	0 (0 - 0)	0 (0 - 0)
Average Rainfall and Warm Location	2.11 (0.022 - 57)	0.006 (0 - 8.5)	0.000006 (0 - 6.9)
Average Rainfall and Temperate Location	1.51 (0.017 - 30.7)	0.0009 (0 - 1.45)	0 (0 - 0.18)
Average Rainfall and Cool Location	0.13 (0.00004 - 9.9)	0 (0 - 0.06)	0 (0 - 0.005)
Wet and Warm Location	1.33 (0.015 - 16.8)	0.013 (0.000006 - 0.6)	0.5 (0.000009 - 12.7)
Wet and Temperate Location	0.18 (0.002 - 6.6)	0.0012 (8.0E-07 - 0.12)	0.07 (0.00002 - 4.4)
Wet and Cool Location	23.7 (9.7 - 55)	8.4 (1.99 - 57)	85 (17.5 - 221)
		Average of Central Values:	4.55
		25th Percentile of Lower Bounds:	0
		Maximum Value:	221
		Summary of Values:	4.55 (0 - 221)

Triclopyr TEA

Table A12-8: Pond, Annual Average Concentration in Surface Water (ug/L or ppb)

Site	Clay	Loam	Sand
Dry and Warm Location	0.001	0	0
	(0 - 1.42)	(0 - 0.07)	(0 - 0)
Dry and Temperate	0.00019	0	0
Location	(0 - 0.09)	(0 - 0.0013)	(0 - 2.9E-06)
Dry and Cold Location	0	0	0
	(0 - 0.26)	(0 - 0)	(0 - 0)
Average Rainfall and	1.18	0.0028	2.1E-06
Warm Location	(0.009 - 27.6)	(0 - 4)	(0 - 3.15)
Average Rainfall and	0.9	0.00024	0
Temperate Location	(0.008 - 14.4)	(0 - 1.09)	(0 - 0.07)
Average Rainfall and Cool	0.09	0	0
Location	(0.000022 - 5.1)	(0 - 0.05)	(0 - 0.002)
Wet and Warm Location	0.7	0.006	0.14
	(0.009 - 9.6)	(1.4E-06 - 0.3)	(0.000004 - 9.8)
Wet and Temperate	0.06	0.00024	0.021
Location	(0.0004 - 2.57)	(1.7E-07 - 0.06)	(1.8E-06 - 1.93)
Wet and Cool Location	11.4	4	33
	(2.16 - 36)	(0.8 - 18.3)	(7 - 93)
		Average of Central Values:	1.91
		25th Percentile of Lower Bounds:	0
		Maximum Value:	93
		Summary of Values:	1.91 (0 - 93)

Appendix 13: TCP Following Application of Triclopyr TEA

TCP from Triclopry TEA Application

Table A13-1: Effective Offsite Application Rate (lb/acre)

Site	Clay	Loam	Sand
Dry and Warm Location	1.56E-05 (0 - 0.0037)	0 (0 - 0.0005)	0 (0 - 0)
Dry and Temperate Location	3.03E-05 (0 - 0.00115)	0 (0 - 0.00018)	0 (0 - 6.70E-07)
Dry and Cold Location	0 (0 - 0.000148)	0 (0 - 0)	0 (0 - 0)
Average Rainfall and Warm Location	0.00078 (0.000119 - 0.0069)	0.000044 (2.81E-07 - 0.00112)	9.90E-08 (0 - 3.80E-06)
Average Rainfall and Temperate Location	0.00065 (2.46E-05 - 0.0056)	5.70E-06 (0 - 0.00084)	0 (0 - 1.26E-05)
Average Rainfall and Cool Location	0.000172 (2.25E-06 - 0.00314)	4.10E-07 (0 - 0.00066)	0 (0 - 4.40E-06)
Wet and Warm Location	0.00117 (0.000077 - 0.0098)	0.000081 (3.50E-06 - 0.00118)	1.43E-07 (0 - 8.10E-06)
Wet and Temperate Location	0.00047 (0.000041 - 0.00277)	1.26E-05 (1.46E-06 - 0.00033)	1.77E-09 (0 - 4.30E-07)
Wet and Cool Location	0.00162 (0.00033 - 0.0122)	0.000202 (0.000036 - 0.00261)	6.90E-08 (0 - 2.34E-05)
		Average of Central Values:	0.0001946
		25th Percentile of Lower Bounds:	0
		Maximum Value:	0.0122
		Summary of Values:	0.000195 (0 - 0.0122)

Appendix 13: TCP Following Application of Triclopyr TEA *(continued)*

TCP from Triclopry TEA Application

Table A13-2: Concentration in Top 12 Inches of Soil (ppm)

Site	Clay	Loam	Sand
Dry and Warm Location	0.064 (0.043 - 0.124)	0.057 (0.038 - 0.104)	0.058 (0.038 - 0.118)
Dry and Temperate Location	0.067 (0.045 - 0.113)	0.059 (0.039 - 0.107)	0.06 (0.039 - 0.107)
Dry and Cold Location	0.09 (0.057 - 0.138)	0.084 (0.053 - 0.13)	0.088 (0.053 - 0.135)
Average Rainfall and Warm Location	0.108 (0.073 - 0.134)	0.103 (0.066 - 0.128)	0.1 (0.061 - 0.127)
Average Rainfall and Temperate Location	0.1 (0.068 - 0.134)	0.095 (0.062 - 0.124)	0.093 (0.06 - 0.125)
Average Rainfall and Cool Location	0.105 (0.073 - 0.14)	0.103 (0.066 - 0.135)	0.101 (0.066 - 0.135)
Wet and Warm Location	0.122 (0.084 - 0.149)	0.113 (0.076 - 0.142)	0.112 (0.076 - 0.141)
Wet and Temperate Location	0.104 (0.066 - 0.133)	0.098 (0.062 - 0.127)	0.098 (0.063 - 0.128)
Wet and Cool Location	0.115 (0.084 - 0.15)	0.109 (0.062 - 0.145)	0.078 (0.0267 - 0.138)
		Average of Central Values:	0.092
		25th Percentile of Lower Bounds:	0.049
		Maximum Value:	0.15
		Summary of Values:	0.092 (0.049 - 0.15)

Appendix 13: TCP Following Application of Triclopyr TEA *(continued)*

TCP from Triclopry TEA Application
Table A13-3: Out_Site01_SOIL36

Site	Clay	Loam	Sand
Dry and Warm Location	0.0214 (0.0145 - 0.041)	0.0191 (0.0128 - 0.035)	0.0192 (0.0128 - 0.039)
Dry and Temperate Location	0.0224 (0.0148 - 0.038)	0.0198 (0.0131 - 0.036)	0.0201 (0.0131 - 0.036)
Dry and Cold Location	0.0301 (0.019 - 0.046)	0.0281 (0.0176 - 0.043)	0.0294 (0.0178 - 0.045)
Average Rainfall and Warm Location	0.036 (0.0243 - 0.045)	0.034 (0.022 - 0.043)	0.034 (0.022 - 0.042)
Average Rainfall and Temperate Location	0.033 (0.0229 - 0.045)	0.032 (0.0209 - 0.041)	0.0315 (0.021 - 0.042)
Average Rainfall and Cool Location	0.035 (0.0244 - 0.047)	0.034 (0.0221 - 0.045)	0.034 (0.022 - 0.045)
Wet and Warm Location	0.041 (0.0279 - 0.05)	0.038 (0.0255 - 0.047)	0.038 (0.0254 - 0.048)
Wet and Temperate Location	0.035 (0.0219 - 0.045)	0.033 (0.0208 - 0.043)	0.033 (0.021 - 0.043)
Wet and Cool Location	0.043 (0.032 - 0.052)	0.043 (0.0304 - 0.052)	0.04 (0.0284 - 0.049)
		Average of Central Values:	0.0317
		25th Percentile of Lower Bounds:	0.0177
		Maximum Value:	0.052
		Summary of Values:	0.032 (0.0177 - 0.052)

Appendix 13: TCP Following Application of Triclopyr TEA *(continued)*

TCP from Triclopry TEA Application

Table A13-4: Maximum Penetration into Soil Column (inches)

Site	Clay	Loam	Sand
Dry and Warm Location	12 (4 - 18)	8 (4 - 24)	12 (4 - 24)
Dry and Temperate Location	12 (8 - 24)	12 (8 - 24)	18 (8 - 36)
Dry and Cold Location	12 (12 - 18)	12 (8 - 18)	18 (12 - 24)
Average Rainfall and Warm Location	24 (18 - 30)	24 (18 - 36)	36 (24 - 36)
Average Rainfall and Temperate Location	24 (18 - 30)	24 (18 - 30)	30 (24 - 36)
Average Rainfall and Cool Location	24 (18 - 30)	24 (24 - 36)	36 (30 - 36)
Wet and Warm Location	36 (30 - 36)	36 (30 - 36)	36 (36 - 36)
Wet and Temperate Location	36 (30 - 36)	36 (36 - 36)	36 (36 - 36)
Wet and Cool Location	36 (36 - 36)	36 (36 - 36)	36 (36 - 36)
		Average of Central Values:	25.4
		25th Percentile of Lower Bounds:	10
		Maximum Value:	36
		Summary of Values:	25.4 (10 - 36)

Appendix 13: TCP Following Application of Triclopyr TEA *(continued)*

TCP from Triclopry TEA Application

Table A13-5: Stream, Maximum Peak Concentration in Surface Water (ug/L or ppb)

Site	Clay	Loam	Sand
Dry and Warm Location	0.06 (0 - 5)	0 (0 - 0.9)	0 (0 - 0)
Dry and Temperate Location	0.11 (0 - 2.12)	0 (0 - 0.3)	0 (0 - 0.0028)
Dry and Cold Location	0 (0 - 0.5)	0 (0 - 0)	0 (0 - 0)
Average Rainfall and Warm Location	1.49 (0.2 - 6.7)	0.06 (0.0006 - 1.03)	0.0014 (0 - 1.21)
Average Rainfall and Temperate Location	1.31 (0.08 - 7.9)	0.012 (0 - 1.2)	0.000018 (0 - 0.04)
Average Rainfall and Cool Location	0.4 (0.006 - 4.3)	0.0007 (1.5E-06 - 0.9)	0.0024 (0.00009 - 0.14)
Wet and Warm Location	1.91 (0.12 - 8.6)	0.12 (0.005 - 1.48)	0.7 (0.04 - 4.6)
Wet and Temperate Location	0.9 (0.05 - 3.2)	0.06 (0.004 - 0.8)	1.88 (0.4 - 5.8)
Wet and Cool Location	1 (0.4 - 6.8)	1.04 (0.17 - 4.6)	12.1 (4.2 - 22.5)
		Average of Central Values:	0.858
		25th Percentile of Lower Bounds:	0
		Maximum Value:	22.5
		Summary of Values:	0.86 (0 - 22.5)

Appendix 13: TCP Following Application of Triclopyr TEA *(continued)*

TCP from Triclopry TEA Application

Table A13-6: Stream, Annual Average Concentration in Surface Water (ug/L or ppb)

Site	Clay	Loam	Sand
Dry and Warm Location	0.00018 (0 - 0.021)	0 (0 - 0.004)	0 (0 - 0)
Dry and Temperate Location	0.0004 (0 - 0.008)	0 (0 - 0.0012)	0 (0 - 0.00001)
Dry and Cold Location	0 (0 - 0.0016)	0 (0 - 0)	0 (0 - 0)
Average Rainfall and Warm Location	0.008 (0.0013 - 0.04)	0.0003 (2.7E-06 - 0.005)	0.000005 (0 - 0.011)
Average Rainfall and Temperate Location	0.006 (0.0003 - 0.04)	0.00004 (0 - 0.005)	7.0E-08 (0 - 0.00017)
Average Rainfall and Cool Location	0.0019 (0.000031 - 0.022)	2.9E-06 (9.0E-09 - 0.003)	0.000018 (4.0E-07 - 0.0013)
Wet and Warm Location	0.01 (0.0009 - 0.03)	0.0007 (0.00006 - 0.007)	0.017 (0.0004 - 0.17)
Wet and Temperate Location	0.005 (0.0007 - 0.027)	0.0007 (0.00004 - 0.04)	0.16 (0.026 - 0.5)
Wet and Cool Location	0.015 (0.005 - 0.09)	0.06 (0.0016 - 0.3)	0.7 (0.2 - 1.57)
		Average of Central Values:	0.0365
		25th Percentile of Lower Bounds:	0
		Maximum Value:	1.57
		Summary of Values:	0.036 (0 - 1.57)

Appendix 13: TCP Following Application of Triclopyr TEA *(continued)*

TCP from Triclopry TEA Application

Table A13-7: Pond, Maximum Peak Concentration in Surface Water (ug/L or ppb)

Site	Clay	Loam	Sand
Dry and Warm Location	0.014 (0 - 2.37)	0 (0 - 0.4)	0 (0 - 0)
Dry and Temperate Location	0.026 (0 - 0.9)	0 (0 - 0.15)	0 (0 - 0.0011)
Dry and Cold Location	0 (0 - 0.13)	0 (0 - 0)	0 (0 - 0)
Average Rainfall and Warm Location	0.6 (0.07 - 3.6)	0.03 (0.00025 - 0.8)	0.0006 (0 - 0.6)
Average Rainfall and Temperate Location	0.5 (0.021 - 4.5)	0.005 (0 - 0.6)	0.000006 (0 - 0.018)
Average Rainfall and Cool Location	0.14 (0.0015 - 2.3)	0.00032 (7.0E-07 - 0.5)	0.0013 (0.00005 - 0.09)
Wet and Warm Location	0.8 (0.05 - 5.4)	0.06 (0.0027 - 0.8)	0.4 (0.021 - 2.78)
Wet and Temperate Location	0.3 (0.019 - 1.71)	0.023 (0.0015 - 0.4)	0.9 (0.2 - 3.7)
Wet and Cool Location	0.4 (0.12 - 3.13)	0.6 (0.07 - 3.1)	6.8 (2.12 - 14.7)
		Average of Central Values:	0.43
		25th Percentile of Lower Bounds:	0
		Maximum Value:	14.7
		Summary of Values:	0.43 (0 - 14.7)

Appendix 13: TCP Following Application of Triclopyr TEA *(continued)*

TCP from Triclopry TEA Application

Table A13-8: Pond, Annual Average Concentration in Surface Water (ug/L or ppb)

Site	Clay	Loam	Sand
Dry and Warm Location	0.0004 (0 - 0.09)	0 (0 - 0.011)	0 (0 - 0)
Dry and Temperate Location	0.0006 (0 - 0.026)	0 (0 - 0.0031)	0 (0 - 0.00003)
Dry and Cold Location	0 (0 - 0.003)	0 (0 - 0)	0 (0 - 0)
Average Rainfall and Warm Location	0.022 (0.004 - 0.13)	0.001 (0.000007 - 0.025)	0.000016 (0 - 0.031)
Average Rainfall and Temperate Location	0.017 (0.0008 - 0.13)	0.00013 (0 - 0.019)	1.4E-07 (0 - 0.0006)
Average Rainfall and Cool Location	0.005 (0.00007 - 0.08)	0.000009 (2.9E-08 - 0.014)	0.00006 (1.6E-06 - 0.004)
Wet and Warm Location	0.028 (0.0028 - 0.15)	0.002 (0.00017 - 0.024)	0.03 (0.0013 - 0.4)
Wet and Temperate Location	0.012 (0.0014 - 0.08)	0.0014 (0.00006 - 0.05)	0.17 (0.031 - 0.5)
Wet and Cool Location	0.019 (0.006 - 0.13)	0.09 (0.0031 - 0.4)	1 (0.31 - 1.93)
		Average of Central Values:	0.0518
		25th Percentile of Lower Bounds:	0
		Maximum Value:	1.93
		Summary of Values:	0.052 (0 - 1.93)